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(54) **PTC HEATER FOR LIQUID HEATING**

(57) A PTC (Positive Temperature Coefficient) heater for liquid heating may include: a heat conductor; a PTC heating assembly; and water pipe assembly. The heat conductor may have a first accommodating duct and a second accommodating duct. The PTC heating assembly at least partially is disposed in the first accommodating duct; moreover, the water pipe assembly at least partially is disposed in the second accommodating duct, with an outer surface of the water pipe assembly at least par-

tially abutting against an inner surface of the second accommodating duct. The PTC liquid heating tube of the present disclosure can achieve a better corrosion resistance and greatly extend the service life of the PTC heater as well as prevent electric leakage accidents. Furthermore, the PTC heater of the present disclosure will have a simple structure and low costs for being convenient to assemble, especially in the replacement of the water pipes for maintaining the PTC heater in future.

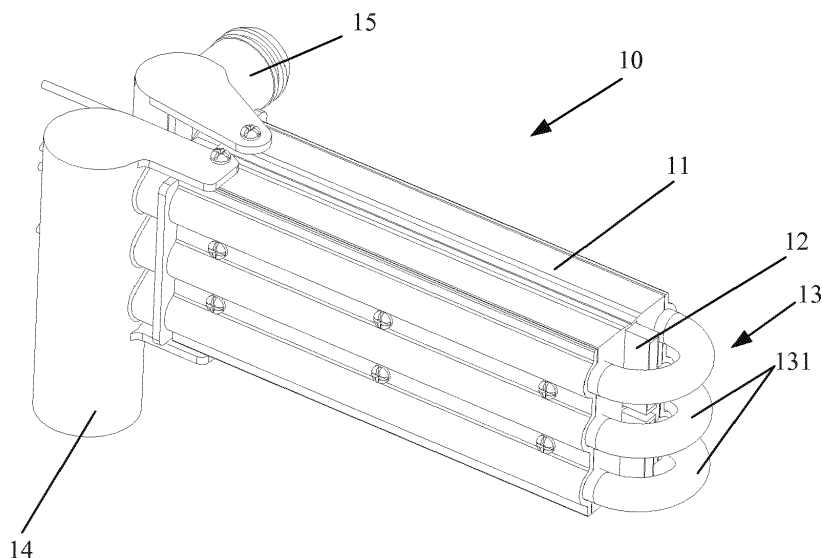


Fig.1

Description

CROSS REFERENCE

[0001] This application claims the benefit and priority of Chinese Application No. 201620804786.7, filed July 28, 2016. The entire disclosures of each of the above applications are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present disclosure relates to a heater, particularly to a PTC heater for liquid heating.

BACKGROUND

[0003] Currently, PTC (Positive Temperature Coefficient) heaters have been widely applied in household appliances, such as SPA pools, entertainment pools, water dispensers, foot baths, and other industrial products.

[0004] One type of common PTC heaters in the prior art may include a heat conductor and a PTC heating element. A plurality of ducts is provided within the heat conductor. Some of the ducts are used for placing PTC heating elements while some of the ducts are used for liquid passage.

[0005] The heat conductors for some of the PTC heaters employ metal materials without an anti-corrosion treatment, which are prone to corrosion after long-term use. When the water is with chemical substances such as oxidizing disinfectants, the oxidation and corrosion of the heat conductor will be accelerated to cause the leakage of liquid easily from the ducts inside the heat conductor. It is an increase in the risk of safety.

SUMMARY

[0006] A technical problem to be solved by the present disclosure is to provide a PTC heater for liquid heating in order to overcome the defect that the PTC heaters in the prior art are prone to corrosion during long-term use.

[0007] The above-mentioned technical problems are solved in the present disclosure by the following technical solution:

a PTC (Positive Temperature Coefficient) heater for liquid heating may include:

a heat conductor including at least one first accommodating duct and at least one second accommodating duct;

a PTC heating assembly at least partially disposed in the first accommodating duct; and

at least one water pipe assembly at least partially disposed in the second accommodating duct, with an outer surface of the water pipe assembly at least partially abutting against an inner surface of the second accommodating duct.

[0008] Preferably, the first and second accommodating ducts are disposed in parallel.

[0009] Preferably, the first accommodating duct is disposed between at least two second accommodating ducts.

[0010] Preferably, the heat conductor is a material of an aluminum alloy.

[0011] Preferably, the water pipe assembly is a material of a corrosion-resistant heat-conducting material.

[0012] Preferably, the water pipe assembly is a material of one of stainless steel, stainless iron and copper.

[0013] Preferably, the water pipe assembly may include at least one water inlet pipe and at least one water outlet pipe, at least one of ends of the water inlet pipe extends out of the second accommodating duct, and at least one of ends of the water outlet pipe extends out of the second accommodating duct.

[0014] Preferably, the PTC heater may further include a water inlet portion, the water inlet portion includes a water inlet duct, the water inlet portion is connected to a first end of the water inlet pipe, and the water inlet duct is in communication with the water inlet pipe.

[0015] Preferably, the first end of the water inlet pipe is disposed inside the water inlet duct of the water inlet portion.

[0016] Preferably, the water inlet portion is connected to a first end of the heat conductor.

[0017] Preferably, a seal is disposed between an outer surface of the first end of the water inlet pipe and an inner surface of the water inlet duct of the water inlet portion.

[0018] Preferably, a seal is disposed between an end face of the water inlet portion and an end face of the first end of the heat conductor.

[0019] Preferably, the PTC heater for liquid heating may further include a water outlet portion, the water outlet portion includes a water outlet duct, the water outlet portion is connected to a first end of the water outlet pipe, and the water outlet duct of the water outlet portion is in fluid communication with the water outlet pipe.

[0020] Preferably, the first end of the water outlet pipe is disposed inside the water outlet duct of the water outlet portion.

[0021] Preferably, the water outlet portion is connected to a first end of the heat conductor.

[0022] Preferably, a seal is disposed between an outer surface of the first end of the water outlet pipe and an inner surface of the water outlet duct of the water outlet portion.

[0023] Preferably, a seal is disposed between an end face of the water outlet portion and an end face of the first end of the heat conductor.

[0024] Preferably, the PTC heater for liquid heating may further include a connecting portion, the connecting portion includes a water flow duct, the connecting portion is connected to a second end of the water inlet pipe and a second end of the water outlet pipe respectively, and the water flow duct is in fluid communication with the water inlet pipe and the water outlet duct.

[0025] Preferably, the connecting portion is connected to a second end of the heat conductor, the second end of the water inlet pipe and the second end of the water outlet pipe being disposed inside the water flow duct of the connecting portion.

[0026] Preferably, the connecting portion is connected to the second end of the heat conductor.

[0027] Preferably, a seal is disposed between an outer surface of the second end of the water inlet pipe and an inner surface of the water flow duct of the connecting portion, and a seal is disposed between an outer surface of the second end of the water outlet pipe and an inner surface of the water flow duct of the connecting portion.

[0028] Preferably, a seal is disposed between an end face of the connecting portion and an end face of the heat conductor.

[0029] Preferably, the water pipe assembly may include at least one U-shaped water pipe at least partially disposed in the second accommodating duct.

[0030] Preferably, the PTC heater for liquid heating may further include a water inlet portion, the water inlet portion includes a water inlet duct, the water inlet portion is connected to a first end of the U-shaped water pipe, and the water inlet portion is in fluid communication with the U-shaped water pipe.

[0031] Preferably, the first end of the U-shaped water pipe is disposed inside the water inlet duct of the water inlet portion.

[0032] Preferably, the water inlet portion is connected to a first end of the heat conductor.

[0033] Preferably, a seal is disposed between an outer surface of the first end of the U-shaped water pipe and an inner surface of the water inlet duct of the water inlet portion.

[0034] Preferably, a seal is disposed between an end face of the water inlet portion and an end face of the first end of the heat conductor.

[0035] Preferably, the PTC heater for liquid heating may further include a water outlet portion, the water outlet portion includes a water outlet duct, the water outlet portion is connected to a second end of the U-shaped water pipe, and the water outlet duct of the water outlet portion is in fluid communication with the U-shaped water pipe.

[0036] Preferably, the second end of the U-shaped water pipe is disposed inside the water outlet duct of the water outlet portion.

[0037] Preferably, the water outlet portion is connected to a first end of the heat conductor.

[0038] Preferably, a seal is disposed between an outer surface of the second end of the U-shaped water pipe and an inner surface of the water outlet duct of the water outlet portion.

[0039] Preferably, a seal is provided between an end face of the water outlet portion and an end face of the first end of the heat conductor.

[0040] Preferably, the heat conductor is an integrally formed component, and the integrally formed component is a one-piece metal alloy shell.

[0041] Preferably, the heat conductor may include:

a first component, the first component including the first accommodating duct and a first groove disposed on an outer surface of the first component, and a second component detachably connected to the first component, the second component including a second groove, the second groove corresponding to the first groove;
wherein the first component is connected to the second component, the second groove is in combination with the first grooves to be configured to the second accommodating duct, and the water pipe assembly is disposed in the second accommodating ducts.

[0042] Preferably, the first and second grooves are profiled grooves.

[0043] Preferably, the water pipe assembly may include a profiled water pipe fastened to the second accommodating duct.

[0044] The positive progressive effects of the present disclosure lie in:

the PTC liquid heating tube of the present disclosure can achieve a better corrosion resistance, greatly extend the service life of the PTC heater and prevent electric leakage accidents. Furthermore, the PTC heater for liquid heating of the present disclosure has a simple structure and low costs, and is convenient to assemble, especially in the replacement of the water pipes for maintaining the PTC heater in future.

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] The above-mentioned and other features, characteristics and advantages of the present disclosure will be more apparent from the following description taken in conjunction with the accompanying drawings and embodiments, and in the accompanying drawings, like reference numbers indicate like features, in which:

Fig. 1 is a first structural schematic view of a first embodiment of a PTC heater for liquid heating of the present disclosure.

Fig. 2 is a second structural schematic view of the first embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 3 is a third structural schematic view of the first embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 4 is a longitudinal sectional view of the first embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 5 is an exploded view of the first embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 6 is a first structural schematic view of a second

embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 7 is a second structural schematic view of the second embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 8 is a third structural schematic view of the second embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 9 is a longitudinal sectional view of the second embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 10 is an exploded view of the second embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 11 is a first structural schematic view of a third embodiment of the PTC liquid heater of the present disclosure.

Fig. 12 is a second structural schematic view of a third embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 13 is a third structural schematic view of the third embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 14 is a longitudinal sectional view of the third embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 15 is an exploded view of the third embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 16 is a first structural schematic view of a fourth embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 17 is a second structural schematic view of the fourth embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 18 is a third structural schematic view of the fourth embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 19 is a longitudinal sectional view of the fourth embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 20 is an exploded view of the fourth embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 21 is a first structural schematic view of a fifth embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 22 is a second structural schematic view of the fifth embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 23 is a third structural schematic view of the fifth embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 24 is a longitudinal sectional view of the fifth embodiment of the PTC heater for liquid heating of the present disclosure.

Fig. 25 is an exploded view of the fifth embodiment of the PTC heater for liquid heating of the present

disclosure.

DETAILED DESCRIPTION

[0046] To make the above-mentioned object, features and advantages of the present disclosure apparent and easily understood, a detailed description of particular embodiments of the present disclosure is made in conjunction with the drawings.

[0047] Embodiments of the present disclosure will now be described in detail with reference to the accompanying drawings. Reference now will be made in detail to preferred embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings. The same reference numerals in all the figures denote the same or similar parts wherever possible. Furthermore, although the terms used in the present disclosure are selected from well-known common terms, some of the terms mentioned in the description of the present disclosure may be selected by the applicant according to his or her judgement, and the detailed meaning thereof is described in the relevant section described herein. Furthermore, the present disclosure must be understood, not simply by the actual terms used but also by the meanings encompassed by each term.

First Embodiment:

[0048] Fig. 1 is a first structural schematic view of a first embodiment of a PTC heater for liquid heating of the present disclosure. Fig. 2 is a second structural schematic view of the first embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 3 is a third structural schematic view of the first embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 4 is a longitudinal sectional view of the first embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 5 is an exploded view of the first embodiment of the PTC heater for liquid heating of the present disclosure.

[0049] As shown in Figs. 1-5, the present disclosure discloses a PTC heater for liquid heating 10, which may include a heat conductor 11, a PTC heating assembly 12 and at least one water pipe assembly 13. The heat conductor 11 is provided with at least one first accommodating duct and at least one second accommodating duct, the PTC heating assembly 12 is at least partially provided in the first accommodating duct, the water pipe assembly 13 is at least partially provided in the second accommodating duct, and an outer surface of the water pipe assembly 13 at least partially abuts against an inner surface of the second accommodating duct. The first and second accommodating ducts are disposed in parallel. Particularly, the first accommodating duct is disposed between the second accommodating ducts.

