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(54) **Pond cleaning apparatus**

(57) There is provided pond cleaning apparatus for pumping waste matter and water from a pond, the apparatus comprising a submersible pump mounted on a tube, the pump being arranged to pump water and waste matter through an inlet of the apparatus and along the tube towards an outlet of the apparatus.

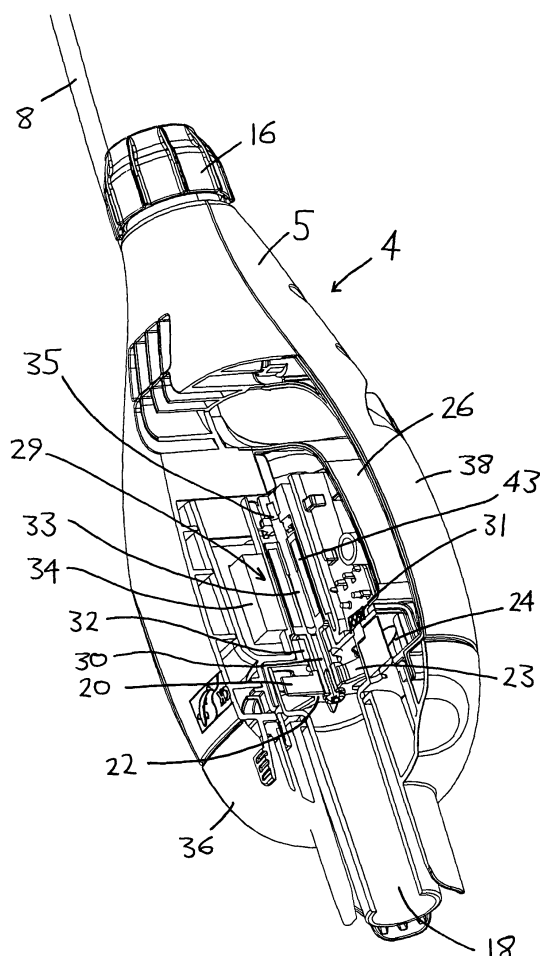


FIG. 2

Description

[0001] The present invention relates to pond cleaning apparatus for pumping waste matter and water from a pond.

[0002] Undesirable waste matter may commonly accumulate in garden ponds. Such waste matter may include, for example, debris, sediment, organic material such as algae, and leaves. If left unattended, a thick layer of waste matter may accumulate on the water surface as well as the bottom of and edges of the pond.

[0003] Besides manual cleaning one approach to pond cleaning is to provide a land based pond vacuum cleaner. In such a device, a vacuum pump is operated at the side of a pond and a submersible nozzle extends into the water from the pump; this arrangement is used to suck waste matter and water out of the pond. The pump has to be able to suck air as well as water/debris to the pond side for collection in the device's tank. Such apparatus is typically bulky and requires a high electrical power input, of the order of 1 kW. Further the tank has to be emptied after a period of time. It is desirable to provide an alternative pond cleaning apparatus which aims to alleviate at least one of the problems associated with the prior art.

[0004] According to one aspect of the present invention there is provided pond cleaning apparatus for pumping waste matter and water from a pond, the apparatus comprising a submersible pump mounted on a tube, the pump being arranged to pump water and waste matter through an inlet of the apparatus and along the tube towards an outlet of the apparatus.

[0005] The pump may comprise an impellor. Preferably the impellor comprises a blade with at least one cutting edge. Such a blade can help to cut any waste matter in the water into smaller pieces reducing the risk of blockage in the apparatus. The impellor may comprise a main body, and the blade of the impellor may be of a different material from the main body. Preferably the cutting edge is of metal. The whole blade may be of metal. The main body may be of plastics material.

[0006] The blade may be arranged to rotate with the main body of the impellor. The blade may be attached to the main body of the impellor.

[0007] The impellor may be arranged to rotate about an axis that is substantially parallel to a water inlet flow direction in which water flows towards the impellor in use.

[0008] Preferably the impellor is arranged such that, in use, the first part of the impellor to make contact with waste water pumped into the apparatus is the blade.

[0009] The impellor may be arranged to pump water towards itself along its axis of rotation. In this arrangement the blade may be provided on an axial surface of the impellor. The blade may have a plurality of cutting edges. The blade may be star shaped. There may be a substantially unobstructed flow path from the inlet of the apparatus to the impellor.

[0010] There may be no support for the impellor at a position in the flow path between the inlet and the impel-

lor. The impellor may be supported for rotation by a bearing which is disposed on a side of the impellor which is opposite that side which, in use, is first met by water flowing towards the impellor from the inlet. In such a case, it can be said that the impellor is supported only from behind.

