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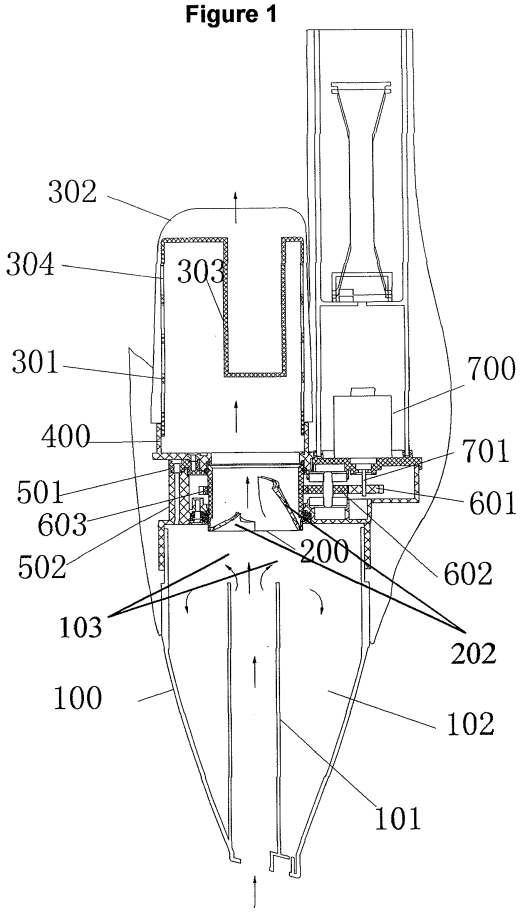
Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) Portable pool cleaner

(57) The present portable pool cleaner (100) is provided with an improved annular impeller (200), which facilitates the possible use of a fore receptacle (102) without a filter bag, operating as an eddy trap for large debris, and also facilitates having an aft receptacle (303) incorporating a filter bag (302) or direct connection to in pool filtration systems. The annular impeller (200) is able to effectively limit object size passing to the next stage, within impeding or striking objections passing through the inside gap in the annular impeller (200). The impeller duct/annular shape, with internal spiral blades (202), forms a through hole for the light sewage to more easily pass, while heavier particles in the sewage are trapped. The optional fore and aft receptacles (102, 303) may be detachable to facilitate cleaning, replacement and access to the impeller (200) for cleaning or replacement. The handheld design facilitates underwater use.

Figure 1



EP 2 987 925 A1

Description

FIELD:

[0001] The present invention relates generally to the pool cleaners for swimming pools and/or spas, and more particularly to handheld vacuum style cleaners for pools.

BACKGROUND:

[0002] While modern swimming pool and/or spa facilities typically include a filtration unit containing appropriate filter media, it is often desirable to use additional devices to clean portions of the pool where solid debris, such as fine grit, silt, twigs, leaves, insects and other particulate matter accumulate notwithstanding the built in filter system.

[0003] Electric motor driven pumps for use with swimming pools and/or spas are generally known in the art, wherein a battery operated motor drives a pump or blade to pull water and impurities through a strainer, then the pump/blade and finally ejecting the liquid back into the pool.

[0004] There is a desire for an improved handheld pool vacuum cleaner in which larger items are more probably collected prior to the strainer/filter to avoid damage to the filaments in the strainer/filter.

[0005] There is a desire for an improved handheld pool vacuum cleaner with greater suction force or to process a greater volume of water in a given period of time.

[0006] There is a desire for an improved impeller for a handheld pool vacuum cleaner.

SUMMARY:

[0007] A handheld pool cleaner features an input, an output, an annular impeller and a power source to drive the annular impeller to draw pool 5 water through the pool cleaner. The annular impeller draws water through the inside of the annulus from the input to an output, and is able to allow particles of a certain diameter to pass unobstructed (without pre-filtering). Cleaning of the pool water may occur by way of an eddy trap at the input, a strainer/filter at the output, an separate in pool filtration system into which the output may eject the water or some combination of the foregoing.

[0008] The impeller is comprised of a cylinder featuring spiral veins about the inner surface. The spiral veins have a depth less than the full radius of the cylinder, so as to create an annular shape pulling water inside the impeller rather than about it. The passage within the annular impeller which is not traversed by the spinning veins facilitate passage of debris laden water through the impeller.

[0009] The input may be a simple opening in the device housing or may include a cleaning head having an input tube having a bypass, a fore receptacle about the bypass, and a fluid connection to the inner passage through the impeller. The output may include an aft receptacle having a strainer/filter bag assembly, or it may include a direct connection adapted to receive a hose to a built in pool filtration system.

[0010] In one example the input includes a bypass, baffles, or other indirect fluid connection with the impeller, and these bypass gaps, baffles or disconnections between the inlet and the outlet of the fore receptacle can be generally referred to as fluid flow disruptions. The fluid flow disruptions create an eddy trap in the fore receptacle, causing heavier, larger or denser debris to fall into or collect within the fore receptacle while other debris is able to pass through the impeller without pre filtering, and into the device outlet.