[0050] The PTC heating assembly 12 can include a PTC heating element, a first electrode, a second electrode, a first protection layer, a second protection layer,

a first interlayer, and a second interlayer. The PTC heating element has a first side and a second side. The first electrode and the second electrode can be positioned on the first side of the PTC heating element and the second side of the PTC heating element respectively. The first insulating interlayer can be located between the first protection layer and the first electrode. The second insulating interlayer can be located between the second protection layer and the second electrode. The first protection layer and the second protection layer can have a greater hardness in comparison with the first and second insulating interlayer.

[0051] Moreover, the PTC heating assembly 12 can further include a heat conductive housing. The first interlayer and second insulating interlayer are placed into the heat conductive housing. A first side wall and a second side wall of the heat conductive housing are inwardly curved.

[0052] Preferably, the heat conductor 11 may include a component 111 and a second component 112. The first component 111 is disposed with the first accommodating duct 113 and a first groove 114 which is disposed at an outer surface of the first component 111, the second component 112 is detachably connected to the first component 111, and the second component 112 is disposed with a second groove 115 corresponding to the first groove 114. When the first component 111 is connected to the second component 112, the second groove 115 and the first groove 114 are combined to form the second accommodating duct, and the water pipe assembly 13 may be disposed in the second accommodating duct.

[0053] Of course, the first groove 114 and the second groove 115 herein may also be profiled grooves, and the water pipe assembly 13 can include a profiled water pipe fastened to the second accommodating duct accordingly. Because of the combination of the first groove 114 and the second groove 115 to configure to the second accommodating duct, the type of the second accommodating duct can be particular corresponding with the type of the profiled groove in accordance with the configuration of first groove 114 and second groove 115. The type of the profiled groove can be the S-shaped groove, U-shaped groove, or other specific shape of the groove. Moreover, the shape of the profiled water pipe can be matched with the type of profiled groove to achieve the assembling of pipe being disposed inside the heat conductor 11.

[0054] Further, the water pipe assembly 13 in this embodiment may include at least one U-shaped water pipe 131, and the U-shaped water pipe 131 is at least partially disposed in the second accommodating ducts.

[0055] Preferably, the PTC heater for liquid heating 10 may further include a water inlet portion 14, and the water inlet portion 14 is provided with a water inlet duct 141. The water inlet portion 14 is connected to a first end of the U-shaped water pipe 131, and the water inlet portion 141 is in communication with the U-shaped water pipe 131. For example, the first end of the U-shaped water

pipe 131 is disposed in the water inlet duct 141 of the water inlet portion 14, such that the water inlet portion is connected to the first end of the heat conductor 11. Seals 142 are disposed both between an outer surface of the first end of the U-shaped water pipe 131 and an inner surface of the water inlet duct 141 of the water inlet portion 14, and between an end face of the water inlet portion 14 and an end face of the first end of the heat conductor 11.

[0056] Further, the PTC heater for liquid heating 10 may further include a water outlet portion 15, and the water outlet portion 15 is provided with a water outlet duct 151, wherein the water outlet portion 15 is connected to a second end of the U-shaped water pipe 131, and the water outlet duct 151 of the water outlet portion 15 is in communication with the U-shaped water pipe 131. For example, the second end of the U-shaped water pipe 131 is disposed in the water outlet duct 151 of the water outlet portion 15, such that the water outlet portion 15 is connected to the first end of the heat conductor 11. Seals 152 are disposed both between an outer surface of the second end of the U-shaped water pipe 131 and an inner surface of the water outlet duct 151 of the water outlet portion 15, and between an end face of the water outlet portion 15 and the end face of the first end of the heat conductor 11.

[0057] Of course, the material of the heat conductor 11 in this embodiment may preferably be an aluminum alloy. The material of the water pipe assembly 13 may preferably be a corrosion-resistant heat-conducting material, such as one of stainless steel, stainless iron or copper.

Second Embodiment:

[0058] Fig. 6 is a first structural schematic view of a second embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 7 is a second structural schematic view of the second embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 8 is a third structural schematic view of the second embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 9 is a longitudinal sectional view of the second embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 10 is an exploded view of the second embodiment of the PTC heater for liquid heating of the present disclosure.

[0059] As shown in Figs. 6-10, the present disclosure discloses another PTC heater for liquid heating 20, which may include a heat conductor 21, a PTC heating assembly 22 and at least one water pipe assembly 23. The heat conductor 21 in this embodiment is made of an integrally formed component. Particularly, the heat conductor 21 is provided with a first accommodating duct 211 and second accommodating ducts 212, the PTC heating assembly 22 is at least partially disposed in the first accommodating duct 211, the water pipe assembly 23 is at least partially disposed in the second accommodating duct

212, and an outer surface of the water pipe assembly 23 at least partially abuts against an inner surface of the second accommodating duct 212. The first accommodating duct 211 and the second accommodating ducts 212 are disposed in parallel. Particularly, the first accommodating duct 211 is disposed between the second accommodating ducts 212.

[0060] Further, the water pipe assembly 23 in this embodiment may include at least one U-shaped water pipe which is at least partially disposed in the second accommodating ducts 212.

[0061] Preferably, the PTC heater for liquid heating 20 may further include a water inlet portion 24, and the water inlet portion 24 is provided with a water inlet duct 241. The water inlet portion 24 is connected to a first end of the U-shaped water pipe 231, and the water inlet portion 241 is in communication with the U-shaped water pipe 231. For example, the first end of the U-shaped water pipe 231 is disposed in the water inlet duct 241 of the water inlet portion 24, such that the water inlet portion is connected to the first end of the heat conductor 21. Seals 242 are disposed both between an outer surface of the first end of the U-shaped water pipe 231 and an inner surface of the water inlet duct 241 of the water inlet portion 24, and between an end face of the water inlet portion 24 and an end face of the first end of the heat conductor 21.

[0062] Further, the PTC heater for liquid heating 20 may further include a water outlet portion 25, and the water outlet portion 25 is provided with a water outlet duct 251, wherein the water outlet portion 25 is connected to a second end of the U-shaped water pipe 231, and the water outlet duct 251 of the water outlet portion 25 is in communication with the U-shaped water pipe 231. For example, the second end of the U-shaped water pipe 231 is disposed in the water outlet duct 251 of the water outlet portion 25, such that the water outlet portion 25 is connected to the first end of the heat conductor 21. Seals 252 are disposed both between an outer surface of the second end of the U-shaped water pipe 231 and an inner surface of the water outlet duct 251 of the water outlet portion 25, and between an end face of the water outlet portion 25 and the end face of the first end of the heat conductor 21.

[0063] Of course, the material of the heat conductor 21 in this embodiment may preferably be an aluminum alloy. The material of the water pipe assembly 23 may preferably be a corrosion-resistant heat-conducting material, such as one of stainless steel, stainless iron or copper.

Third Embodiment:

[0064] Fig. 11 is a first structural schematic view of a third embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 12 is a second structural schematic view of a third embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 13 is a

third structural schematic view of the third embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 14 is a longitudinal sectional view of the third embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 15 is an exploded view of the third embodiment of the PTC heater for liquid heating of the present disclosure.

[0065] As shown in Figs. 11-15, the present disclosure still discloses a PTC heater for liquid heating 30, which may include a heat conductor 31, a PTC heating assembly 32 and at least one water pipe assembly 33. The heat conductor 31 is provided with first and second accommodating ducts, the PTC heating assembly 32 is at least partially disposed in the first accommodating duct, the water pipe assembly 33 is at least partially disposed in the second accommodating duct, and an outer surface of the water pipe assembly 33 at least partially abuts against an inner surface of the second accommodating duct. The first and second accommodating ducts are disposed in parallel. Particularly, the first accommodating duct is disposed between the second accommodating ducts.

[0066] Preferably, the heat conductor 31 may include a first component 311 and a second component 312. The first component 311 is provided with the first accommodating duct 313 and a first groove 314 which is disposed at an outer surface of the first component 311, the second component 312 is detachably connected to the first component 311, and the second component 312 is provided with a second groove 315 corresponding to the first groove 314. When the first component 311 is connected to the second component 312, the second groove 315 and the first groove 314 are combined to form the second accommodating duct, and the water pipe assembly 33 may be disposed in the second accommodating duct.

[0067] Of course, the first groove 314 and the second groove 315 herein may also be profiled grooves, and the water pipe assembly 33 can include a profiled water pipe fastened to the second accommodating duct accordingly. Because of the combination of the first groove 314 and the second groove 315 to configure to the second accommodating duct, the type of the second accommodating duct can be particular corresponding with the type of the profiled groove in accordance with the configuration of first groove 314 and second groove 315. The type of the profiled groove can be the S-shaped groove, U-shaped groove, or other specific shape of the groove. Moreover, the shape of the profiled water pipe can be matched with the type of profiled groove to achieve the assembling of pipe being disposed inside the heat conductor 31.

[0068] Further, the water pipe assembly 33 in this embodiment may include at least one water inlet pipe 331 and at least one water outlet pipe 332. At least one end of the water inlet pipe 331 and at least one end of the water outlet pipe 332 extend out of the second accommodating duct.

[0069] Moreover, the water pipe assembly 33 in the

PTC heater for liquid heating 30 may further include a connecting portion 333, the connecting portion 333 is provided with a water flow duct, the connecting portion 333 is connected to a second end of the water inlet pipe 331 and a second end of the water outlet pipe 332 respectively, and the water flow duct is in communication with the water inlet pipe 331 and the water outlet duct 332. Seals 334 are disposed between an outer surface of the second end of the water inlet pipe 331 and an inner surface of the water flow duct of the connecting portion 333, and between an outer surface of the second end of the water outlet pipe 332 and an inner surface of the water flow duct of the connecting portion 333. A seal 334 may also be disposed between an end face of the connecting portion 333 and an end face of the heat conductor 31.

[0070] Preferably, the PTC heater for liquid heating 30 may further include a water inlet portion 34, and the water inlet portion 34 is provided with a water inlet duct 341. The water inlet portion 34 is connected to a first end of the water inlet pipe 331, and the water inlet duct 341 is in communication with the water inlet pipe 331. For example, the first end of the water inlet pipe 331 is disposed in the water inlet duct 341 of the water inlet portion 34, such that the water inlet portion 34 is connected to the first end of the heat conductor 11. Seals 342 are disposed both between an outer surface of the first end of the water inlet pipe 331 and an inner surface of the water inlet duct 341 of the water inlet portion 34, and between an end face of the water inlet portion 34 and an end face of the first end of the heat conductor 31.

[0071] Further, the PTC heater for liquid heating 30 may further include a water outlet portion 35, and the water outlet portion 35 is provided with a water outlet duct 351, wherein the water outlet portion 35 is connected to the first end of the water inlet pipe 332, and the water outlet duct 351 of the water outlet portion 35 is in communication with the water outlet pipe 332. For example, the first end of the water outlet pipe 332 is disposed in the water outlet duct 351 of the water outlet portion 35, such that the water outlet portion 35 is connected to the first end of the heat conductor 31. Seals 352 are disposed both between an outer surface of the first end of the water outlet pipe 332 and an inner surface of the water outlet duct 351 of the water outlet portion 35, and between an end face of the water outlet portion 35 and the end face of the first end of the heat conductor 31.

[0072] Of course, the material of the heat conductor 31 in this embodiment may preferably be an aluminum alloy. The material of the water pipe assembly 33 may preferably be a corrosion-resistant heat-conducting material, such as one of stainless steel, stainless iron or copper.

Fourth Embodiment:

[0073] Fig. 16 is a first structural schematic view of a fourth embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 17 is a second structural

schematic view of the fourth embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 18 is a third structural schematic view of the fourth embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 19 is a longitudinal sectional view of the fourth embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 20 is an exploded view of the fourth embodiment of the PTC heater for liquid heating of the present disclosure.

[0074] As shown in Figs. 16-20, the present disclosure discloses yet another PTC heater for liquid heating 40, which may include a heat conductor 41, a PTC heating assembly 42 and at least one water pipe assembly 43. The heat conductor 41 in this embodiment is made of an integrally formed component. Particularly, the heat conductor 41 is provided with a first accommodating duct 411 and second accommodating ducts 412, the PTC heating assembly 42 is at least partially disposed in the first accommodating duct 411, the water pipe assembly 43 is at least partially disposed in the second accommodating duct 412, and an outer surface of the water pipe assembly 43 at least partially abuts against an inner surface of the second accommodating duct 412. The first accommodating duct 411 and the second accommodating ducts 412 are disposed in parallel. Particularly, the first accommodating duct 411 is disposed between the second accommodating ducts 412.

[0075] Further, the water pipe assembly 43 in this embodiment may include at least one water inlet pipe 431 and at least one water outlet pipe 432. At least one end of the water inlet pipe 431 and at least one end of the water outlet pipe 432 extend out of the second accommodating duct 412.