[0011] The impellor may be mounted on a cantilevered shaft. The shaft may be journaled in said bearing.

[0012] The pump may comprise a support plate which comprises the bearing which supports the impellor for rotation.

[0013] The pump may comprise access means being arranged to enable access to the interior of the pump for cleaning. The access means may comprise a hatch in the pump or a removable portion of the pump, for example.

[0014] The apparatus may comprise disabling means for disabling the pump.

[0015] The pump may comprise at least one moving part and the disabling means may be operable to isolate the at least one moving part from a driving source. The driving source may comprise an electrical supply and the disabling means may be operable to break a connection to the electrical supply.

[0016] The apparatus may comprise a switch which is operable to disable the pump electrically.

[0017] The apparatus may comprise a moveable portion which is moveable between a first position in which access to the at least one moving part is obscured, and a second position in which access to the at least one moving part may be obtained and the disabling means may be arranged so that the pump is disabled when the moveable portion is in the second position.

[0018] The moveable portion may be a removable portion. The moveable portion may be an openable portion.

[0019] Preferably the apparatus comprises a removable portion, and is arranged such that the removal of said removable portion disables the pump.

[0020] The apparatus may comprise a moving part enclosure, which obscures access to the at least one moving part. The at least one moving part may comprise the impellor.

[0021] The moving part enclosure may be a removable portion of the apparatus. The moving part enclosure may comprise at least two components which fit together to obscure access to the at least one moving part. The moving part enclosure may be openable to allow access to the at least one moving part.

[0022] The apparatus may be arranged to disable the at least one moving part when the moving part enclosure is opened and/or removed from the apparatus.

[0023] The apparatus may comprise a removable portion comprising the impellor. Said removable portion may comprise a cover portion defining at least one access aperture to allow access to the impellor. Preferably the at least one access aperture is obscured when the removable portion is mounted on the remainder of the apparatus. The at least one access aperture may be ar-

ranged to fit with at least one corresponding formation on the remainder of the apparatus. Preferably the at least one access aperture is arranged on the opposite side of the impellor to the pump inlet.

[0024] The disabling means may comprise a sensor portion and an actuator portion. One of the sensor portion and the actuator portion may be provided on the moveable portion and the other provided on the remainder of the apparatus. The sensor portion may comprise a micro-switch. The sensor portion may comprise a reed-switch. The actuator portion may comprise an actuating member, for example a projection, or a plain piece of material, the absence of which can be detected. The actuator portion may comprise a magnet. Other types of sensor and actuator portion are also envisaged.

[0025] Where there is a moving part enclosure with two parts, the sensor or actuator may be disposed on one of those parts. That part may be one which can be removed to allow access to the impellor, whilst the other part is still mounted on the remainder of the apparatus. The sensor or actuator may act past or through the part of the enclosure on which it is not provided. Such features can allow the disabling of the pump whether the whole enclosure is removed or whether a "front" cover portion of the enclosure is removed.

[0026] Preferably water and waste matter is arranged to be pumped along a channel from the pump to the outlet. The channel may comprise the interior of the tube. The channel may comprise a waste exhaust channel, which is disposed in a housing of the pump. The channel may be arranged to have a substantially constant cross-sectional area along its length.

[0027] The cross-sectional shape of the channel may be changeable along the length of the channel, but if so the shape of the cross-section is preferably arranged to change continuously. These features can avoid the formation of sites at which debris is likely to collect in use.

[0028] According to another aspect of the present invention there is provided a method of cleaning a pond comprising the steps of: using an apparatus as defined above, submersing the pump in the pond and moving it to a site occupied by waste matter; and operating the apparatus to pump water and waste matter along the tube from the inlet towards the water outlet.

[0029] An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figures 1A to 1C show respectively a side view, top view, and perspective view of a pond cleaning apparatus;

Figure 2 shows a pump unit of the pond cleaning apparatus of Figures 1A to 1C, with a cut away section showing inner components;

Figure 3 shows an exploded perspective view of the pump unit of Figure 2; and

Figure 4 shows the exploded view of Figure 3 from an alternative perspective.

[0030] Figures 1A-1C show a pond cleaning apparatus 1 which comprises a tube 2, a pump unit 4, a nozzle attachment 6, and two handles 12, 14 for a user to hold when using the apparatus. The tube 2 is arranged to be hollow and rigid, with the pump unit 4 mounted at one end thereof and the two handles 12, 14 mounted on the tube at positions spaced from the pump unit 4. The nozzle attachment 6 is attachable to the pump unit 4 on the opposite side to the tube 2. The end of the tube 2 remote from the pump unit 4 comprises a waste outlet 10. The waste outlet 10 is provided in one of the handles 12.