[0011] Incorporating an aft receptacle, such as a strainer/filter bag assembly, downstream of the impeller at the output is an optional improvement which may allow less wear and tear on filter bags as compared to device in which the filter bag is positioned upstream of the impeller. Debris which is too large to pass through the through passage of the impeller is impeded and does not tear the filter, whereas, due to the shape of the impeller, smaller or longer objects are unlikely to contact the blades as would be the case with externally protruding blades in the impeller.

[0012] The motor rotates to drive the high speed rotation of the impeller, and gears may be used to ensure the operating frequency of the impeller is within an appropriate operating range as compared to the actual frequency of the motor. The centrifugal and displacement forces generated in the high-speed rotation of the impeller creates suction to draw sewage water into the input, through the eddy trap/fore receptacle (if provided), through the annular impeller, and out the output which could be an aft receptacle, a bypass valve or a direct connection to the built in pool filtration system. Heavier debris tends to accumulate in the eddy trap (if provided), so as to be less likely to damage the filaments in the filter bag or impact the impeller.

[0013] The input from the cleaning head through the fore receptacle to the impeller need not be in perfect fluid communication with the impeller. Gaps or open slates around the primary intake nozzle temporarily agitate the flow and redirect larger objects from the impeller, which may creating an improved eddy trap for large debris in a handheld pool cleaner. The inlet to the fore receptacle may be directed towards a baffle, which the outlet from the fore receptacle may be positioned at a different angle so as to improve the eddy trap effect.

[0014] A combination of an eddy trap upstream of the impeller and a strainer/filter bag assembly downstream of the annular impeller may serve to protect the strainer/filter bag assembly from damage potentially caused by larger or heavy debris which is caught in the eddy trap. A cylinder/annular shaped impeller featuring veins on the inner surface of cylinder (rather than radial from the centre) may improve flow through the device as compared to prior art devices.

[0015] Preferably, the motor and power supply for the

device is sealed from the impeller and fore and aft receptacle, so as to prevent water from corroding or damaging the motor and power supply. A small engine may also be used to drive the impeller, without departing from the inventive aspects related to the locations of the various debris receptacles, impeller and filter.

[0016] The impeller duct shape, with internal spiral blades, provides additional benefit in that debris is less likely to strict the blades than in traditional axle driven designs.

[0017] In one example, the body of the device comprises an outer cover and an inner cover, the outer cover and inner cover defining an outer cavity which may be referred to as the motor cavity wherein a drive shaft for the motor and gears are to be located, and an inner cover defining an inner cavity which may be referred to as the suction cavity wherein the impeller rotates.

[0018] In one example, the input detachably attaches to the body in front of the impeller. Where the input includes a fore receptacle, an output of the fore receptacle is in fluid communication with the impeller and the inlet tube of the fore receptacle is available to draw fluids into the device, but otherwise the fore receptacle has a water tight seal to the body of the device. In such a pool cleaner, the fore receptacle can be fully removed for cleaning and to empty collected debris. In another example of the pool cleaner, the input may include a fore receptacle which is fully attached to the device, but contains a door which may be opened to allow debris to be cleared from the eddy trap in the fore receptacle.

[0019] In another pool cleaner, the output comprises an aft receptacle with a strainer or cage within a removable filter bag, which strainer/filter bag assembly detachably attaches to the body in back of the impeller. An input of the aft receptacle is in fluid communication with the impeller and outlets from the aft receptacle and the filter are available to permit discharge of water from the device. In such an embodiment, the aft receptacle and filter can be fully removed for cleaning and to empty collected debris and replacement of the filter bag (if necessary). In another embodiment, the aft receptacle is attached, but contains a door which may be opened to allow the filter to be removed and debris to be cleared from the filter before replacing it in the aft receptacle. A bypass valve may be provided should the aft receptacle fill or all outputs become clogged, and an attachment to permit direct connection to an external or built in pool filtration system may be provided.

BRIEF DESCRIPTION OF THE DRAWINGS:

[0020]

Figure 1 shows a cross sectional view of the operating portion of a portable pool cleaner in the longitudinal direction of flow.

Figure 2 shows a cross section view of the motor chamber and suction chamber of the portable pool cleaner perpendicular to the direction of flow.

Figure 3 shows an expanded cross sectional view of body of the device of Figure 1.

Figure 4 shows an exploded perspective view of another embodiment of a portable pool cleaner from the front.

Figure 5 shows a different exploded perspective view of the embodiment of a portable pool cleaner shown in Figure 4 from the side.

Figure 6A, Figure 6B and Figure 6C shows perspective views of one example of the annular impeller from the front, the back and with a size of debris which is capable of passing straight through the inside passage of such impeller without contacting the blade(s), respectively.

DETAILED DESCRIPTION:

[0021] Certain embodiments of the present invention will now be described in greater detail with reference to the accompanying drawings.