[0076] Moreover, the water pipe assembly 43 in the PTC heater for liquid heating 40 may further include a connecting portion 433, the connecting portion 433 is provided with a water flow duct, the connecting portion 433 is connected to a second end of the water inlet pipe 431 and a second end of the water outlet pipe 432 respectively, and the water flow duct is in communication with the water inlet pipe 431 and the water outlet duct 432. Seals 434 are disposed both between a surface of the second end of the water inlet pipe 431 and an inner surface of the water flow duct of the connecting portion 433, and between the second end of the water outlet pipe 432 and an inner surface of the water flow duct of the connecting portion 433, and may be also disposed between an end face of the connecting portion 433 and an end face of the heat conductor 41.

[0077] Preferably, the PTC heater for liquid heating 40 may further include a water inlet portion 44, and the water inlet portion 44 is provided with a water inlet duct 441. The water inlet portion 44 is connected to a first end of the water inlet pipe 431, and the water inlet duct 441 is in communication with the water inlet pipe 431. For example, the first end of the water inlet pipe 431 is disposed in the water inlet duct 441 of the water inlet portion 44, such that the water inlet portion 44 is connected to the

first end of the heat conductor 41. Seals 442 are disposed both between an outer surface of the first end of the water inlet pipe 431 and an inner surface of the water inlet duct 441 of the water inlet portion 44, and between an end face of the water inlet portion 44 and an end face of the first end of the heat conductor 41.

[0078] Further, the PTC heater for liquid heating 40 may further include a water outlet portion 45, and the water outlet portion 45 is provided with a water outlet duct 451, wherein the water outlet portion 45 is connected to the first end of the water inlet pipe 432, and the water outlet duct 451 of the water outlet portion 45 is in communication with the water outlet pipe 432. For example, the first end of the water outlet pipe 432 is disposed in the water outlet duct 451 of the water outlet portion 45, such that the water outlet portion 45 is connected to the first end of the heat conductor 41. Seals 452 are disposed both between an outer surface of the first end of the water outlet pipe 432 and an inner surface of the water outlet duct 451 of the water outlet portion 45, and between an end face of the water outlet portion 45 and the end face of the first end of the heat conductor 41.

[0079] Of course, the material of the heat conductor 41 in this embodiment may preferably be an aluminum alloy. The material of the water pipe assembly 43 may preferably be a corrosion-resistant heat-conducting material, such as one of stainless steel, stainless iron or copper.

Fifth Embodiment:

[0080] Fig. 21 is a first structural schematic view of a fifth embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 22 is a second structural schematic view of the fifth embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 23 is a third structural schematic view of the fifth embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 24 is a longitudinal sectional view of the fifth embodiment of the PTC heater for liquid heating of the present disclosure. Fig. 25 is an exploded view of the fifth embodiment of the PTC heater for liquid heating of the present disclosure.

[0081] As shown in Figs. 21-25, the present disclosure discloses another PTC heater for liquid heating 50, which may include a heat conductor 51, a PTC heating assembly 52 and at least one water pipe assembly 53. The heat conductor 51 in this embodiment is made of an integrally formed component. Particularly, the heat conductor 51 is provided with a first accommodating duct 511 and second accommodating ducts 512, the PTC heating assembly 52 is at least partially disposed in the first accommodating duct 511, the water pipe assembly 53 is at least partially disposed in the second accommodating duct 512, and an outer surface of the water pipe assembly 53 at least partially abuts against an inner surface of the second accommodating duct 512. The first accommodating duct 511 and the second accommodating ducts

512 are disposed in parallel. Particularly, the first accommodating duct 511 is disposed between the second accommodating ducts 512.

[0082] Further, the water pipe assembly 53 in this embodiment may include at least one water inlet pipe 531 and a plurality of water outlet pipes 532. At least one end of the water inlet pipe 531 and at least one end of the water outlet pipes 532 extend out of the second accommodating duct 512.

[0083] Moreover, the water pipe assembly 53 in the PTC heater for liquid heating 50 may further include a connecting portion 533, the connecting portion 533 is provided with a water flow duct, the connecting portion 533 is connected to a second end of the water inlet pipe 531 and a second end of each water outlet pipe 532 respectively, and the water flow duct is in communication with the water inlet pipe 531 and the water outlet duct 532. Seals 534 are disposed both between an outer surface of the second end of the water inlet pipe 531 and an inner surface of the water flow duct of the connecting portion 533, and between an end face of the connecting portion 533 and an end face of the heat conductor 51.

[0084] Preferably, the PTC heater for liquid heating 50 may further include a water inlet portion 54, and the water inlet portion 54 is provided with a water inlet duct 541. The water inlet portion 54 is connected to a first end of the water inlet pipe 531, and the water inlet duct 541 is in communication with the water inlet pipe 531. For example, the first end of the water inlet pipe 531 is disposed in the water inlet duct 541 of the water inlet portion 54, such that the water inlet portion 54 is connected to the first end of the heat conductor 51. Seals 56 are disposed both between an outer surface of the first end of the water inlet pipe 531 and an inner surface of the water inlet duct 541 of the water inlet portion 54, and between an end face of the water inlet portion 54 and an end face of the first end of the heat conductor 51.

[0085] Further, the PTC heater for liquid heating 50 may further include a water outlet portion 55, and the water outlet portion 55 is provided with a water outlet duct 551, wherein the water outlet portion 55 is connected to the first end of the water inlet pipe 532, and the water outlet duct 551 of the water outlet portion 55 is in communication with the water outlet pipe 532. For example, the first end of the water outlet pipe 532 is disposed in the water outlet duct 551 of the water outlet portion 55, such that the water outlet portion 55 is connected to the first end of the heat conductor 51. Seals 56 are disposed both between an outer surface of the first end of the water outlet pipe 532 and an inner surface of the water outlet duct 551 of the water outlet portion 55, and between an end face of the water outlet portion 55 and the end face of the first end of the heat conductor 51.

[0086] Preferably, in this embodiment, for convenience of production, both the water inlet portion 54 and the water outlet portion 55 may be integrally formed.

[0087] Of course, the material of the heat conductor 51 in this embodiment may preferably be an aluminum

alloy. The material of the water pipe assembly 53 may preferably be a corrosion-resistant heat-conducting material, such as one of stainless steel, stainless iron or copper.

[0088] As mentioned previously, the PTC heater for liquid heating can include the heat conductor having one first accommodating duct arranged in one side, and one second accommodating duct arrange in another side for holding the PTC heating assembly and water pipe assembly, respectively. Additionally, the heat conductor may be a type of configuration having a plurality of first accommodating ducts and second accommodating ducts forming a plurality of holding chambers the PTC heating assemblies and water pipe assemblies are arranged inside the holding chambers.

[0089] In summary, the PTC liquid heating tube of the present disclosure can achieve a better corrosion resistance, greatly extend the service life of the PTC heater and prevent electric leakage accidents. Furthermore, the PTC heater for liquid heating of the present disclosure has a simple structure and low costs, and is convenient to assemble, especially in the replacement of the water pipes for maintaining the PTC heater in future.

[0090] While the particular embodiments of the present disclosure have been described, a person skilled in the art should understand that these are merely illustrative, and that the scope of protection of the present disclosure is defined by the appended claims. Various alterations or modifications can be made by a person skilled in the art to these embodiments without departing from the principle and substance of the present disclosure; however, these alterations and modifications all fall within the scope of protection of the present disclosure.

Claims

1. A PTC heater for liquid heating, comprising:

a heat conductor comprising at least one first accommodating duct and at least one second accommodating duct;
a PTC heating assembly at least partially disposed in the first accommodating duct; and
at least one water pipe assembly at least partially disposed in the second accommodating duct, with an outer surface of the water pipe assembly at least partially abutting against an inner surface of the second accommodating duct.

2. The PTC heater for liquid heating of claim 1, wherein the first and second accommodating ducts are disposed in parallel.

3. The PTC heater for liquid heating of claim 1, wherein the first accommodating duct is disposed between at least two second accommodating ducts.

4. The PTC heater for liquid heating of claim 1, wherein the heat conductor is a material of an aluminum alloy.

5. The PTC heater for liquid heating of claim 1, wherein the water pipe assembly is a material of a corrosion-resistant heat-conducting material.

6. The PTC heater for liquid heating of claim 1, wherein the water pipe assembly is a material of one of stainless steel, stainless iron and copper.

7. The PTC heater for liquid heating of claim 6, wherein the water pipe assembly comprises at least one water inlet pipe and at least one water outlet pipe, at least one of ends of the water inlet pipe extends out of the second accommodating duct and at least one of ends of the water outlet pipe extends out of the second accommodating duct.

8. The PTC heater for liquid heating of claim 7, further comprising a water inlet portion, the water inlet portion comprising a water inlet duct, the water inlet portion being connected to a first end of the water inlet pipe, and the water inlet duct being in communication with the water inlet pipe.

9. The PTC heater for liquid heating of claim 8, wherein the first end of the water inlet pipe is disposed inside the water inlet duct of the water inlet portion.

10. The PTC heater for liquid heating of claim 8, wherein the water inlet portion is connected to a first end of the heat conductor.

11. The PTC heater for liquid heating of claim 9, wherein a seal is disposed between an outer surface of the first end of the water inlet pipe and an inner surface of the water inlet duct of the water inlet portion.

12. The PTC heater for liquid heating of claim 10, wherein a seal is disposed between an end face of the water inlet portion and an end face of the first end of the heat conductor.

13. The PTC heater for liquid heating of claim 8, further comprising a water outlet portion, the water outlet portion comprising a water outlet duct, the water outlet portion being connected to a first end of the water outlet pipe, and the water outlet duct of the water outlet portion being in fluid communication with the water outlet pipe.

14. The PTC heater for liquid heating of claim 13, wherein the first end of the water outlet pipe is disposed inside the water outlet duct of the water outlet portion.

15. The PTC heater for liquid heating of claim 13, wherein the water outlet portion is connected to a first end

of the heat conductor.

16. The PTC heater for liquid heating of claim 14, wherein a seal is disposed between an outer surface of the first end of the water outlet pipe and an inner surface of the water outlet duct of the water outlet portion.
17. The PTC heater for liquid heating of claim 15, wherein a seal is disposed between an end face of the water outlet portion and an end face of the first end of the heat conductor.
18. The PTC heater for liquid heating of claim 10, further comprising a connecting portion, the connecting portion comprising a water flow duct, the connecting portion being connected to a second end of the water inlet pipe and a second end of the water outlet pipe respectively, the water flow duct being in fluid communication with the water inlet pipe and the water outlet duct.
19. The PTC heater for liquid heating of claim 18, wherein the connecting portion is connected to a second end of the heat conductor, the second end of the water inlet pipe and the second end of the water outlet pipe being disposed inside the water flow duct of the connecting portion.
20. The PTC heater for liquid heating of claim 18, wherein the connecting portion is connected to the second end of the heat conductor.
21. The PTC heater for liquid heating of claim 19, wherein a seal is disposed between an outer surface of the second end of the water inlet pipe and an inner surface of the water flow duct of the connecting portion, and a seal is disposed between the second end of the water outlet pipe and an inner surface of the water flow duct of the connecting portion.
22. The PTC heater for liquid heating of claim 20, wherein a seal is disposed between an end face of the connecting portion and an end face of the heat conductor.
23. The PTC heater for liquid heating of claim 1, wherein the water pipe assembly comprises at least one U-shaped water pipe at least partially disposed in the second accommodating duct.
24. The PTC heater for liquid heating of claim 23, further comprising a water inlet portion, the water inlet portion comprising a water inlet duct, the water inlet portion being connected to a first end of the U-shaped water pipe, the water inlet portion being in fluid communication with the U-shaped water pipe.
25. The PTC heater for liquid heating of claim 24, where-

in the first end of the U-shaped water pipe is disposed inside the water inlet duct of the water inlet portion.

26. The PTC heater for liquid heating of claim 24, wherein the water inlet portion is connected to a first end of the heat conductor.
27. The PTC heater for liquid heating of claim 25, wherein a seal is disposed between an outer surface of the first end of the U-shaped water pipe and an inner surface of the water inlet duct of the water inlet portion.
28. The PTC heater for liquid heating of claim 26, wherein a seal is disposed between an end face of the water inlet portion and an end face of the first end of the heat conductor.
29. The PTC heater for liquid heating of claim 18, further comprising a water outlet portion, the water outlet portion comprising a water outlet duct, the water outlet portion being connected to a second end of the U-shaped water pipe, the water outlet duct of the water outlet portion being in fluid communication with the U-shaped water pipe.
30. The PTC heater for liquid heating of claim 29, wherein the second end of the U-shaped water pipe is disposed inside the water outlet duct of the water outlet portion.
31. The PTC heater for liquid heating of claim 29, wherein the water outlet portion is connected to a first end of the heat conductor.
32. The PTC heater for liquid heating of claim 30, wherein a seal is disposed between an outer surface of the second end of the U-shaped water pipe and an inner surface of the water outlet duct of the water outlet portion.
33. The PTC heater for liquid heating of claim 31, wherein a seal is disposed between an end face of the water outlet portion and an end face of the first end of the heat conductor.
34. The PTC heater for liquid heating of claim 1, wherein the heat conductor is an integrally formed component, the integrally formed component being a one-piece metal alloy shell.
35. The PTC heater for liquid heating of claim 1, wherein the heat conductor comprises:

a first component the first component comprising the first accommodating duct and a first groove disposed on an outer surface of the first component; and

a second component detachably connected to the first component, the second component comprising a second groove, the second groove corresponding to the first groove, wherein the first component is connected to the second component, the second groove is in combination with the first groove to be configured to the second accommodating duct, and the water pipe assembly is disposed in the second accommodating ducts

- 36.** The PTC heater for liquid heating of claim 35, wherein the first groove and second groove are profiled grooves and the water pipe assembly comprises a profiled water pipe being fastened to the second accommodating duct.