[0031] The pump unit 4 is arranged to pump water and waste matter through an inlet of the nozzle attachment 6 into the pump unit 4 and out of the pump unit 4 and into and along the tube 2 to the outlet 10.

[0032] The tube 2 comprises a plurality of removable segments, and it may be telescopically extendable. The nozzle attachment 6 comprises projections and/or bristles 7 for dislodging waste matter from surfaces in a pond. The bristles may be fibrous or rubber or of any other suitable material.

[0033] The pump unit 4 is electrically operable and an electrical cable 8 is provided from the pump unit 4 to the remote end of the tube 2 and beyond. In Figure 1, only a portion of the electrical cable 8 is shown.

[0034] The outlet 10 of the tube 2 is connectable to a hose (not shown) for carrying away water and waste matter. The outlet 10 comprises a standard push fit hose connector 11 which is part of a hose adaptor 13 that in turn is connected to the handle 12 via a bayonet connection. The hose adaptor 13 is arranged to trap waste matter having a larger diameter than that of the hose. Such material can be easily removed from the apparatus 1 by disconnecting the hose adaptor 13 from the handle 12 by means of the bayonet connection.

[0035] In an alternative, flow control means may be provided, for example in the handle 12. Such a flow control means would typically controllably partially obstruct the flow path out of the apparatus. This can allow control of "how hard the apparatus sucks".

[0036] In use, a user holds the apparatus 1 with the handles 12, 14 and submerses the pump unit 4 and nozzle attachment 6 in a pond. With the pump unit operating, waste matter and water are then pumped through the inlet of the nozzle attachment 6, via the pump unit 4, and into the tube 2. The waste matter and water are pumped along the tube 2 towards the outlet 10 from where they may be disposed of via a hose (not shown).

[0037] Figures 2, 3 and 4 show the pump unit 4 in greater detail. In Figures 2, 3 and 4 the electrical cable 8 is shown but the nozzle attachment 6 and tube 2 are not.

[0038] The pump unit 4 comprises a housing 5 which is partly cut away in Figure 2 to show the internal components of unit 4. A sealing collar 16 is provided at one end of the housing 5 for connection with the tube 2. At

the other end of the housing 5 there is a water inlet portion 18 which is arranged to receive the nozzle attachment 6 (not shown in Figures 2, 3 and 4).

[0039] The pump unit 4 comprises an impellor 20 which is provided in the pump housing 5. The impellor 20 is mounted on a shaft 30 which is supported for rotation by a bearing 32. The pump unit 4 comprises a motor 29 for rotatingly driving the shaft 30 and hence the impellor 20 relative to the housing 5. The motor comprises windings 34 mounted in the housing 5 and a magnet 43 carried on the shaft 30.

[0040] The impellor 20 is mounted at one end of the shaft. Thus, the impellor 20 is mounted on the shaft 30 in a cantilevered arrangement. The shaft 30 extends away from the impellor 20 in a direction that is away from the inlet 18. The impellor 20 is provided on the shaft "in front of" the bearing 32. That is the shaft 30 is not supported on the side of the impellor which is closest to the inlet. This means that there is no obstruction between the inlet and the impellor 20. This can help prevent clogging.

[0041] The impellor 20 comprises a blade 22 and a main body 23. Both the main body 23 and the blade 22 are star shaped, having radial arms that extend from an axis which is occupied by the shaft 30. The blade 22 is mounted on the impellor main body 23 on an axial surface with respect to the shaft 30. The blade 22 is provided on the impellor 20 on a side closest to the inlet 18. Preferably the main body of the impellor 23 is of plastics material and the blade is of metal. The blade 22 comprises a plurality of cutting edges for cutting waste matter in water into smaller pieces; this serves to reduce the risk of the impellor arrangement becoming clogged by waste matter.

[0042] By mounting the impellor 20 in a cantilevered arrangement the blade 22 is made easy to fit, replace, clean, sharpen and maintain, as required. Also, the blade 22 is generally the first point of the impellor 20 to make contact with waste matter, and so the waste matter may be rapidly cut into smaller pieces.

[0043] The impellor 20 is disposed in a pump chamber having an axial water inlet in the form of the housing inlet 18 and a radial water outlet 24 with respect to its axis of rotation. Accordingly, whether the impellor 20 rotates clockwise or anticlockwise it is arranged to pump water and waste matter from the inlet 18 towards the outlet 24. The impellor outlet 24 is also the beginning of a waste channel 26 which extends through the pump unit 4 towards the tube 2. Waste water and matter from the impellor outlet 24 follow a path along the waste channel 26 and the interior of the tube 2 towards the water outlet 10 at the end of the tube 2. The cross-sectional area of the waste channel 26 and the tube 2 is arranged to be substantially constant along the path that the water and waste matter follow. In addition, the cross-sectional shape of the waste channel 26 and tube 2 is arranged so that any changes in shape happen in a continuous manner. In this way, the flow of water and waste matter

may be substantially unrestricted and there may be avoidance of debris collection sites such as could arise if there were discontinuities in the path.

