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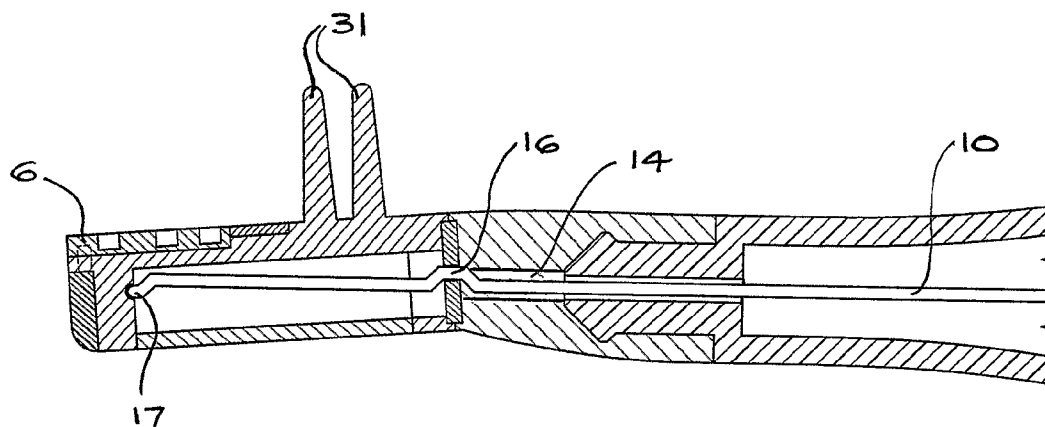
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(54) Title: ELECTRIC TOOTHBRUSH



(57) Abstract: The toothbrush handle (1) is connected to the vibrating head (5) by a flexible coupling (8). A longitudinally extending rotary member (10) has an inner end drivingly connected to the motor (3) received in a cavity (2) in the handle. Two longitudinally spaced and angularly out of phase eccentrics (16, 17) are provided on an outer end of the rotary member (10), each eccentric (16, 17) engaging a respective longitudinally spaced eccentric-receiving recess (20, 21) of the head, such that rotation of the rotary member (10) vibrates the head (5) with a wobbling motion by flexure of the flexible coupling (8).

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## **ELECTRIC TOOTHBRUSH**

### **Technical field**

The present invention relates to electric toothbrushes having a tuft carrier oscillated by a motor-driven rotary member.

### 5 **Background of the Invention**

The applicant's US Patent No. 6 421 866 describes an electric toothbrush with a flexible coupling connecting the handle to the vibrating head upon which the tuft carrier is provided. A longitudinally extending rotary member has an inner end drivingly connected to a motor in the handle. An eccentric on an outer end of the  
10 rotary member engages the head, such that rotation of the rotary member vibrates the head by flexure at the coupling. While this tuft carrier motion provides satisfactory cleaning, there is a continuing need to provide electric toothbrushes which can provide alternative tuft carrier motion or improved cleaning.

### **Disclosure of the Invention**

15 According to one aspect of the present invention there is provided an electric toothbrush comprising:

a handle having a cavity;

a head;

a flexible coupling between the handle and head;

20 a tuft carrier disposed on the head;

a motor received in the cavity;

a longitudinally extending rotary member with an inner end drivingly connected to the motor,

wherein two longitudinally spaced and angularly out of phase eccentrics are provided  
5 on an outer end of the rotary member, each eccentric being engaged in an eccentric-receiving recess in the head, such that rotation of the rotary member vibrates the head.

Preferably the eccentrics are angularly out of phase by substantially 180 degrees. The offset of both eccentrics from the axis of rotation of the rotary member may be  
10 substantially equal.

Preferably each eccentric-receiving recess is substantially cylindrical and each eccentric has a cylindrical journal face. Alternatively one or both of the eccentric-receiving recesses could be transverse slots in the head, such that during rotation of the rotary member the eccentric can reciprocate freely parallel to the slot, while  
15 driving the head to reciprocate perpendicular to the slot.

The coupling preferably includes a resilient element, and most preferably the coupling is formed from an elastomer. Preferably the rotary member is received in a channel extending through the coupling into a recess in the head, most preferably the channel encloses the rotary member.

20 Preferably a bearing formed in an outer end of the handle receives the rotary member.

Preferably the rotary member is an elongate metal shaft in which the eccentrics are formed.

In a preferred embodiment the tuft carrier is demountably fixed to the head.