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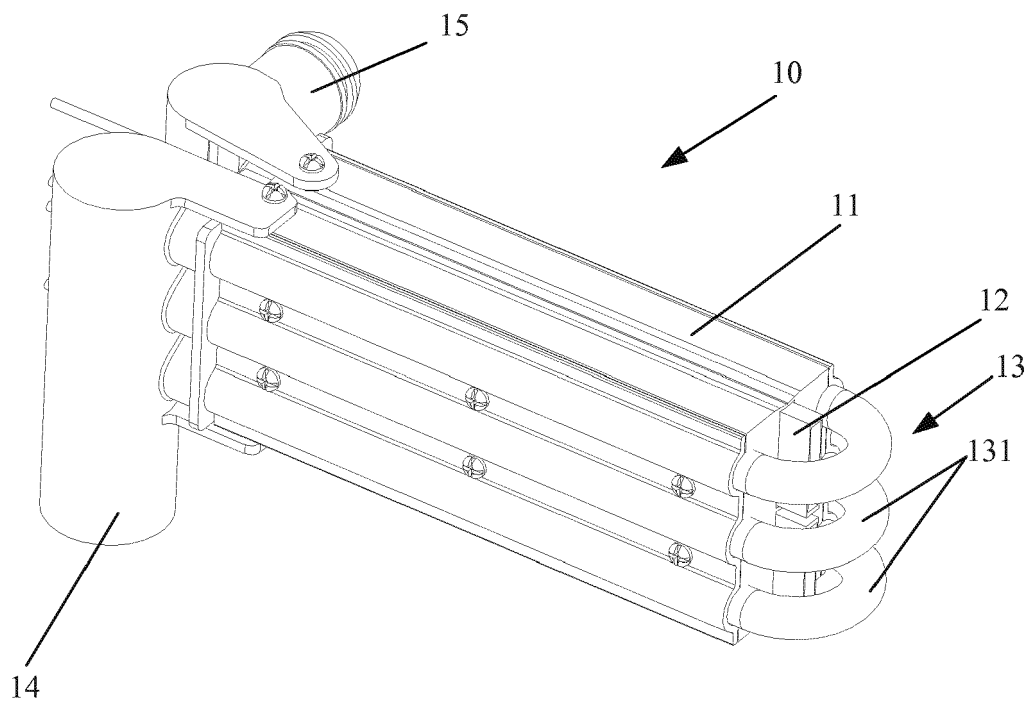