[0044] The pond cleaning apparatus 1 is likely to require cleaning during or after use. To this end, the apparatus 1 is arranged to be easy to clean and disassemble. Figures 3 and 4 show exploded views of the pump unit 4. These exploded views in fact illustrate the way in which the apparatus 1 may be disassembled into a number of easy-to-clean components.

[0045] Specifically, the pump unit 4 comprises:

- i) a main body 38 comprising the waste channel 26 and the motor windings 34;
- ii) an integrated impellor unit 40 comprising the impellor 20 and the shaft 30;
- iii) a moveable baffle portion 55;
- iv) an inlet unit 50 comprising the water inlet 18; and
- v) a removable end housing portion 36.

[0046] The integrated impellor unit 40 comprises the bearing 32 that supports the shaft 20 on which the impellor is supported. The bearing 32 is provided in a rear plate 51 of the integrated impellor unit. The pump unit 4 is assembled by fitting the integrated impellor unit 40 inside the main body section 38 so inserting the magnet 43 into the windings 34 to "make" the motor, attaching the inlet unit 50 to the integrated impellor unit 40 capturing the moveable baffle portion 55 and clipping the removable end housing portion 36 onto the main body 38. Fitting the end housing portion 36 on the main body 38 covers the impellor unit 40 and inlet unit 50 and holds the entire assembly together in a secure way.

[0047] As best seen in Figure 2, the main body 38 comprises a support pin 33 which is held in a seat 35. This pin projects along the bore defined by the windings 34 and is received inside the shaft 30 at the region which carries the magnet 43. The shaft 30 is supported by the pin 33 but able to rotate relative to it.

[0048] The inlet unit 50 is arranged to clip together with the integrated impellor unit 40 to form an enclosure for the impellor 20. This obstructs access to the impellor 20 even when the end housing portion 36 is removed.

[0049] The integrated impellor unit 40 comprises a plurality of apertures 44 situated behind the impellor 20 and away from the inlet unit 50. The apertures 44 are arranged to be engaged by protrusions 45 in the main body section 38 when the apparatus is in the assembled state. The protrusions 45 are complementary in shape to the apertures 44. This arrangement allows some access to the reverse of the impellor 20 when the enclosure is removed, and permits easy cleaning. If a blockage cannot be removed in this way the inlet unit 50 may be removed from the integrated impellor unit 40 to allow greater access to the impellor.

[0050] The inlet unit 50 comprises a flow enhancement baffle 52 which is arranged to receive the moveable baffle portion 55 and engage with a receiving aperture 53 in

the rear plate 51 of the integrated impellor unit 40 when the two are connected together. The baffle 52 improves the dynamics of the water and the waste matter flow as pumped by the impellor 20 from the inlet 18 towards the impellor outlet 24. The moveable baffle portion 55 can flip to one side or the other depending on the direction of rotation of the impellor.

[0051] The flow enhancement baffle 52 carries a projection 52a which projects into a receiving aperture 53.

[0052] A microswitch 31 is provided in the main body 38 and is arranged to be depressible by the projection 52a carried on the flow enhancement baffle 52 when the impellor enclosure (integrated impellor unit 40 and inlet unit 50) is mounted in the main body. When this is not the case (i.e. if the enclosure or inlet unit 50 is removed), the microswitch 31 is released and the pump mechanism is rendered inoperable i.e. power is cut to the motor 29. In this way, the pump is isolated when access may be obtained to the impellor 20 (by removal of inlet unit or removal of the whole of the impellor enclosure) and this prevents possible injury and/or damage to the components when the pump unit 4 is disassembled.

[0053] In alternatives the microswitch might be depressed by a portion of the removable end housing portion 36.

[0054] In other alternatives another type of sensor and/or sensor actuator might be used in controlling operation of the pump unit. For example a reed switch might be mounted in the main body and a magnet provided on a moveable or removable part e.g. the end portion 36, the integrated impellor unit 40, an impellor enclosure, the inlet unit. In some cases the sensor might be on the moveable/removable part and the actuator on the main body.

Claims

1. Pond cleaning apparatus for pumping waste matter and water from a pond, the apparatus comprising a submersible pump mounted on a tube, the pump being arranged to pump water and waste matter through an inlet of the apparatus and along the tube towards an outlet of the apparatus.
2. Pond cleaning apparatus according to claim 1 in which the pump comprises an impellor and in which there is a substantially unobstructed flow path from the inlet of the apparatus to the impellor.
3. Pond cleaning apparatus according to claim 2 in which there is no support for the impellor at a position in the flow path between the inlet and the impellor.
4. Pond cleaning apparatus according to claim 2 or claim 3 in which the impellor is supported for rotation by a bearing which is disposed on a side of the impellor which is opposite that side which, in use, is first met by water flowing towards the impellor from

the inlet.