[0022] As shown in Figure 1, the pool cleaner **100** has in input tube **101** towards an impeller cylinder **200,** with one or more gaps or slots **103** interrupting fluid communication between the input tube **101** and the impeller **200,** so as to permit the sewage/debris water to eddy within the fore receptacle **102.** As shown in Figure 1 and Figure 2, an electric motor **700** drives axle **701** and gears **601, 602** and **603** to turn the impeller **200** within the sealed suction chamber formed (in this embodiment) between upper cover **501** and lower cover **502.** The direction of sewage/debris water flow is shown by the arrows. Although the drive means shown are an electric motor **700,** axle **701** and gears **601, 602** and **603;** other means to drive the annular 5 rotor may be known and useful, including electric rotor designs (in which the annual impeller is the rotor) or other gearing systems powered by engines instead of motors; etc.

[0023] The sewage/debris water leaving the impeller **200** flows into aft receptacle **303** about which the filter bag **302** is to be fitted. Aft receptacle **303** is plastic cage portions **301** defining openings **304** to strain larger material from the water before it exits into the filter bag **302** and is returned to the pool or spa. The aft receptacle **303** detachably attaches to the body of the device at output cap **400** by means of a snap, threaded or other connection.

[0024] Figure 2 also shows the through bore **201** notionally formed between the veins **(202 of in Figure 1)** of spinning impeller **200,** as a more direct path between the fore receptacle and aft receptacle.

[0025] As shown in Figure 3, auxiliary support may be provided to the impeller by a wheel support lower support members **803** and **804,** to reduce friction and align the impeller. The contact position of the impeller **200** and the inner cover **501,** the impeller **200** and the lower cover **502** and the contact position of the support member **803** are each provided with two rows of peripheral recesses

shaped, concave embedded ball grooves **801,** which define the axial movement of the impeller **200** and which can serve to reduce the frictional force. In other embodiments, the recess can be embedded in the bearing. Various low friction seals **802** prevent sewage/debris water from flowing about the impeller **200** into the cavity where gear **603** on the impeller is driven by step-down gears **602** and **601** attached to the drive axle **701.**

[0026] Figure 4 and Figure 5 show another embodiment of the pool cleaner **1.** The suction head **10** is provided with an input path **11** and 5 threaded grooves for detachable attachment to the rest of the device. Optional rollers **15** may be fitted or clipped into roller slots **17** and optional brush head **16** may be fitted or clipped into brush slot **18.** The main body **20** (as indicated in Figure 5) is comprised for a right outer cover **21,** left outer cover **22,** front cap **23,** intermediate support **24** and end cap **25.** The right outer cover **21** and left outer cover **22** notionally define an outer cover. The front cap **23,** intermediate support **24** and end cap **25** notionally define an inner cover, and the impeller **30** fits into a impeller guide [not labelled] within the inner cover. Impeller gear **31** about the impeller **30** is accessible within a gear cavity created between the outer cover and the inner cover and the intermediate support **24.** The intermediate support and the motor cover **44,** create a motor cavity for the motor **41** which drives drive gear **42.** Drive gear **42** drives impeller gear **31** and thereby drives the impeller **30.**

[0027] Waste water pulled through the impeller 30 is expelled into a aft receptacle **50** (as indicated in Figure 5) comprising a strainer **51** covered by a filter bag **52.** The combination of the eddy trap in the fore receptacle **10,** the size of the through passage in the impeller **30** and the size of the slots in the strainer cage **51** protect the filter bag **52,** and may allow a greater rate of water volume to pass through the device than competing front filter vacuum cleaners.

[0028] Figure 6 shows three perspective views (A, B and C) an annular impeller **90,** having spiral inner veins or blades **91.** A through passage **92** (shown in Figure 6A and Figure 6B) allows passage of a particle **93** (shown in Figure 6C) up to a maximum diameter of less than a known size from passing. Where a helical blade form is used, it allows objects to pass between the blade and the inner wall of the impeller.

[0029] In prototyping, an impeller having total diameter of approximately 49 mm has one helical internally disposed blade which protrudes to within approximately 7 mm of the centre axis of the impeller (total diameter of the through bore when seen from the front is approximately 14 mm). Due to the helical shape of the blade, the impeller allows unobstructed passage of hard rubbish with a maximum diameter of approximately 2 cm, twigs smaller than approximately 10 cm by 0.5 cm, and leaves or flower heads smaller than approximately 20 cm by 8 cm or 15 cm by 15 cm. As tested, with the impeller operating at speeds of about 1000 r/min, through put of approximately 37 litres per minute was possible.

[0030] Larger impellers, and veins of larger or smaller relative size may be used, within the scope of handheld pool cleaners, without departing from the purposes herein disclosed.

[0031] The foregoing embodiments and advantages are merely exemplary and are not to be construed as limiting the present invention. The present teaching can be readily applied to other types of apparatuses. Also, the description of the embodiments of the present invention is intended to be illustrative, and not to limit the scope of the claims, and many alternatives, modifications, and variations will be apparent to those skilled in the art.

Claims

1. A portable pool cleaner comprising:

a. a pool water input,
b. an cleaner output, and
c. an annular impeller in fluid communication with the pool water input on an upstream side of the impeller and the water output on a downstream side of the impeller,
d. wherein the annular impeller comprises a cylinder having one or more inwardly disposed blades adapted to create suction from the upstream side of the impeller to the downstream side of the impeller when the impeller is rotated.