Fig.1

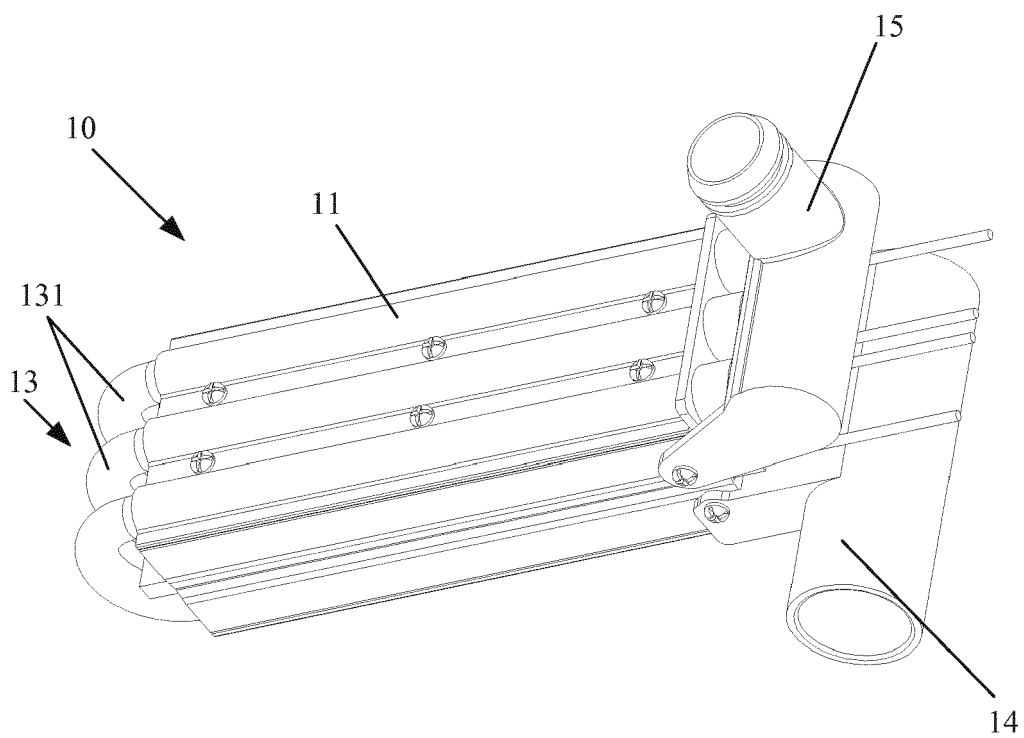


Fig.2

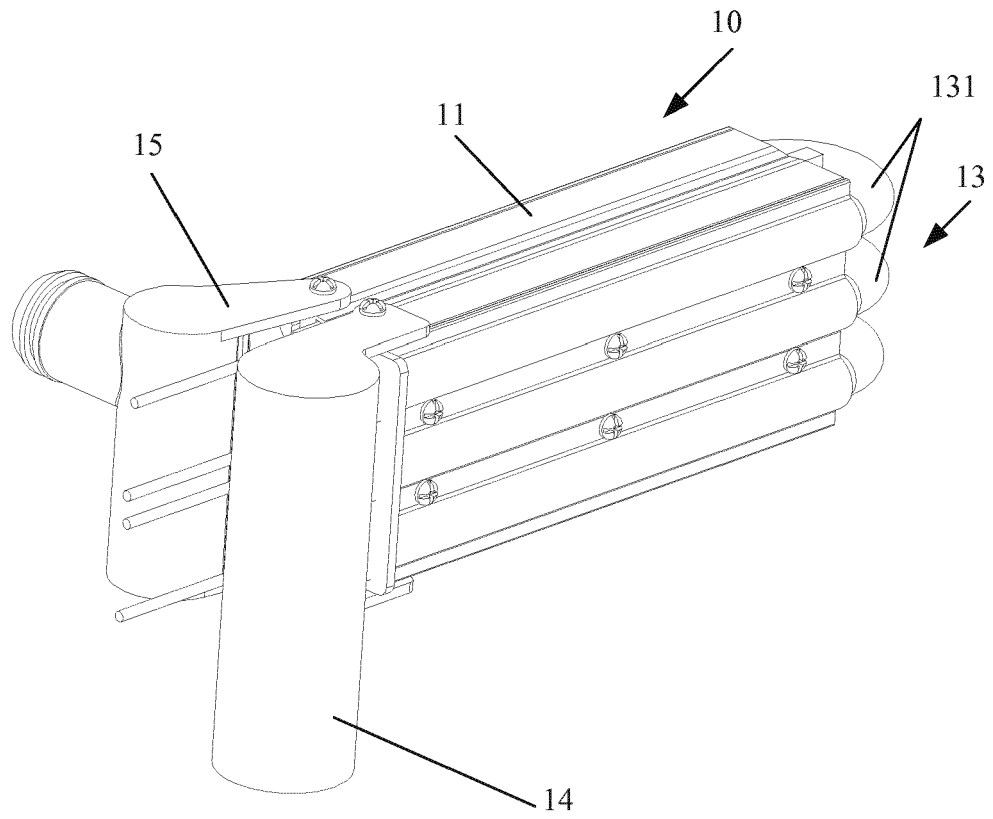


Fig.3

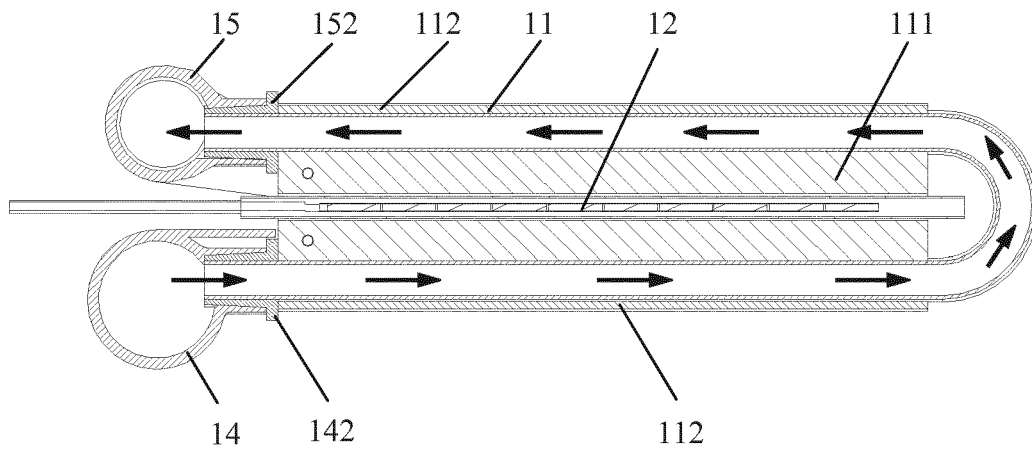


Fig.4

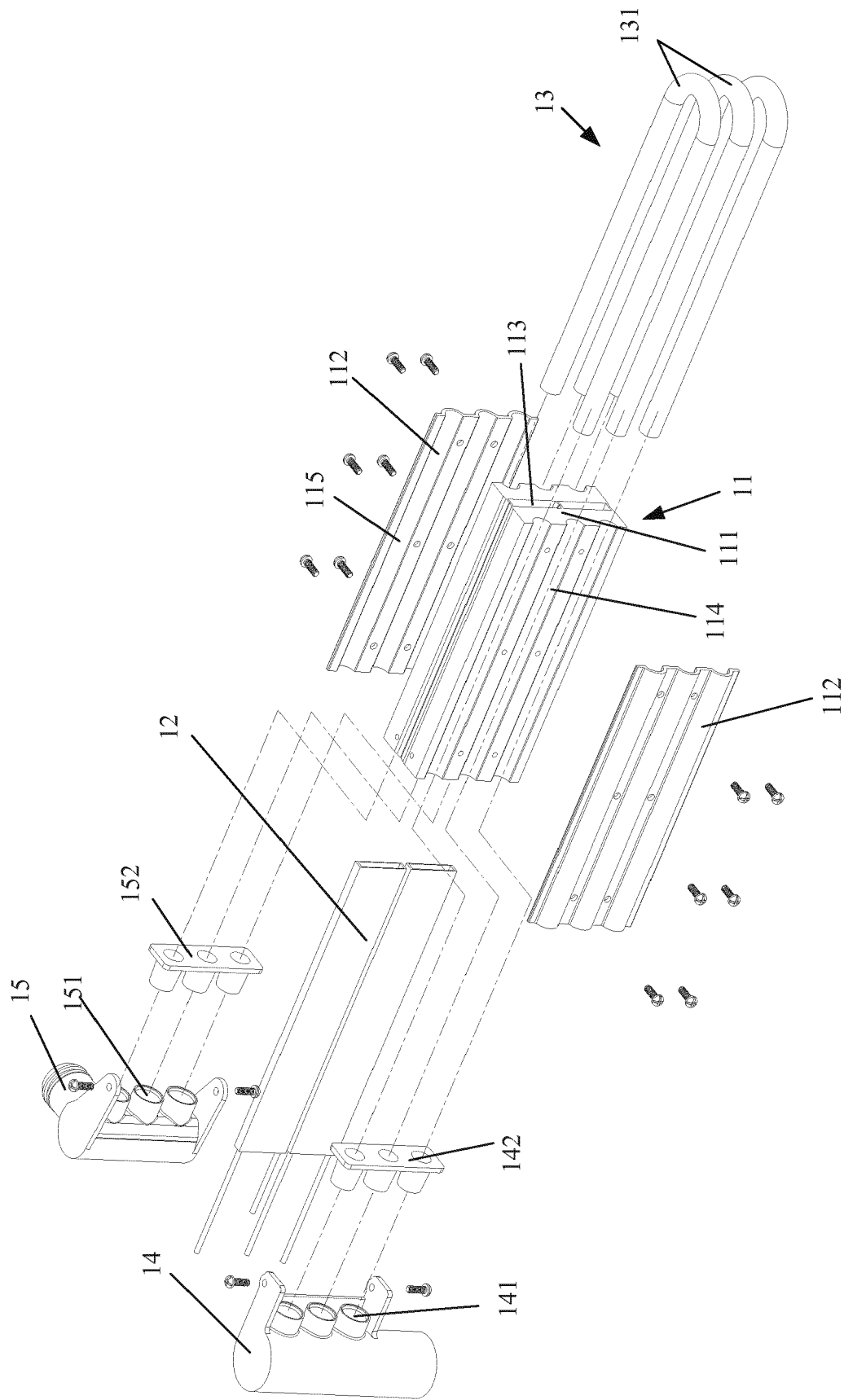


Fig.5

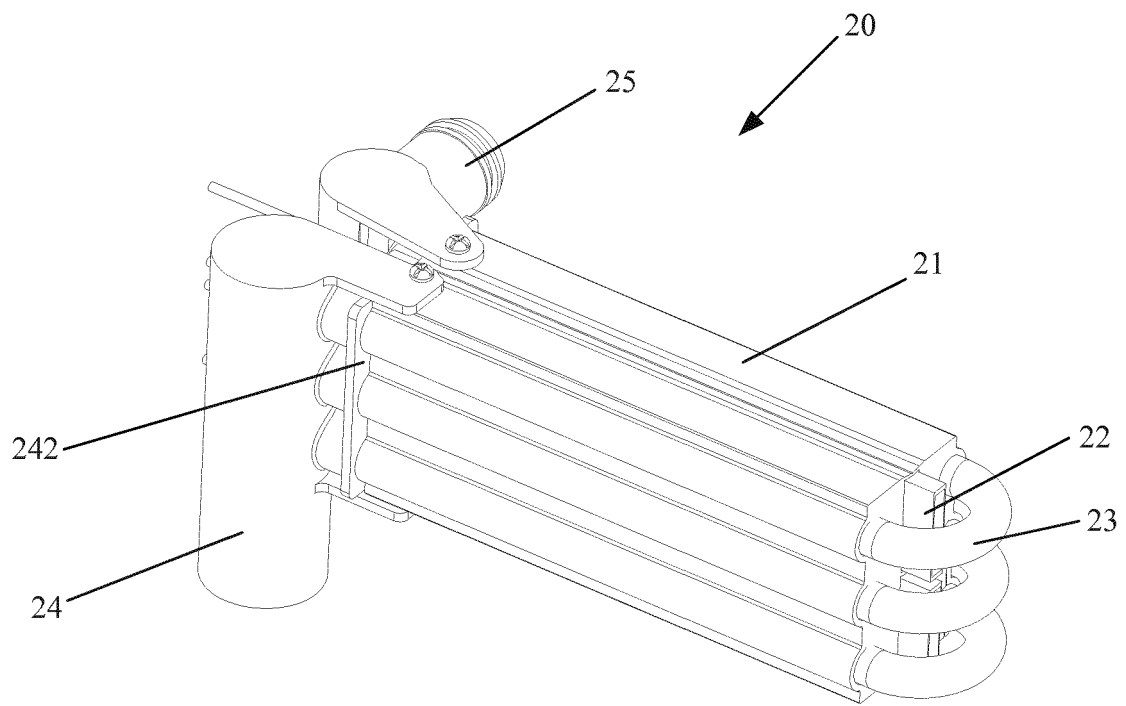


Fig.6

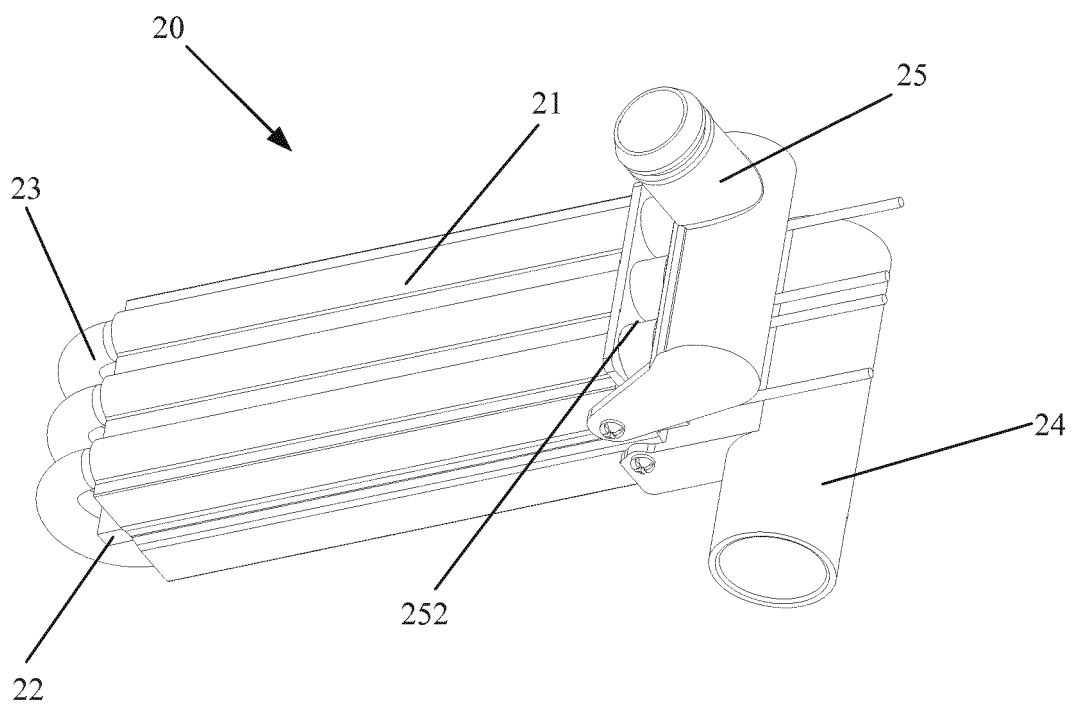
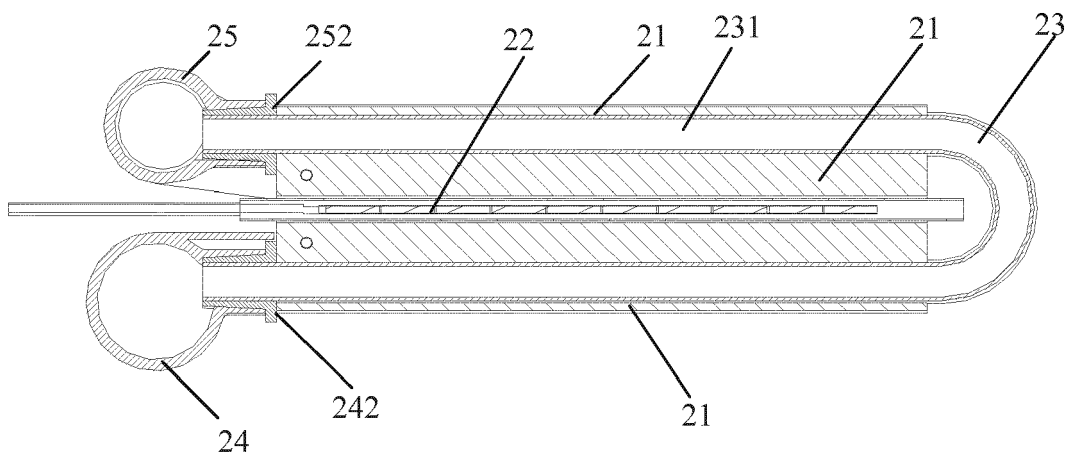
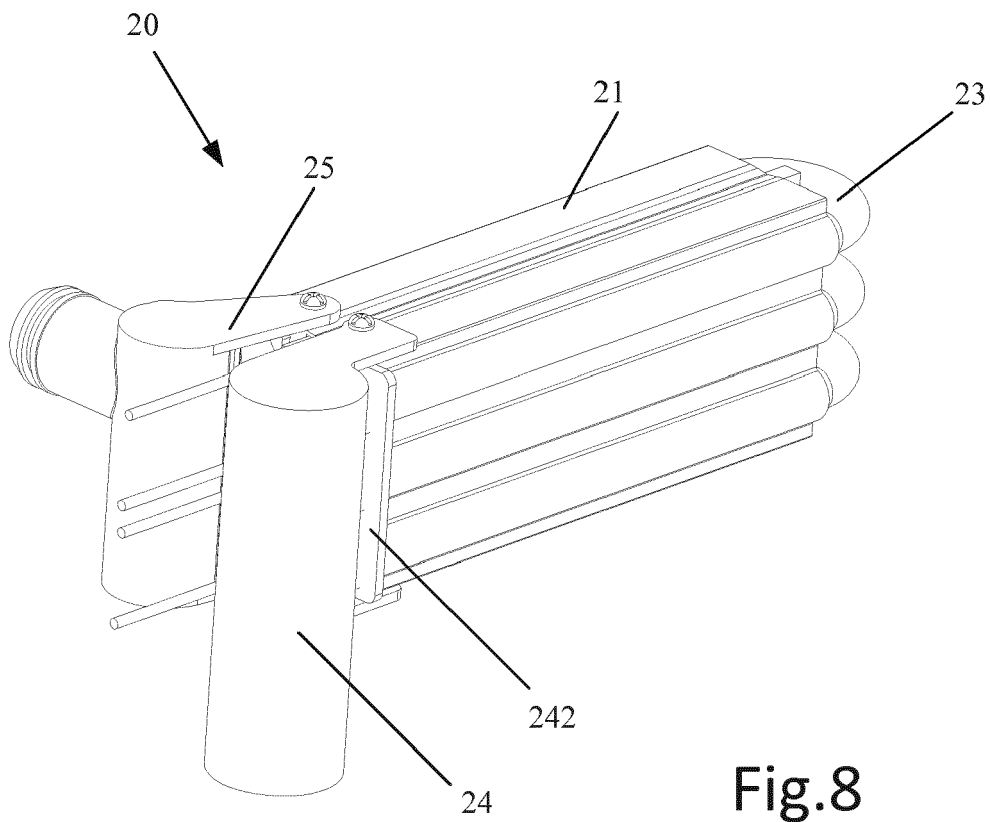