5. Pond cleaning apparatus according to any of claims 2 to 4 in which the impellor is mounted on a cantilevered shaft.
6. Pond cleaning apparatus according to any of claims 2 to 5 in which the impellor comprises a blade with at least one cutting edge.
7. Pond cleaning apparatus according to claim 6 in which the impellor is arranged such that, in use, the first part of the impellor to make contact with waste water pumped into the apparatus is the blade.
8. Pond cleaning apparatus according to claim 6 or claim 7 in which the impellor is arranged to pump water towards itself along its axis of rotation and the blade is provided on an axial surface of the impellor.
9. Pond cleaning apparatus according to any of claims 6 to 8 in which the blade has a plurality of cutting edges.
10. Pond cleaning apparatus according to any preceding claim which comprises disabling means for disabling the pump and the pump comprises at least one moving part and the disabling means is operable to isolate the at least one moving part from a driving source.
11. Pond cleaning apparatus according to claim 10 in which the at least one moving part comprises the impellor.
12. Pond cleaning apparatus according to claim 10 or 11 in which the apparatus comprises a moveable portion which is moveable between a first position in which access to the at least one moving part is obscured, and a second position in which access to the at least one moving part may be obtained and the disabling means is arranged so that the pump is disabled when the moveable portion is in the second position.
13. Pond cleaning apparatus according to any of claims 10 to 12 in which the apparatus comprises a moving part enclosure, which is a removable portion of the apparatus and comprises at least two components which fit together to obscure access to the at least one moving part wherein the moving part enclosure is openable to allow access to the at least one moving part and wherein the apparatus is arranged to disable the at least one moving part when the moving part enclosure is opened and/or removed from the apparatus.
14. Pond cleaning apparatus according to any of claims

10 to 13 in which the disabling means comprises a sensor portion and an actuator portion with one of the sensor portion and the actuator portion provided on the moveable portion and the other provided on the remainder of the apparatus.

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15. Pond cleaning apparatus according to claim 14 when dependent on claim 13 in which the sensor or actuator is disposed on one of the parts of the moving part enclosure and in which said part to which the sensor or actuator is disposed is removable to allow access to the impellor, whilst the other part is still mounted on the remainder of the apparatus.
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16. Pond cleaning apparatus according to claim 15 in which the sensor or actuator is arranged to act past or through the part of the enclosure on which it is not provided.
- 15
17. Pond cleaning apparatus according to any preceding claim which is arranged to pump water and waste matter along a channel from the pump to the outlet, said channel comprising the interior of the tube and a waste exhaust channel, which is disposed in a housing of the pump and wherein the channel is arranged to have a substantially constant cross-sectional area along its length.
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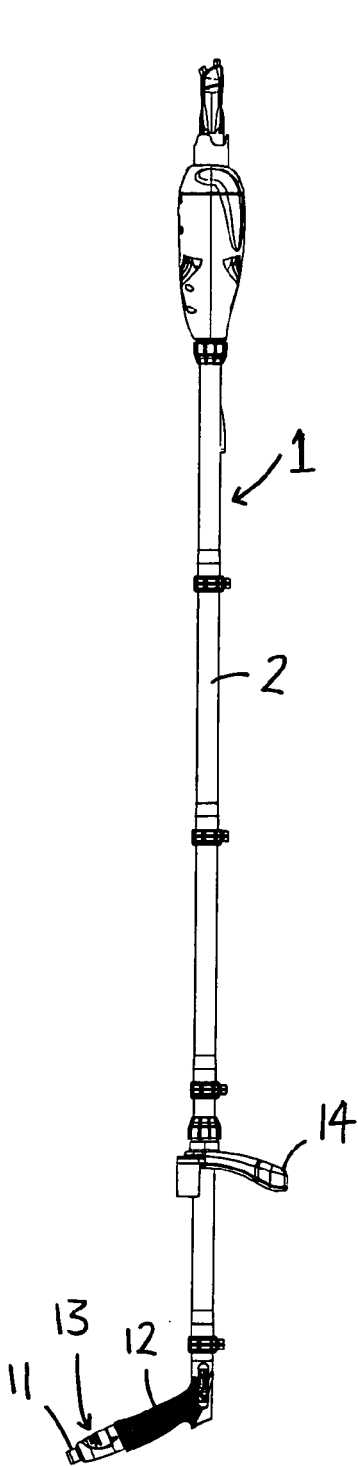