2. The portable pool cleaner of claim 1, wherein the pool water input is a cleaning head comprising an inlet in fluid communication with a fore receptacle and a fore receptacle outlet, wherein fluid flow disruptions between the inlet and fore receptacle outlet create an eddy trap to collect pool water debris on the upstream side of the impeller.

3. The portable pool cleaner of claim 2, wherein the input is detachable from the portable pool cleaner.

4. The portable pool cleaner of claim 1, wherein the output is an aft receptacle comprising an aft receptacle inlet in tight fluid communication with the annular impeller on the downstream side of the impeller, a plurality of aft receptacle outputs, and a filter outside the aft receptacle outputs.

5. The portable pool cleaner of claim 4, wherein the output is detachable from the portable pool cleaner.

6. The portable pool cleaner of claim 1, wherein the output is a hose connection for in pool filtration systems.

7. The portable pool cleaner of claim 1, wherein the one or more inwardly disposed blades is a single helical shaped blade.

8. A portable pool cleaner comprising:

a. a fore receptacle comprising a pool water inlet and a fore receptacle outlet with a bypass opening between the pool water inlet and the fore receptacle outlet;
b. an aft receptacle comprising an aft receptacle inlet into a strainer adapted to be covered by a filter bag; and
c. an impeller in tight fluid communication with the fore receptacle outlet and the aft receptacle inlet.

9. The portable pool cleaner of claim 8 further comprising drive means to rotate the impeller and thereby pull pool water through the pool water inlet, into the fore receptacle, through the fore receptacle outlet, through the impeller and push water through the aft receptacle inlet into the strainer.

10. The portable pool cleaner of claim 9, wherein the bypass creates an eddy to trap heavier debris from the pool water within the fore receptacle.

11. The portable pool cleaner of claim 9 further comprising a main body housing the drive means, the impeller and to which the fore receptacle and aft receptacle may be detachably detached.

12. The portable pool cleaner of claim 11 further comprising a detachable handle to permit a user outside the water to manoeuvre the portable pool cleaner while it is submerged.

13. The portable pool cleaner of claim 8, wherein the impeller comprises a cylinder having an inner wall and an outer wall, with one or more spiral veins disposed on the inner wall.

14. The portable pool cleaner of claim 13, wherein the impeller further comprises an impeller gear about the outer wall for interaction with drive means.

Amended claims in accordance with Rule 137(2) EPC.

1. A portable pool cleaner comprising:

a. a pool water input,
b. an cleaner output, and
c. an annular impeller in fluid communication with the pool water input on an upstream side of the impeller and the water output on a downstream side of the impeller,
d. wherein the annular impeller comprises a cylinder having one or more inwardly disposed blades adapted to create suction from the upstream side of the impeller to the downstream side of the impeller when the impeller is rotated.

2. The portable pool cleaner of claim 1, wherein the pool water input is a cleaning head comprising an inlet in fluid communication with a fore receptacle and a fore receptacle outlet, wherein fluid flow disruptions between the inlet and fore receptacle outlet create an eddy trap to collect pool water debris on the upstream side of the impeller.

3. The portable pool cleaner of claim 2, wherein the input is detachable from the portable pool cleaner.

4. The portable pool cleaner of claim 1, wherein the output is an aft receptacle comprising an aft receptacle inlet in tight fluid communication with the annular impeller on the downstream side of the impeller, a plurality of aft receptacle outputs, and a filter outside the aft receptacle outputs.

5. The portable pool cleaner of claim 4, wherein the output is detachable from the portable pool cleaner.

6. The portable pool cleaner of claim 1, wherein the output is a hose connection for in pool filtration systems.

7. The portable pool cleaner of claim 1, wherein the one or more inwardly disposed blades is a single helical shaped blade.

8. The portable pool cleaner of claim 1, comprising:

a. a fore receptacle comprising a pool water inlet and a fore receptacle outlet with a bypass opening between the pool water inlet and the fore receptacle outlet;
b. an aft receptacle comprising an aft receptacle inlet into a strainer adapted to be covered by a filter bag; and
c. an impeller in tight fluid communication with the fore receptacle outlet and the aft receptacle inlet.

9. The portable pool cleaner of claim 8 further comprising drive means to rotate the impeller and thereby pull pool water through the pool water inlet, into the fore receptacle, through the fore receptacle outlet, through the impeller and push water through the aft receptacle inlet into the strainer.

10. The portable pool cleaner of claim 9, wherein the bypass creates an eddy to trap heavier debris from the pool water within the fore receptacle.

11. The portable pool cleaner of claim 9 further comprising a main body housing the drive means, the impel-

ler and to which the fore receptacle and aft receptacle may be detachably detached.

12. The portable pool cleaner of claim 11 further comprising a detachable handle to permit a user outside the water to manoeuvre the portable pool cleaner while it is submerged.

13. The portable pool cleaner of claim 8, wherein the impeller comprises a cylinder having an inner wall and an outer wall, with one or more spiral veins disposed on the inner wall.