Fig.7



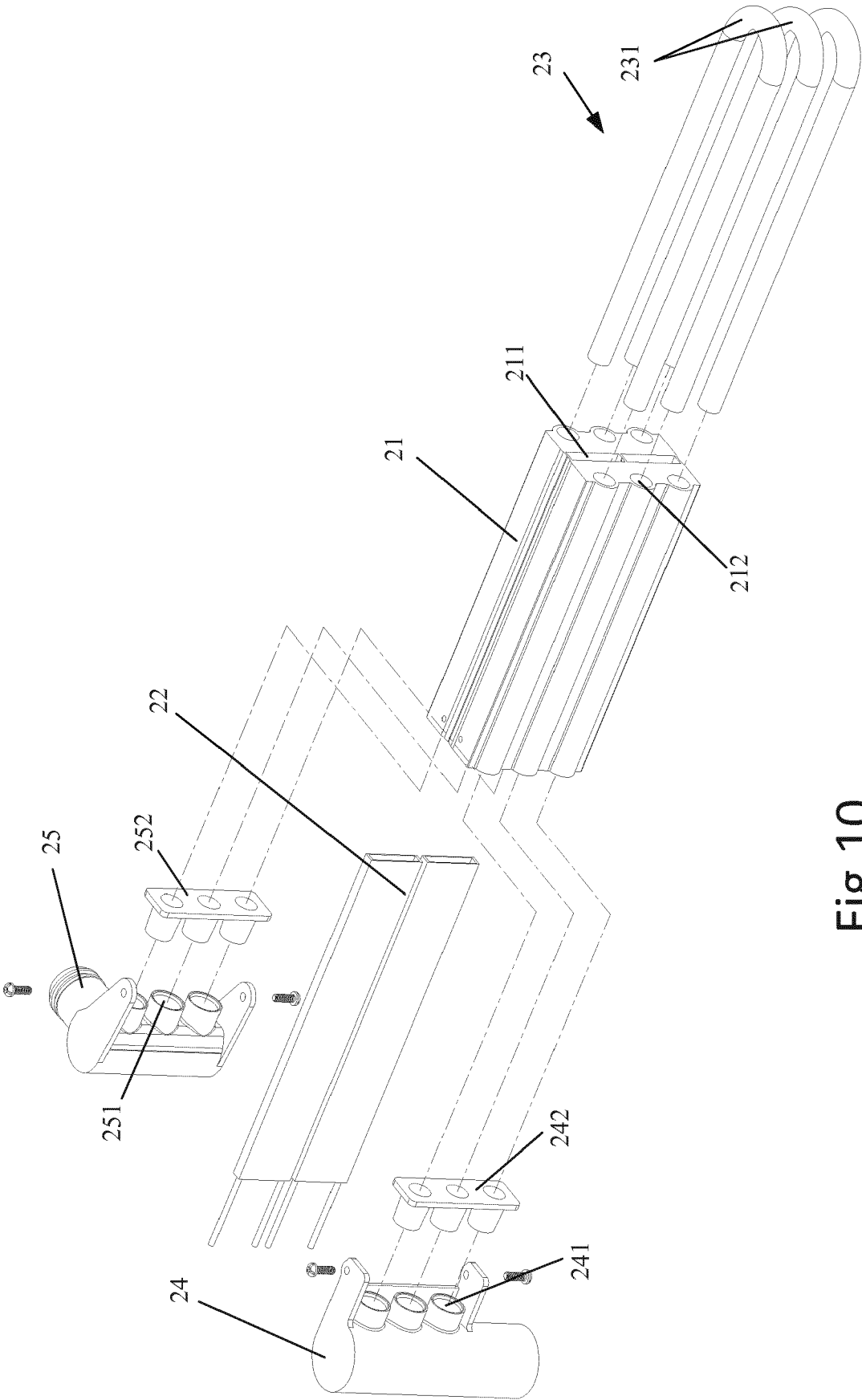


Fig.10

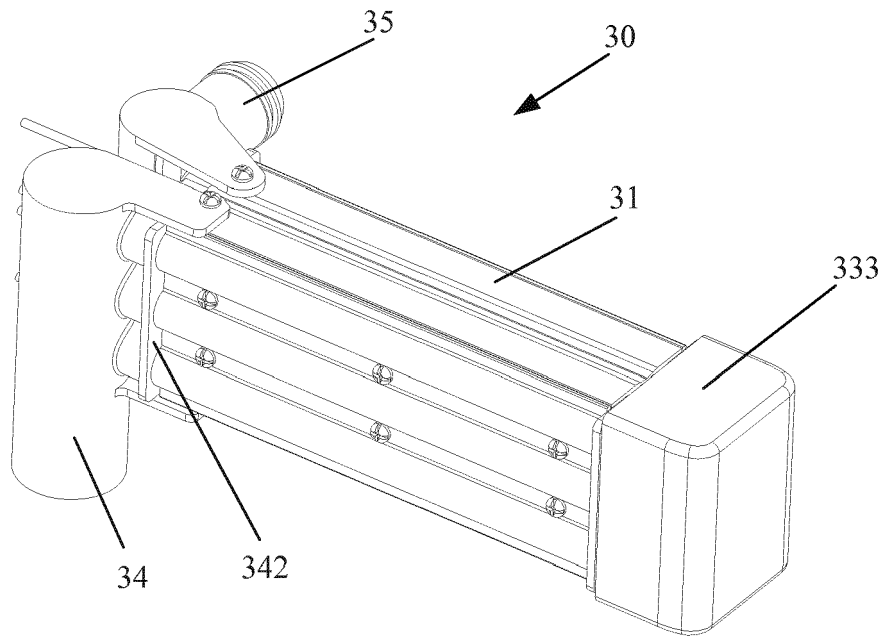


Fig.11

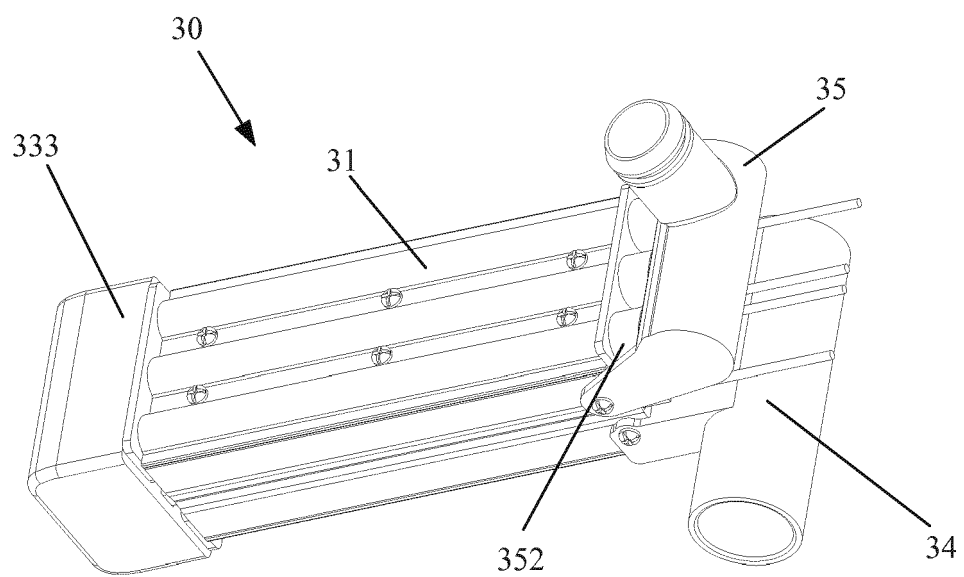


Fig.12

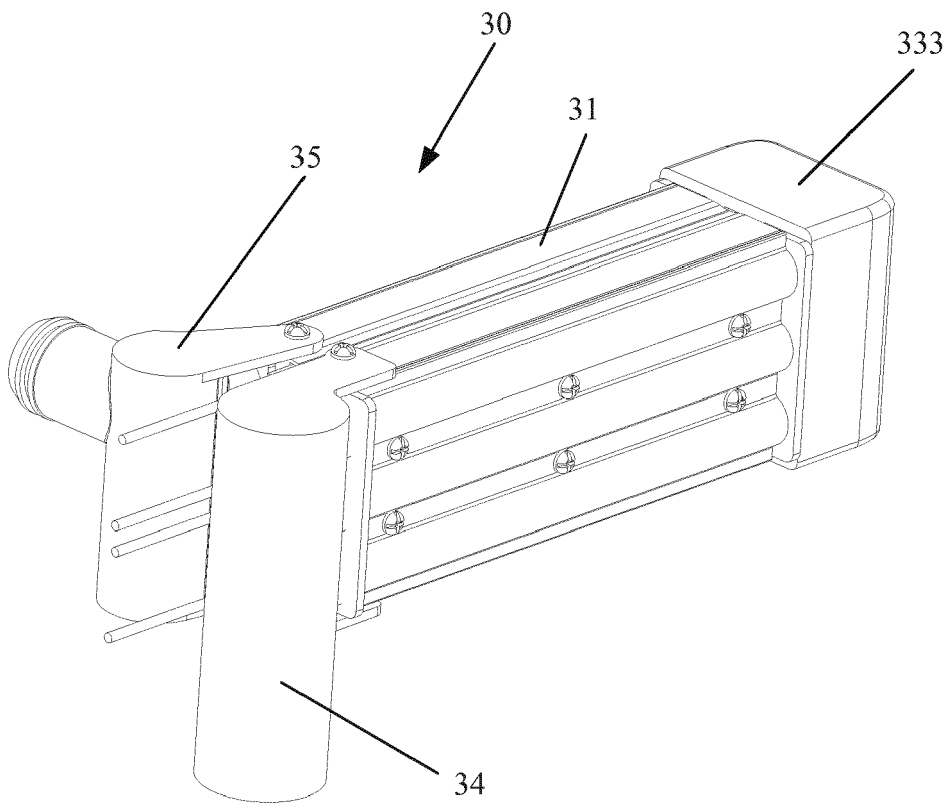


Fig.13

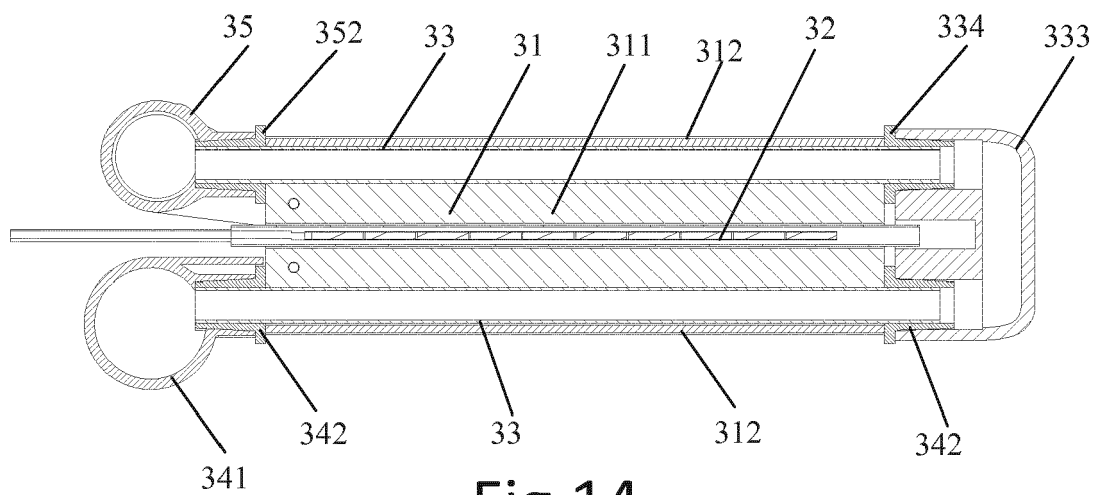


Fig.14

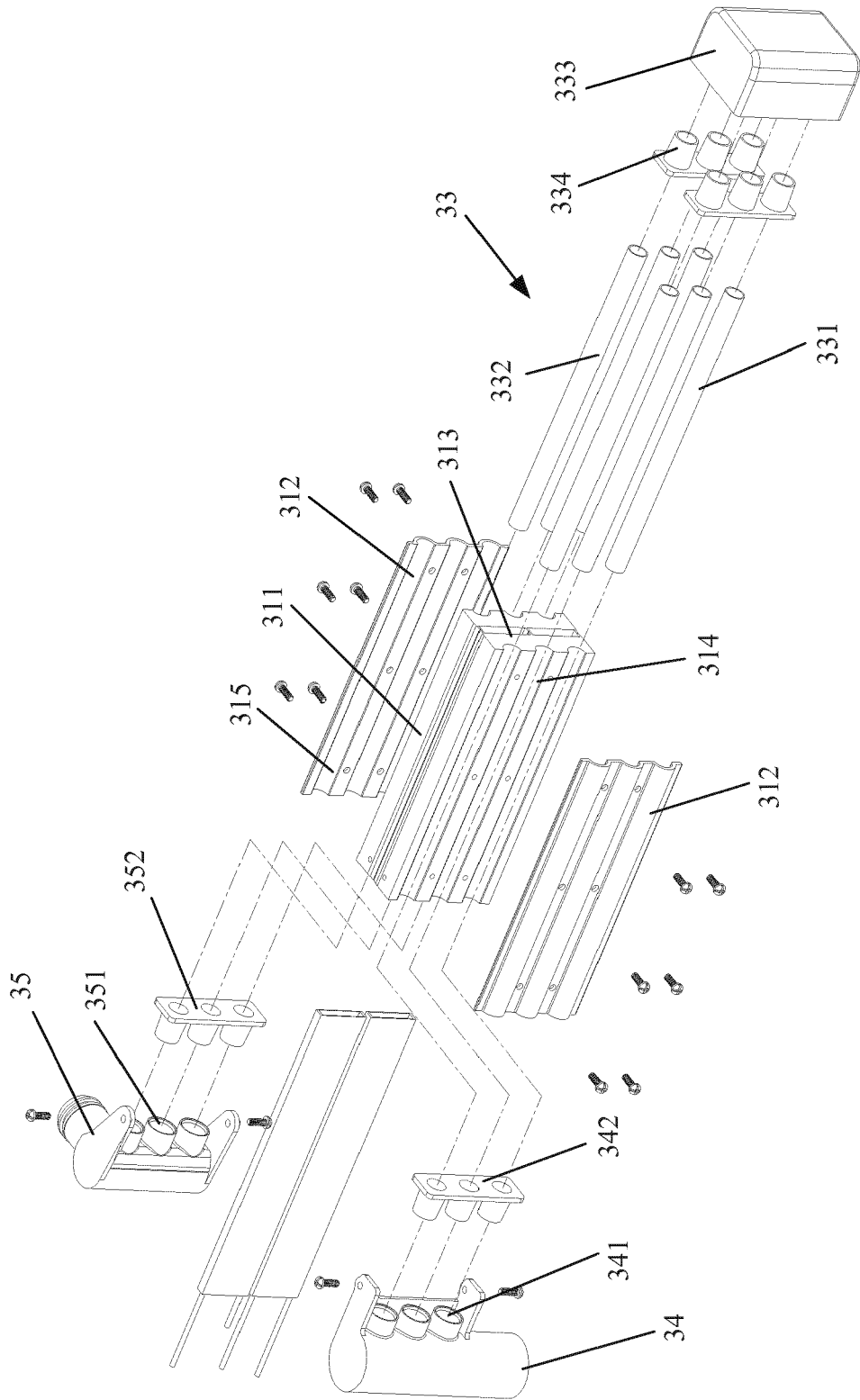


Fig.15

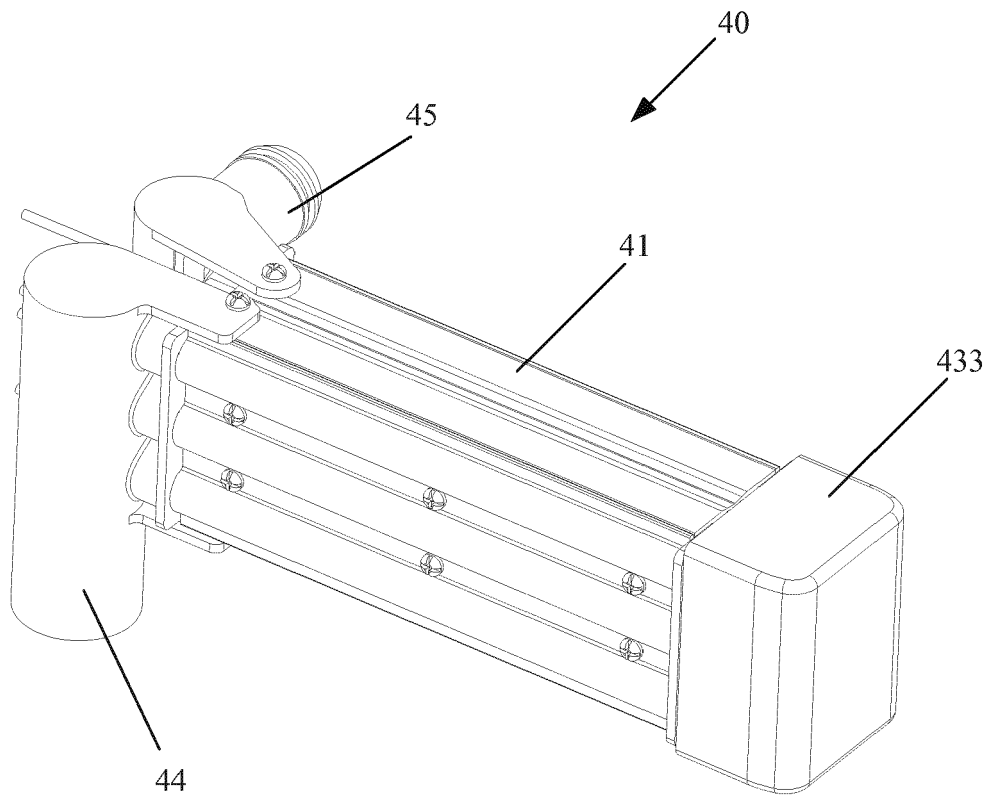


Fig.16