Preferably the head has a rib that extends longitudinally at one end of the head, the  
5 rib protruding from a pilot region, with channels formed in either side of the rib;

the tuft carrier having a pilot surface for engaging the pilot region on the head, a recess in the tuft carrier configured to receive the rib, with tongue portions on the edges of the recess adapted to be received in the channels, and

a detent for fastening the tuft carrier to the head.

10 a light is mounted adjacent the end of the rib.

This invention provides an electric toothbrush which provides effective and efficient cleaning, and has an overall simple design which minimizes manufacturing costs.

#### **Brief Description of the Drawings**

15 Preferred forms of the present invention will now be described by way of example with reference to the accompanying drawings, wherein:

Figure 1 is a longitudinal section through a first embodiment of the toothbrush of the invention;

Figure 2 is an enlarged view of the head of the toothbrush of Fig. 1 showing the shaft  
20 rotated 90 degrees relative to Fig. 1;

Figure 3 is a pictorial view of the outer end of the shaft of the toothbrush of Fig. 1;

Figure 4 is a fragmentary pictorial view of the end of a toothbrush of a second embodiment of the invention;

Figure 5 is an exploded view of the end of a toothbrush of Fig. 4;

5 Figure 6 is a longitudinal section through the end of a toothbrush of the toothbrush of Fig. 4;

Figure 7 is a longitudinal section through the end of a toothbrush of Fig. 4 showing the shaft rotated 90 degrees relative to Fig. 6.

#### 10 **Description of the Preferred Embodiments**

Referring to the drawings, Figs 1-3 illustrate a first embodiment of the electric toothbrush of the invention having an elongate handle 1 with a closed cavity 2 holding an electric motor 3 and battery 4. A closure 43 at the end of the handle 1 is provided for replacement of the battery 4. Two switches 44 are provided for turning  
15 the motor on or off.

A head 5 includes an integrally formed tuft block or tuft carrier portion 6 with apertures holding transversely extending tufts 7 of bristles. A flexible coupling 8 joins the head 5 to a neck portion an outer end of the handle 1. The handle 1 and head 5 are moulded from substantially rigid polymers, whereas the flexible coupling  
20 8 is moulded from an elastomer.

A rotary member in the form of an elongate shaft 10 is rotationally fixed at its inner

end by a connector 11 to the rotating output shaft of the motor 3. The motor is driven at 8 000 – 10 000 RPM. The shaft 10 is supported in a bearing 13 held in the neck 9 and extends longitudinally through a channel 14 in the flexible coupling 8 into a recess 15 in the head 5.

5 The shaft 10 is formed from a steel bar of circular cross-section with two longitudinally spaced eccentrics 16, 17. Offset from the axis 19, these eccentrics 16, 17 are cranks, crank portions or throws formed at the outer end of the shaft 10, defined by cylindrical journal faces which are aligned longitudinally. The journal face centres 22, 23 are radially offset by dimension 18 on opposing sides of the long axis  
10 19 of the shaft 10. In this manner the eccentrics 16, 17 are angularly out of phase by 180 degrees.

The eccentrics 16, 17 are received to rotate in respective bearing recesses 20, 21 formed in the head 5. These eccentric-receiving recesses 20, 21 are preferably coaxial and at least partially cylindrical. The head 5 is thus coupled to the shaft 10  
15 such that shaft rotation moves opposing ends of the head in eccentric circles angularly out of phase, vibrating the head with a three-dimensional wobbling motion, and causing flexure of the flexible coupling 8.

Figs 4-7 show a second embodiment of the electric toothbrush of the invention wherein the tuft carrier 6 is demountably fixed to the head 5, but which is otherwise  
20 of like construction. The construction of the head 5 is best shown in Fig. 5 wherein (along with Figs 6 and 7) the tufts 7 shown in Fig. 4, are omitted for clarity. The head 5 includes a body 25 with an upper planar pilot region 26 and downwardly-extending flanges 27, 28 at the inner and outer end of the body 25.

A rib 29 extends longitudinally at the inner end of the head, protruding above the pilot region 26, with channels 30a, 30b formed in either side of the rib 29. Two resilient fingers 31 are fixed to the rib 29 extending outwardly in general alignment with the tufts 7. A light-emitting diode (LED) 32 is mounted at the outer end of the rib 29 and emits light in the blue region of the visible spectrum from between the tufts. Research has found that blue and some green light, particularly of a wavelength between 380 to 520 nanometres, can kill or inactivate certain oral pathogens. Alternatively, the LED 32 may emit light in the red visible spectrum, particularly in the range 535 to 785 nanometres, which may provide a therapeutic affect.