FIG. 1A

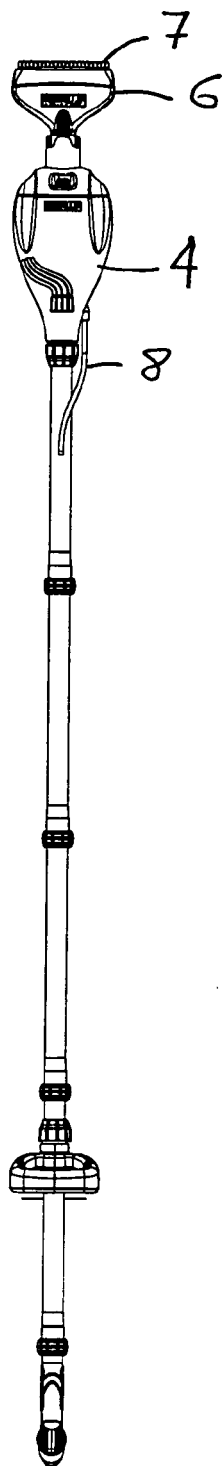


FIG. 1B

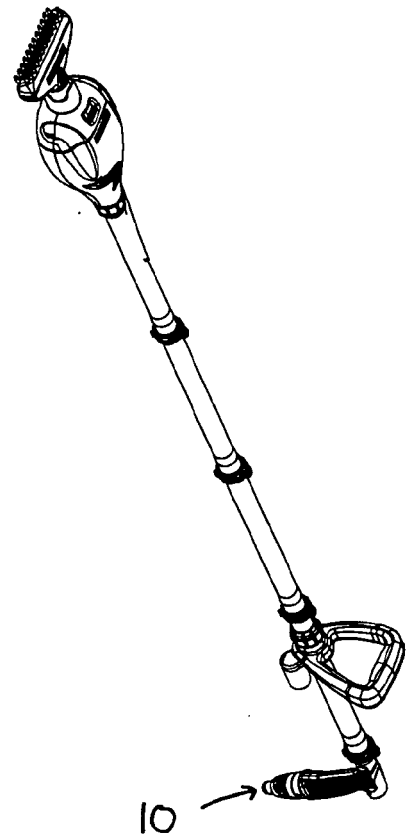