14. The portable pool cleaner of claim 13, wherein the impeller further comprises an impeller gear about the outer wall for interaction with drive means.

Figure 1

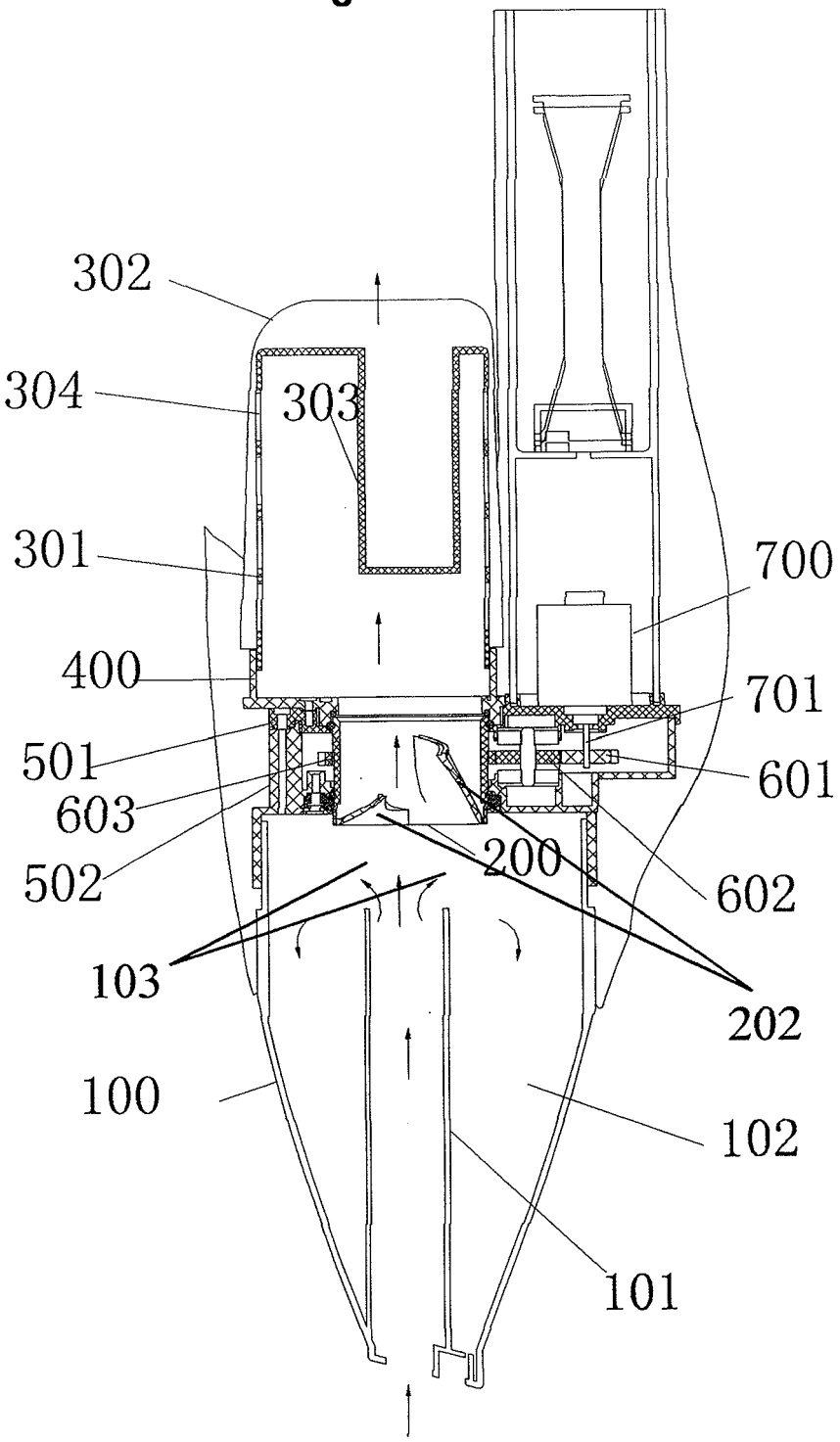

302
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Figure 2

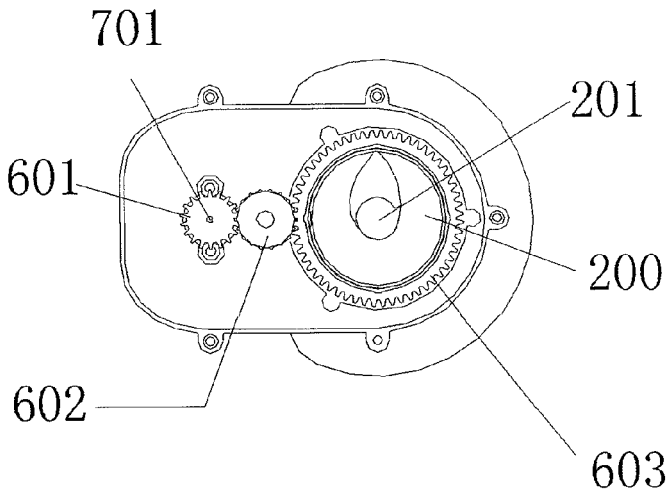


Figure 3