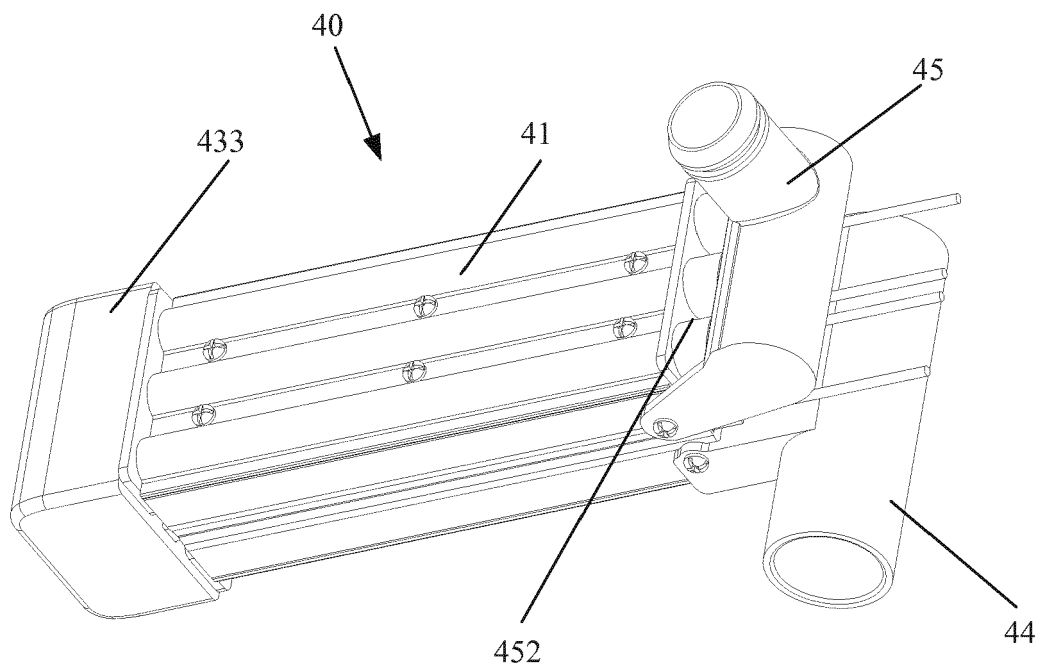


Fig.17

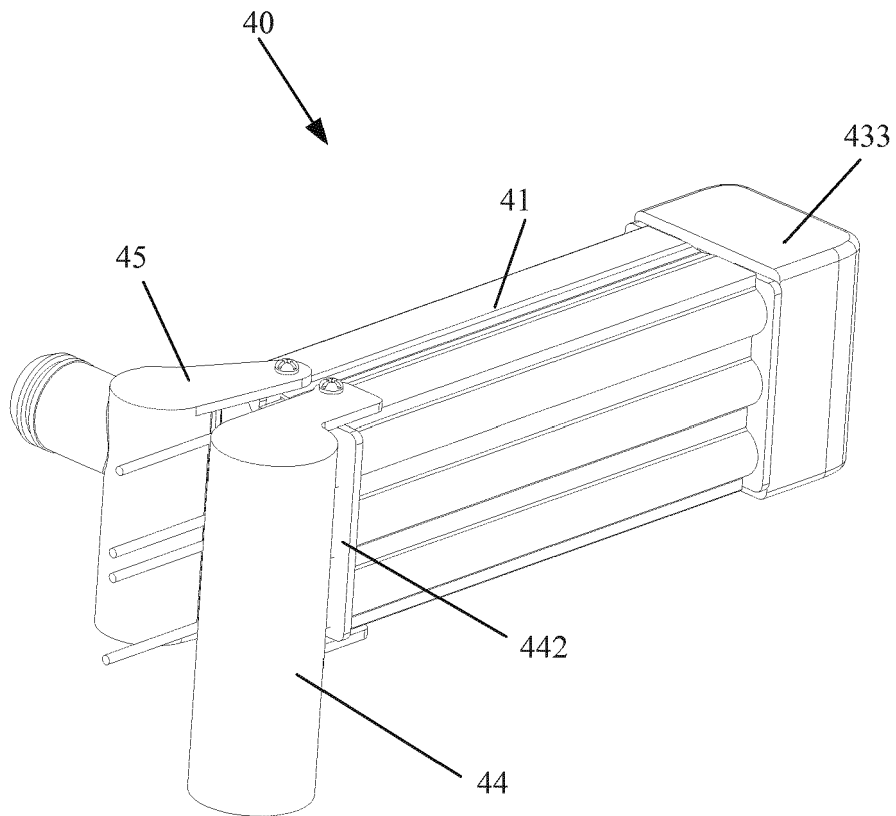


Fig.18

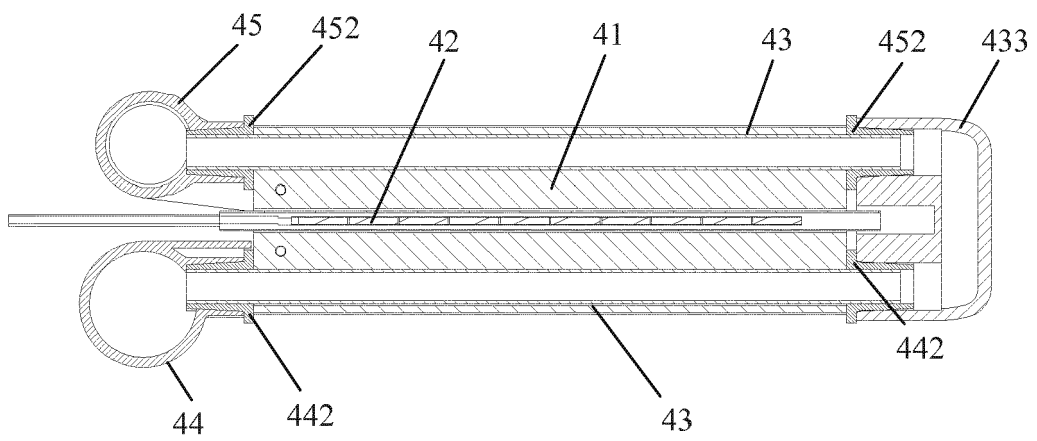


Fig.19

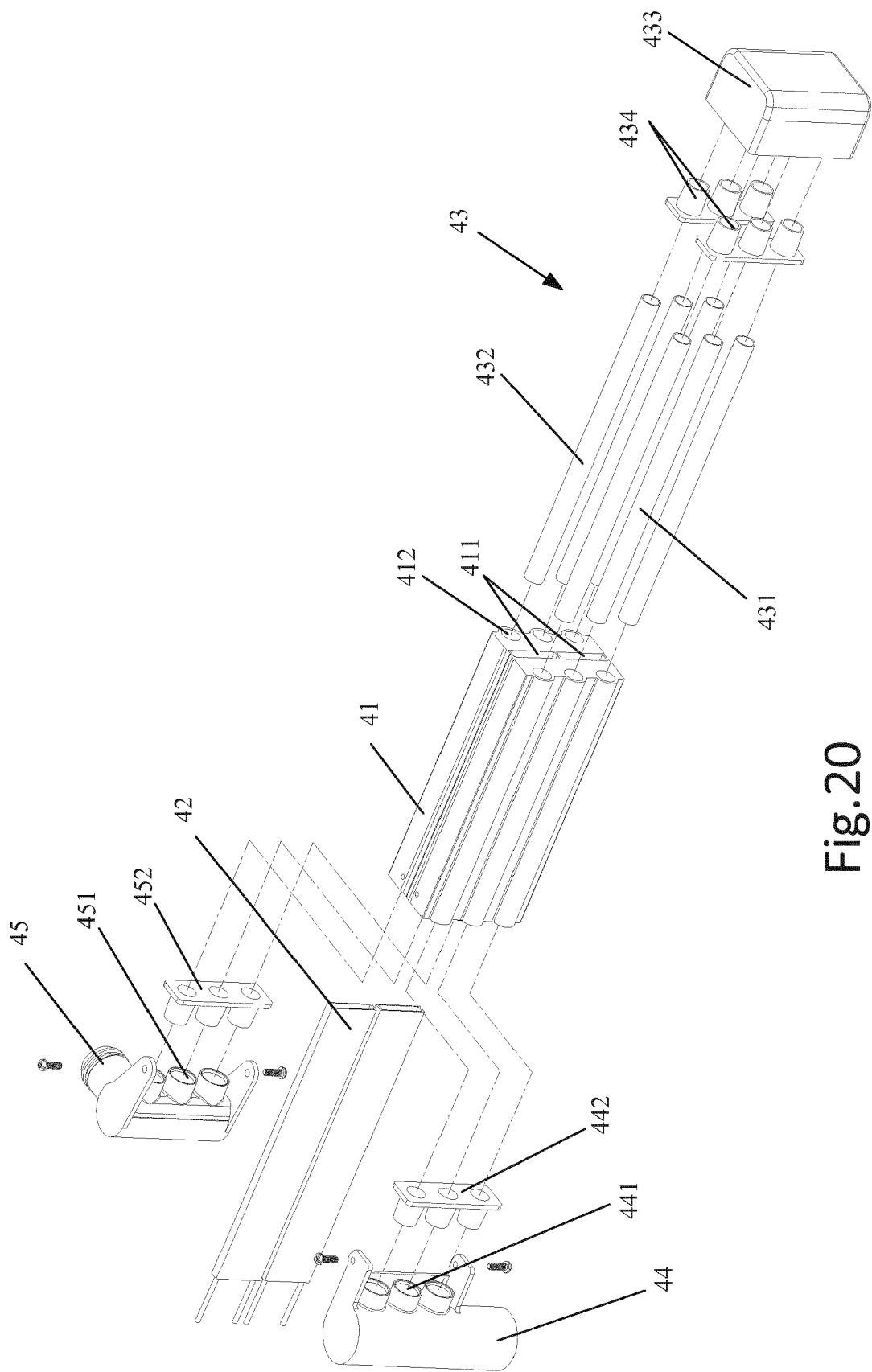


Fig.20

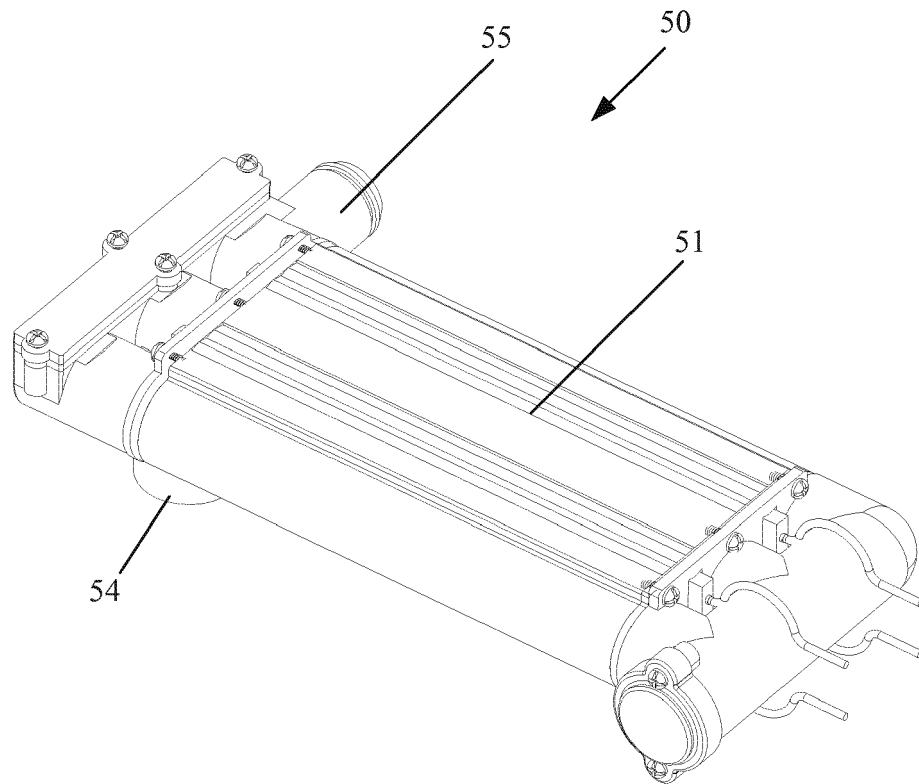


Fig.21

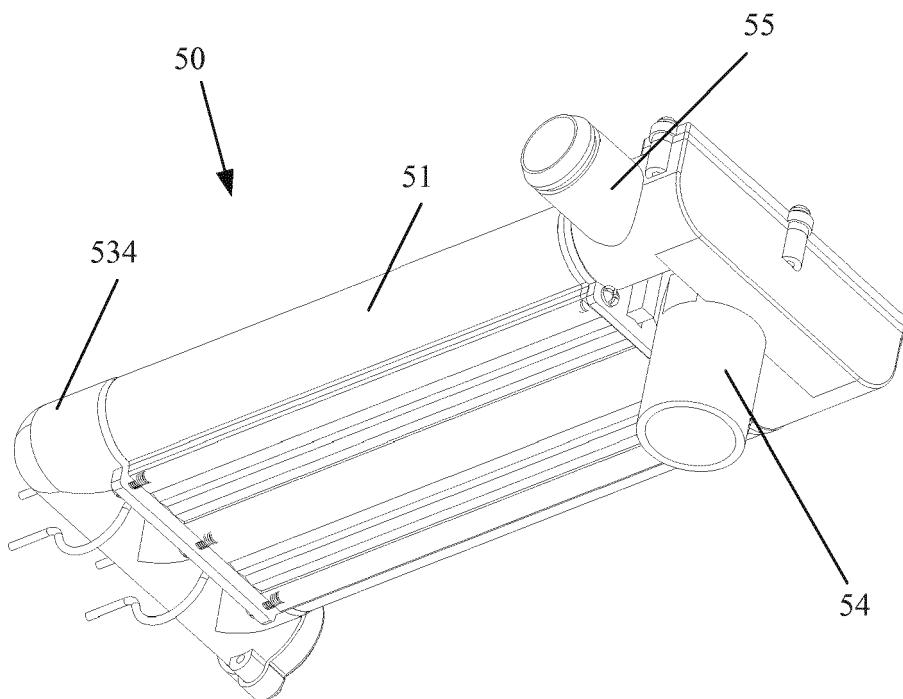


Fig.22

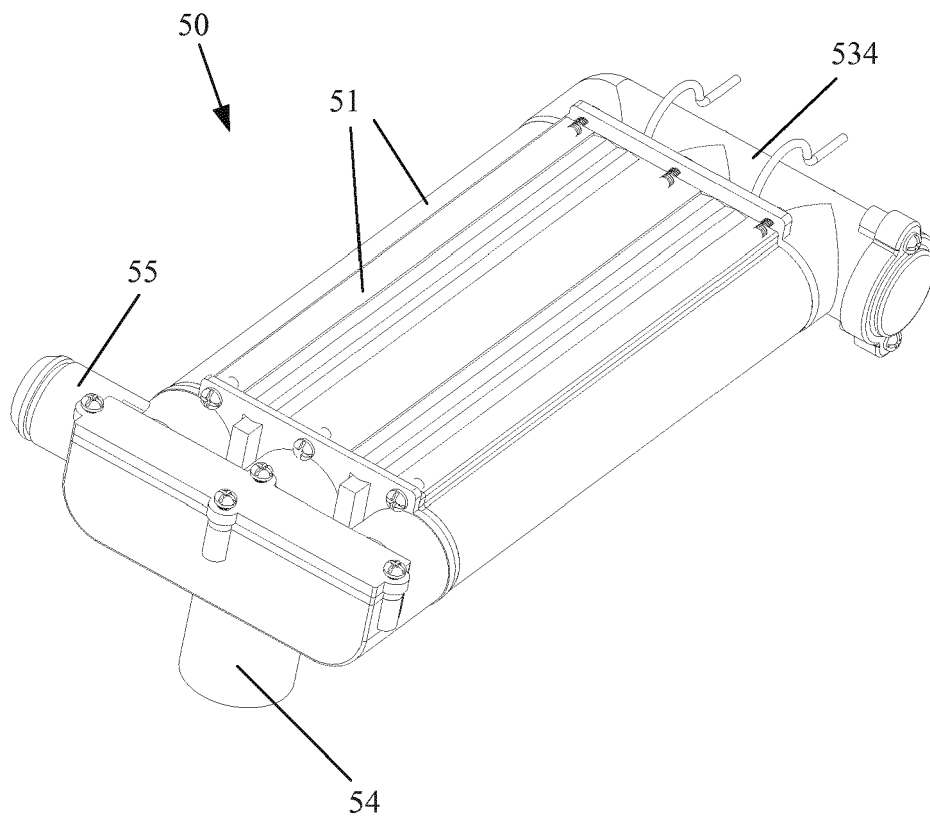


Fig. 23

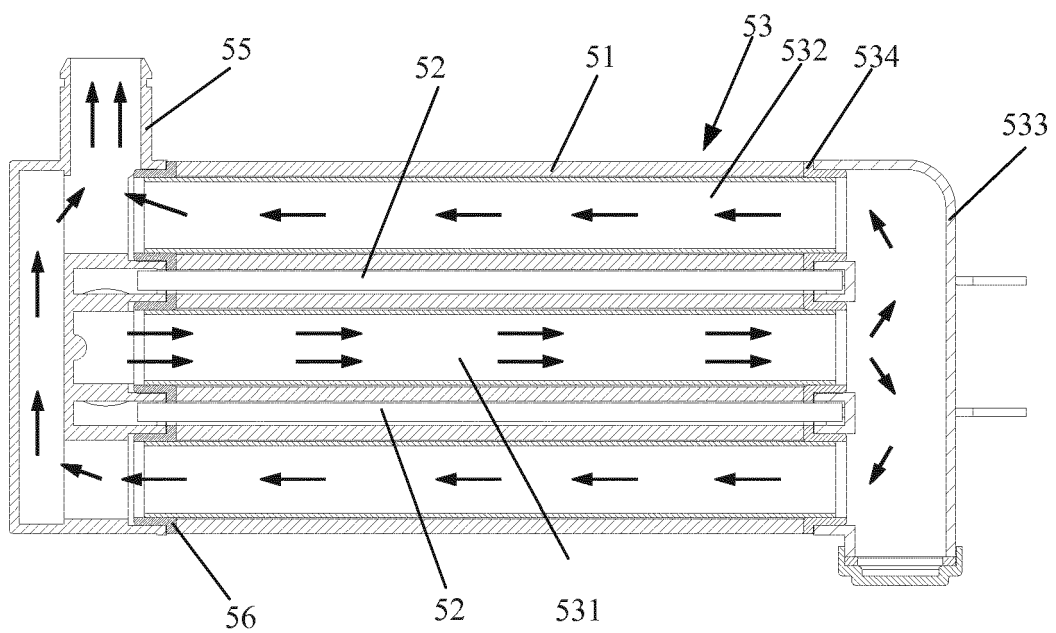


Fig. 24