FIG. 1C

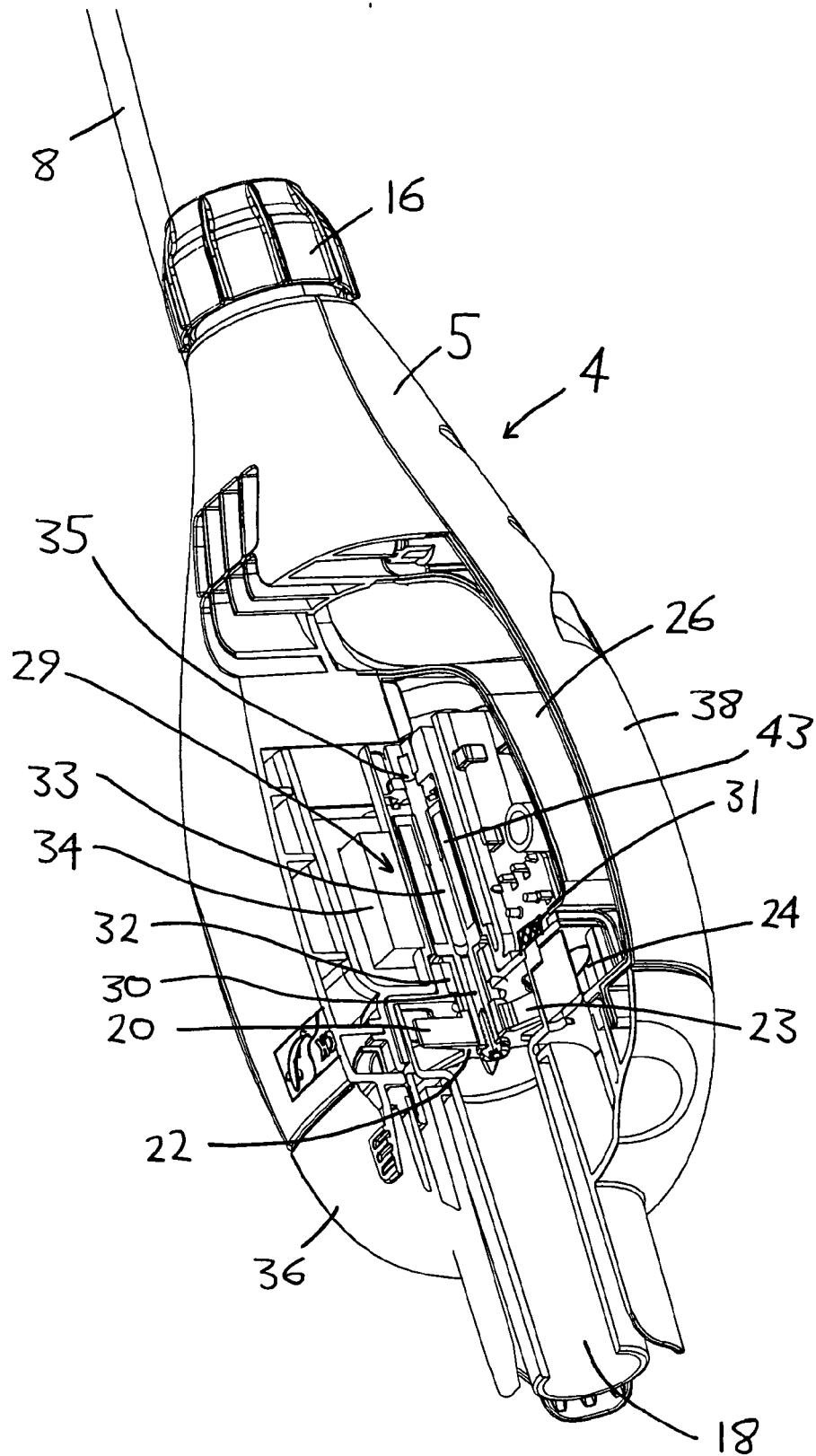


FIG. 2