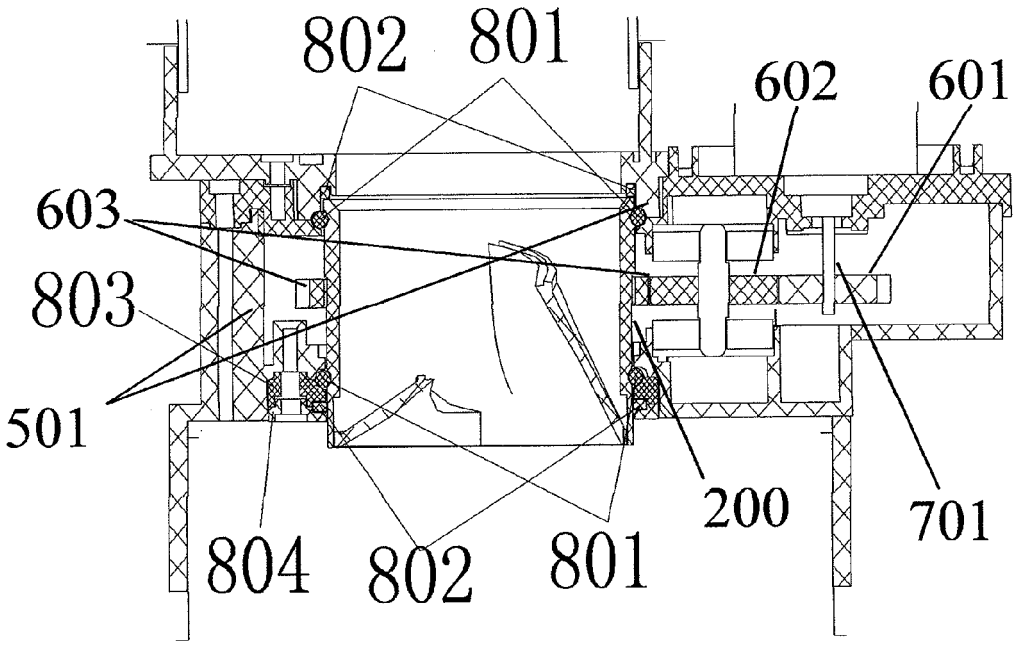


Figure 4

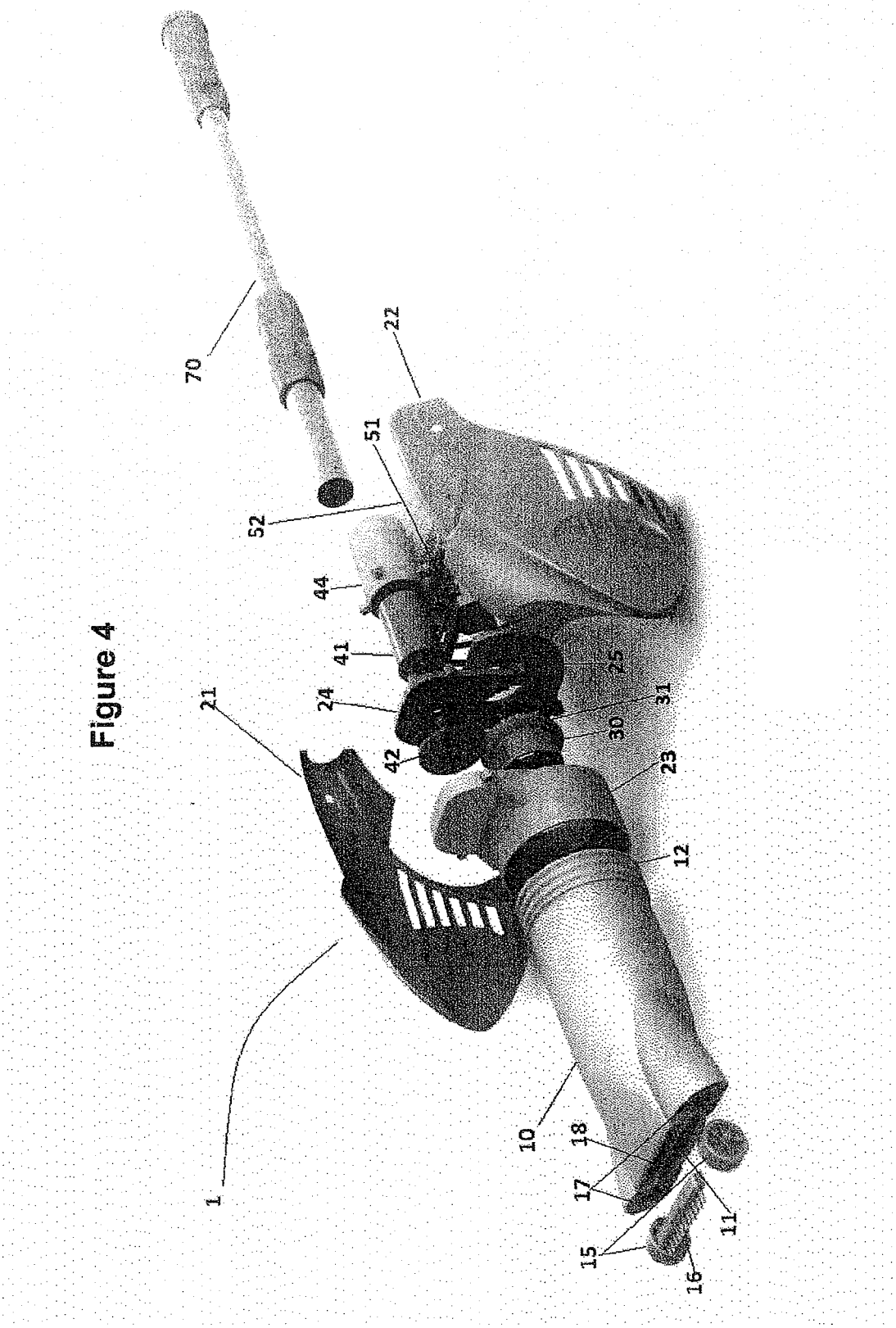


Figure 5

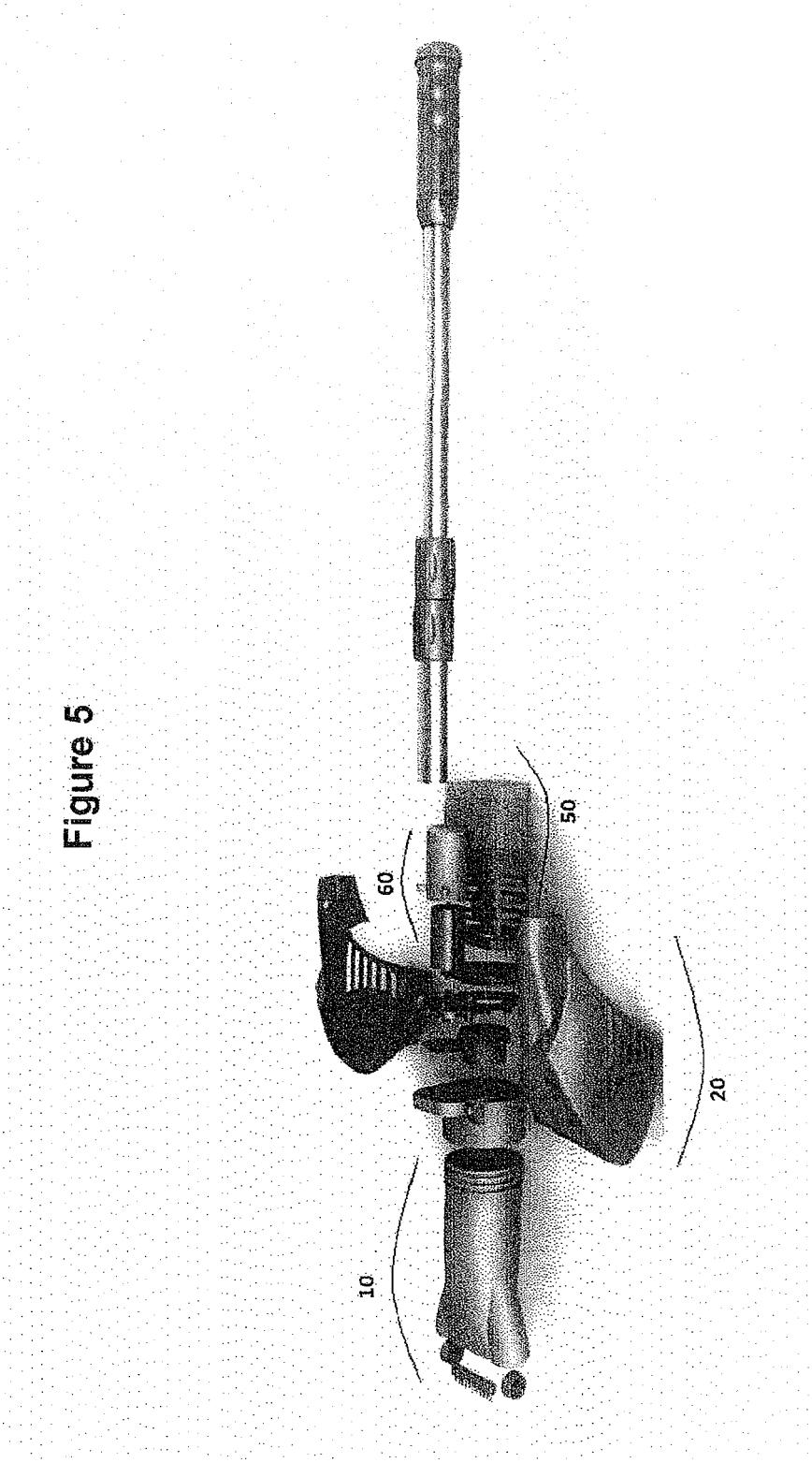
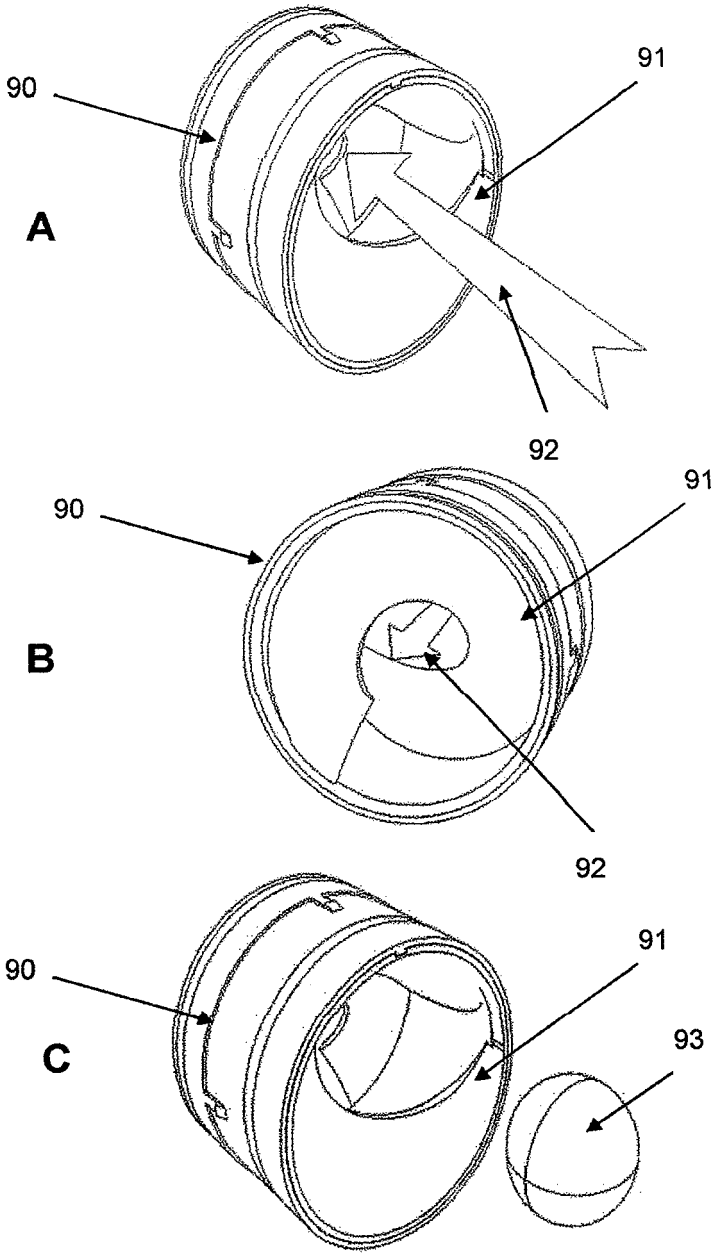