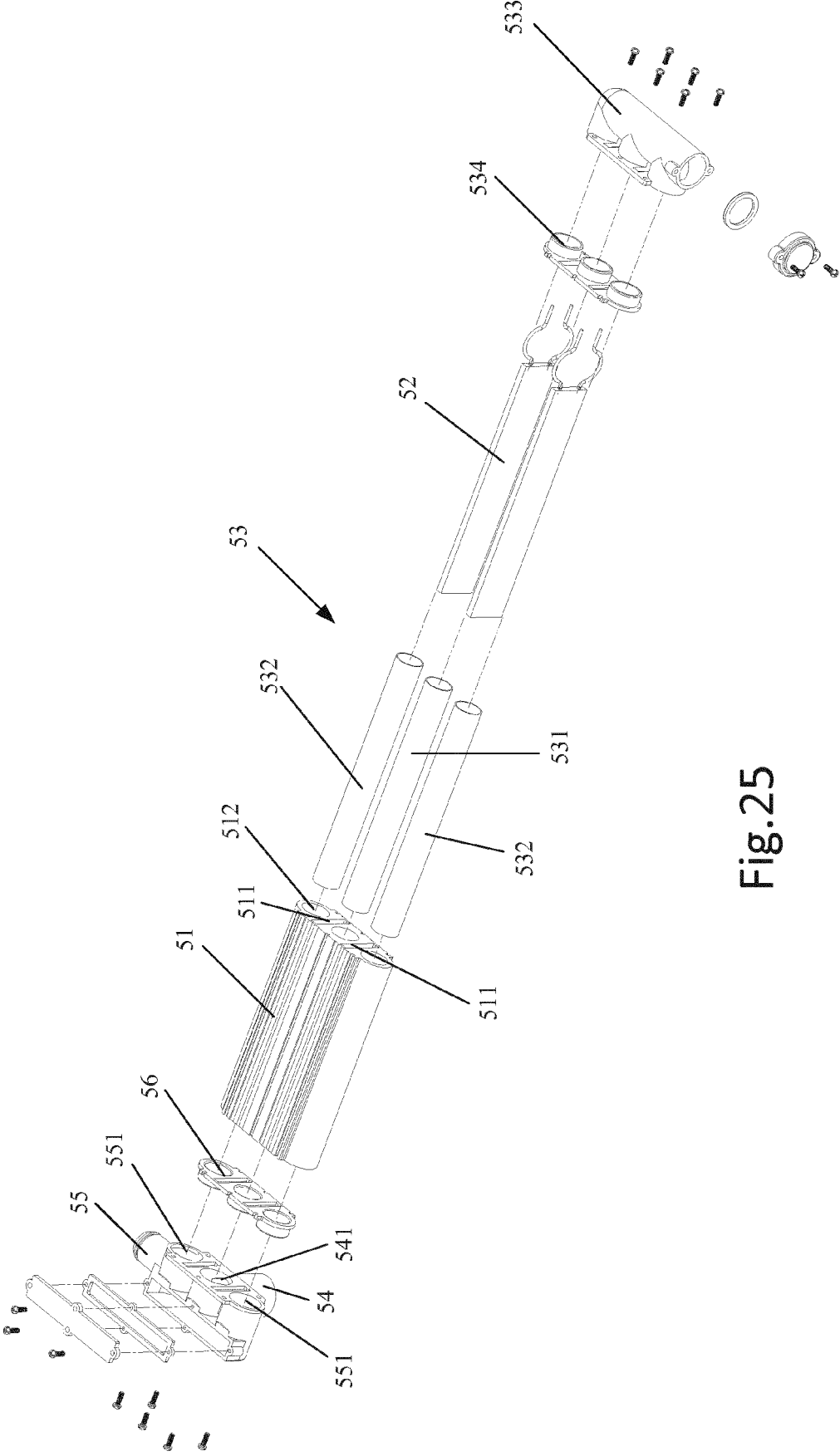


Fig.25



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Application Number
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			F24H E04H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 September 2017	Examiner Ast, Gabor
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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