The tuft carrier 6 has a planar lower pilot surface 33 and a recess 34 configured to receive the rib 29. Tongue portions 35a, 35b on both opposing edges of the recess 35 are adapted to be received in the channels 30a, 30b.

To connect the tuft carrier 6, the pilot surface 33 is engaged with the pilot region 26, before sliding the rib 29 into the recess 34. A detent 36 includes a pair of parallel pins 37a, 37b and is received in a recess 38 in the flange 28. The pins 37a, 37b protrude through openings 39a, 39b in the body 25 and are received in apertures (not shown) in the pilot surface 32 to prevent longitudinal movement and fasten the tuft carrier to the body 25.

The cylindrical eccentric-receiving recess 21 is formed centrally in a disc 40, which is received in a circular opening in the flange 27. With the eccentric 21 located in the cylindrical eccentric-receiving recess 20 in the flange 28, the shaft 10 is thus drivingly connected to the head 5. A channel-shaped cover 41 is received between the flanges 27, 28 to enclose the shaft 10 in the cavity 15, and may be fixed by adhesive or welding. The flexible coupling 8 may be fixed to the head 5 and neck 9

by adhesive.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof.



**CLAIMS:**

1. An electric toothbrush comprising:
  - a handle having a cavity;
  - a head;
  - 5 a flexible coupling between the handle and head;
  - a tuft carrier disposed on the head;
  - a motor received in the cavity;
  - a longitudinally extending rotary member with an inner end drivingly connected to the motor,
  - 10 wherein two longitudinally spaced and angularly out of phase eccentrics are provided on an outer end of the rotary member, each eccentric being engaged in an eccentric-receiving recess in the head, such that rotation of the rotary member vibrates the head.
- 15 2. The toothbrush of claim 1 wherein the eccentrics are angularly out of phase by substantially 180 degrees.
3. The toothbrush of claim 1 or claim 2 wherein each eccentric-receiving recess is substantially cylindrical and each eccentric has a cylindrical journal face.

4. The toothbrush of any one of claims 1 to 3 wherein the coupling is formed from an elastomer.
  
- 5 5. The toothbrush of any one of claims 1 to 4 wherein the rotary member is received in a channel extending through the coupling into a recess in the head.
  
6. The toothbrush of claim 5 wherein the channel encloses the rotary member.
  
- 10
  
7. The toothbrush of any one of claims 1 to 6 wherein a bearing is formed in an outer end of the handle and receives the rotary member.
  
8. The toothbrush of any one of claims 1 to 7 wherein the rotary member is an  
15 elongate metal shaft in which the eccentrics are formed.
  
9. The toothbrush of any one of claims 1 to 9 wherein the tuft carrier is demountably fixed to the head.

10. The toothbrush of any one of claims 1 to 10 wherein a light source is mounted to the head to emit light between tufts on the tuft carrier.

5 11. The toothbrush of claim 9 wherein the head has a rib that extends longitudinally at one end of the head, the rib protruding from a pilot region, with channels formed in either side of the rib;

the tuft carrier having a pilot surface for engaging the pilot region on the head, a recess in the tuft carrier configured to receive the rib, with tongue portions on the edges of the recess adapted to be received in the channels,  
10 and

a detent for fastening the tuft carrier to the head.