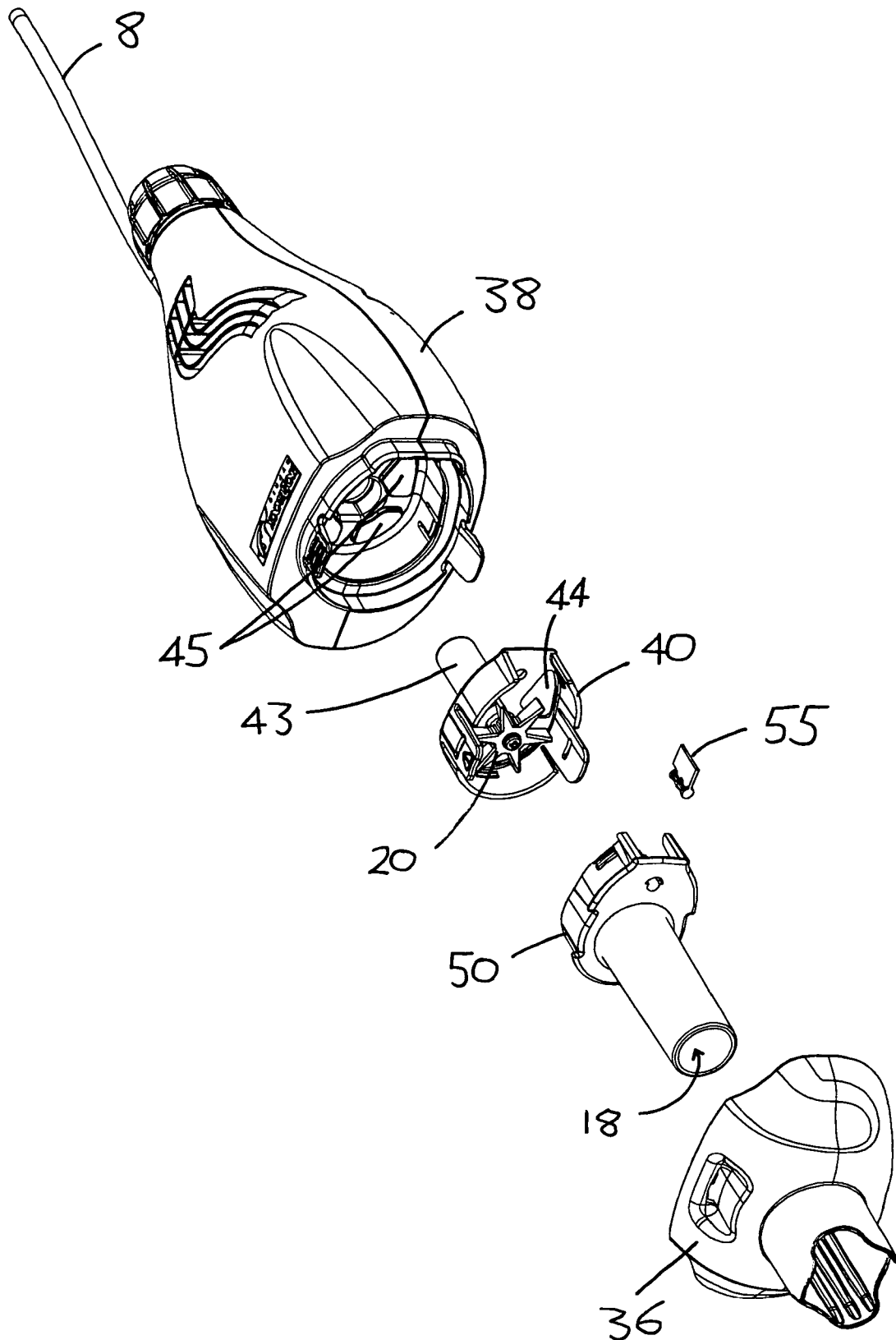


FIG. 3

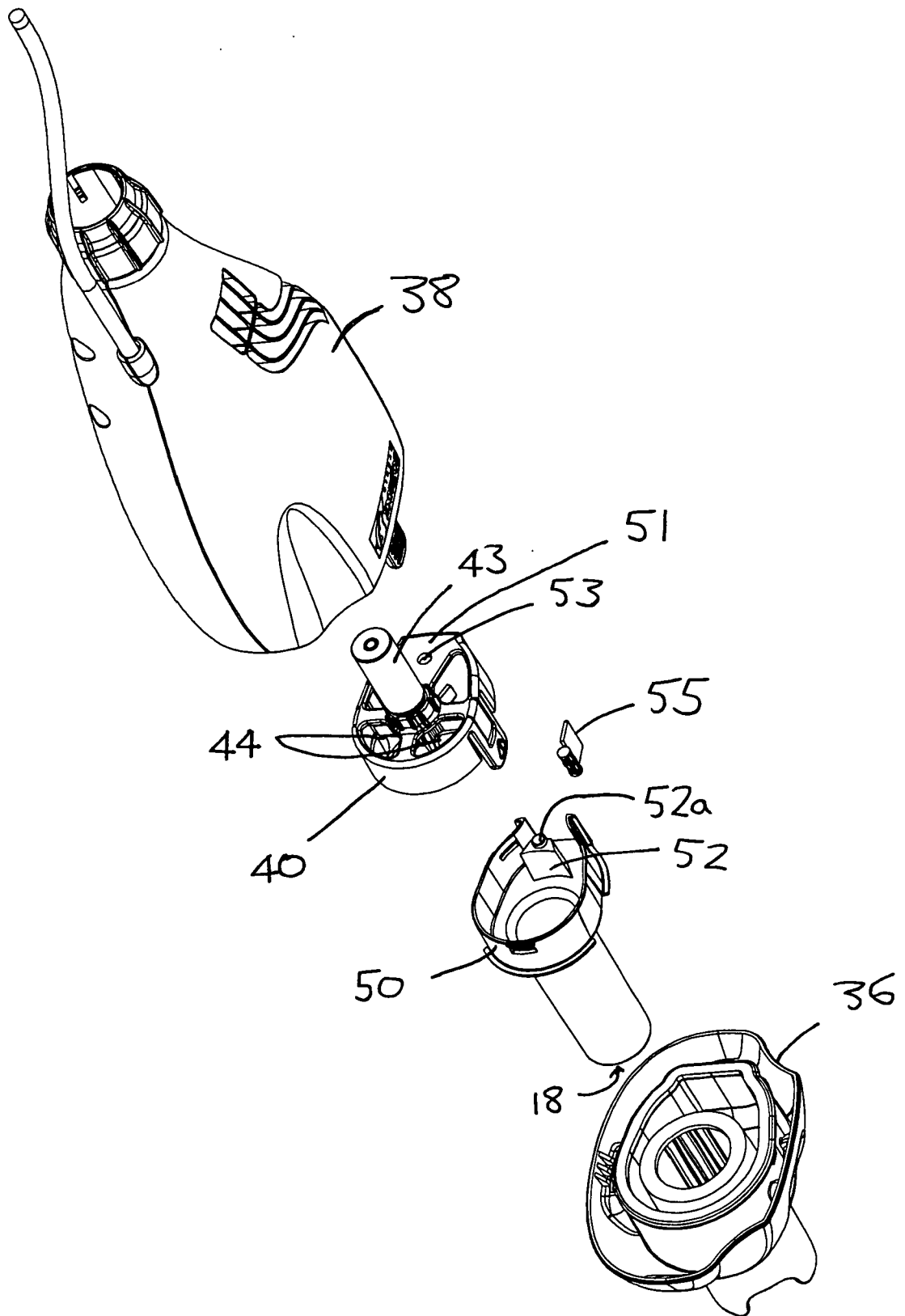


FIG. 4