Figure 6



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PARTIAL EUROPEAN SEARCH REPORT

under Rule 62a and/or 63 of the European Patent Convention. This report shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number
EP 14 18 1520

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 8 281 441 B1 (ERLICH GUY [US] ET AL) 9 October 2012 (2012-10-09) * figures 4,5 *	1-7	INV. E04H4/16
A	US 2014/076789 A1 (SHLOMI-SHLOMI IDAN [IL] ET AL) 20 March 2014 (2014-03-20) * figure 3 *	1-7	
A	WO 2009/007921 A2 (ALLERS DU PLOOY EUDORE [ZA]; DU PLOOY WILHELM ANDREA [ZA]) 15 January 2009 (2009-01-15) * figure 1 *	1-7	

TECHNICAL FIELDS SEARCHED (IPC)

E04H

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

Place of search	Date of completion of the search	Examiner
Munich	17 March 2015	Brucksch, Carola

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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INCOMPLETE SEARCH
SHEET C

Application Number
EP 14 18 1520

Claim(s) completely searchable:
1-7

Claim(s) not searched:
8-14

Reason for the limitation of the search:

Claims 1 and 8 have been drafted as separate independent claims. An application may contain more than one independent claim in a particular category only if the subject-matter claimed involves one of the following:
- a plurality of interrelated products,
- different uses of a product or apparatus,
- alternative solutions to a particular problem, where it is inappropriate to cover these alternatives by a single claim. This is not the case in the present application.

In reply to the invitation to indicate the claims on which the search is to be based, the applicant failed to supply the requested indication in due time. With his letter of 10.03.2015 he filed a new set of claims. However, the amendments cannot be accepted since they were filed prior to the receipt of the European search report (rule 137(1)EPC). Thus, the search report has been drawn up on the basis of the first independent claim of each category (Rule 62a(1) EPC): independent claim 1 and its dependent claims 2-7.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 18 1520

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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17-03-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 8281441 B1	09-10-2012	CN 102783929 A	21-11-2012
		EP 2525020 A2	21-11-2012
		US 8281441 B1	09-10-2012
US 2014076789 A1	20-03-2014	EP 2725169 A2	30-04-2014
		US 2014076789 A1	20-03-2014
WO 2009007921 A2	15-01-2009	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82