12. The toothbrush of claim 11 wherein a light source is mounted adjacent the end of the rib.

13. The toothbrush of claim 10 or claim 12 wherein the light source emits blue  
15 light.

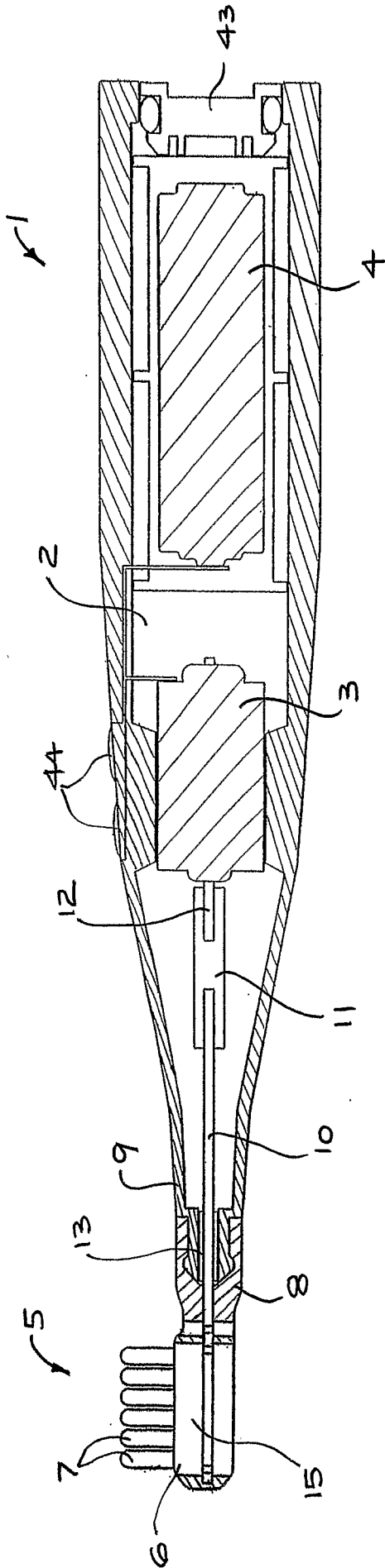


FIG. 1

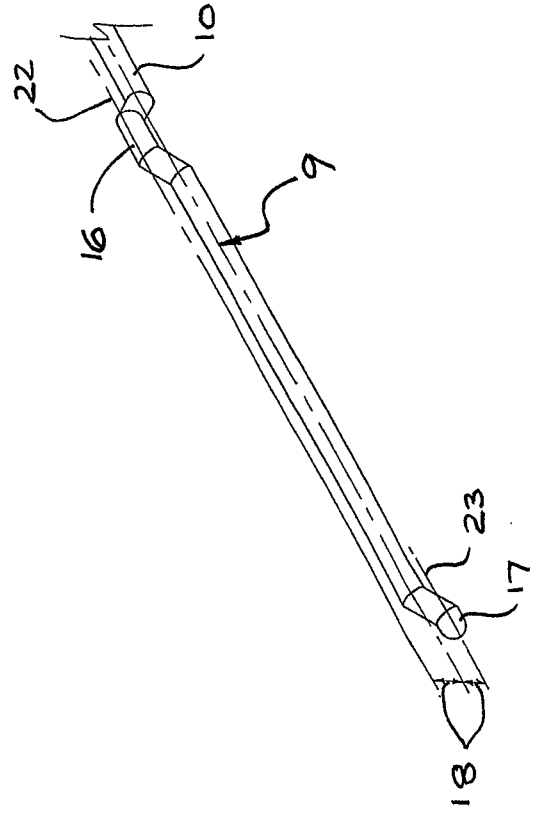


FIG. 3

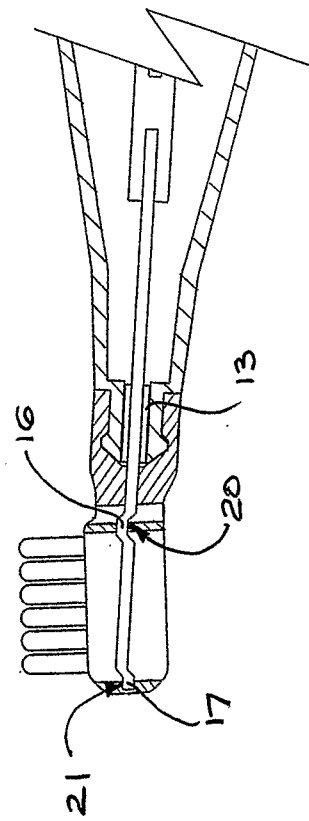
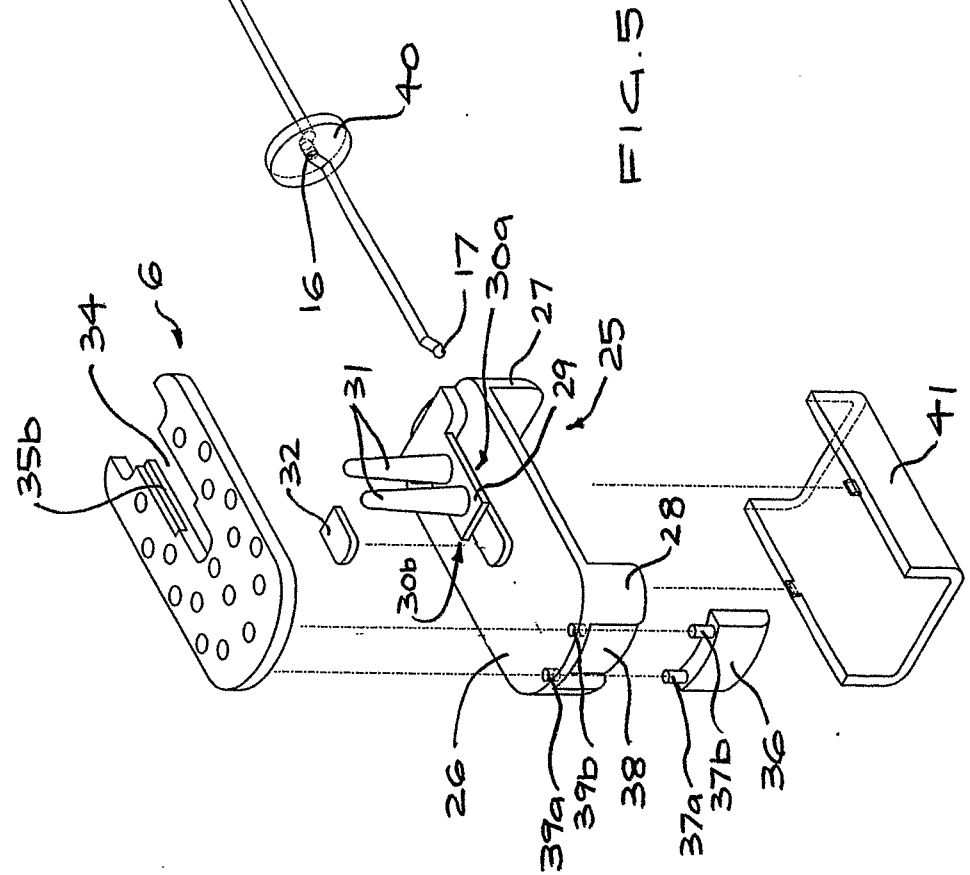
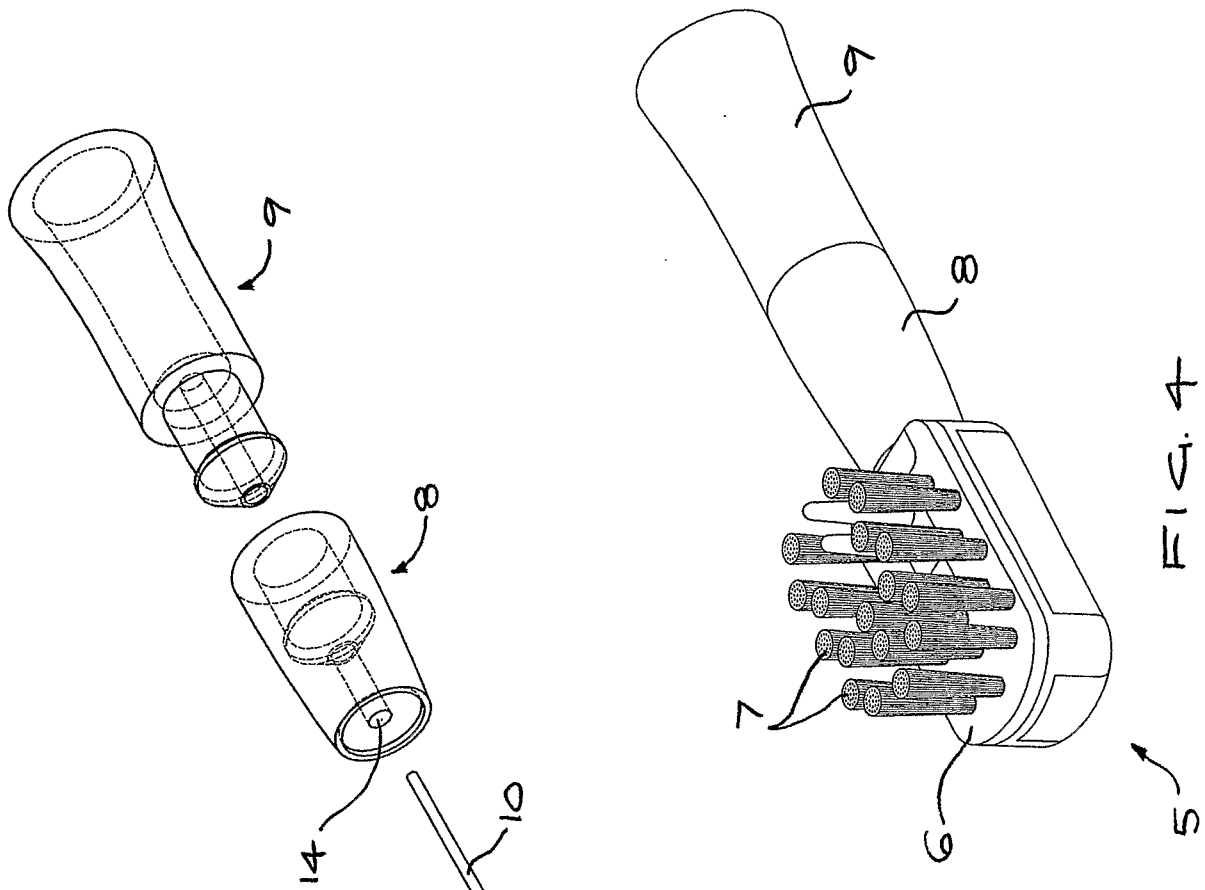


FIG. 2



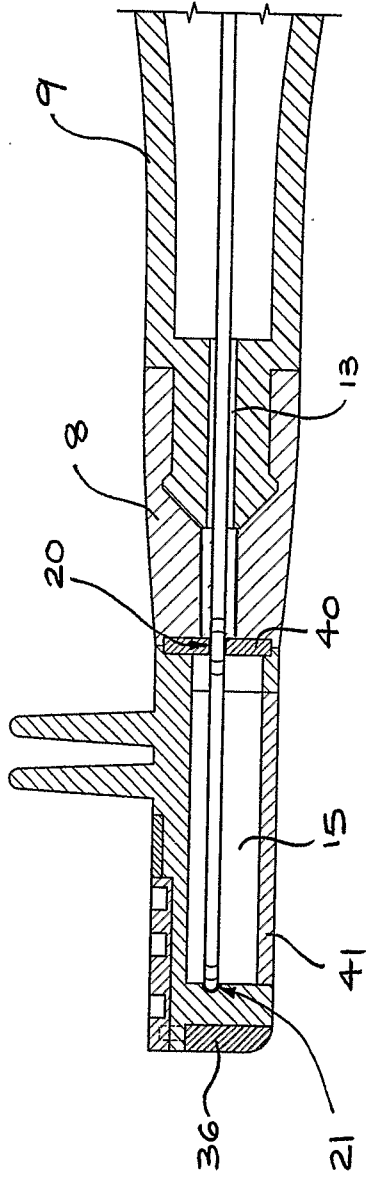


FIG. 6

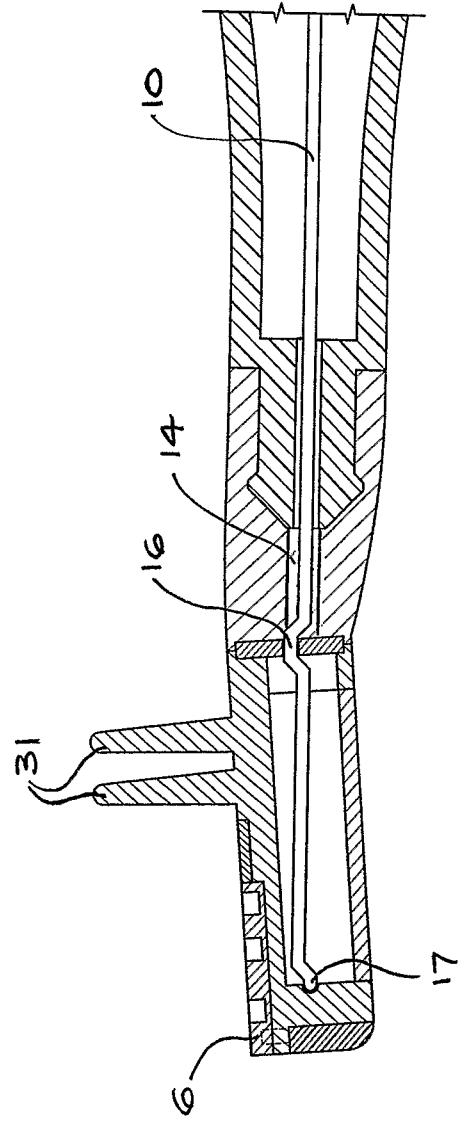


FIG. 7