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(54) **Fog machine with a movable discharge**

(57) A head-movable stage fog machine (100) comprises: a base body (102); a pair of support brackets (104) mounted on the base body (102); and a sprayer head (106) pivotally supported by the two support brackets (104) for spraying fog. The head-movable stage fog machine (100) further comprises a stepping motor (122) connected with the sprayer head (106) to cause rotation of the sprayer head (106).

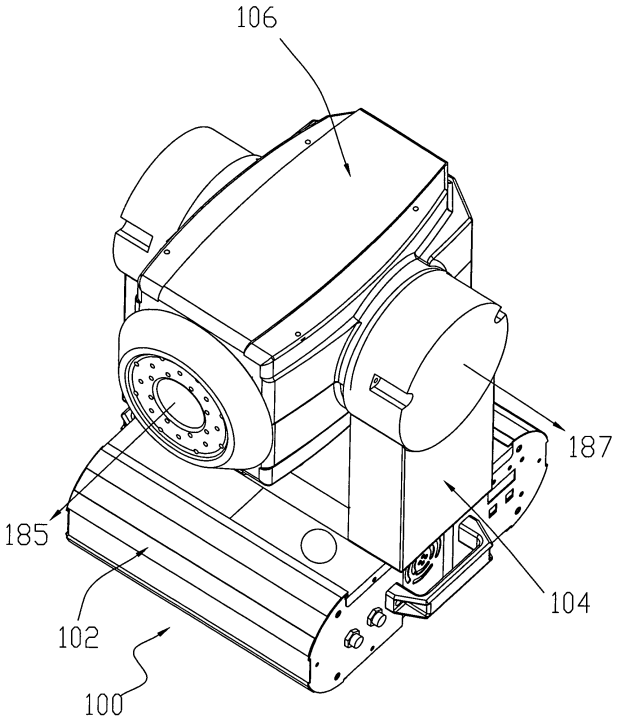

Fig. 1a

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Description

[0001] The present invention relates to a device used for stages, particularly, relates to a stage fog sprayer, and more specifically, the invention relates to a head-movable stage fog sprayer for spraying fog in multiple directions and producing a color-changing foggy effect.

[0002] Stage fog sprayers are commonly used equipments designed for stage in order to produce foggy effect and decorate the stage. By now, various stage fog sprayers exist in current marketplace. However, these conventional devices have a common disadvantage of disabling to sway the head of the sprayer at a relative large range of angle; and limitedly, these devices only have a small range of sway angle. Therefore, the stage effect obtained by a conventional sprayer is not very ideal. On the other hand, to provide a stage fog sprayer capable of spraying fog in multi directions and movably spraying color-changing fog is demand of the marketplace.

[0003] Thus, there is a need for an improved stage fog sprayer that does not suffer from the above-mentioned drawbacks.

[0004] Main object of the present invention is to provide a head-movable fog sprayer capable of rotating its head around both longitudinal and widthwise axes of the head.

[0005] To achieve above object, a head-movable stage fog sprayer comprises: a base body; a pair of support brackets mounted on the base body; and a sprayer head pivotally supported by the two support brackets for spraying fog. The head-movable stage fog sprayer further comprises a stepping motor connected with the sprayer head to cause rotation of the sprayer head.

[0006] The sprayer head may be driven by the stepping motor through transmission between a gear of the stepping motor, a driven gear of the sprayer head, and a transfer belt that interconnects the two gears.

[0007] In an embodiment, the stepping motor is mounted on the base body to cause rotation of the sprayer head around a longitudinal axis of the sprayer head, and the rotation angle of the sprayer head ranges in 0-540 degrees. In another embodiment, the stepping motor is mounted on one of the support brackets and located at a lateral side of the sprayer head to drive the sprayer head rotating around a widthwise axis of the sprayer head, and the rotation angle of the sprayer head ranges in 0-270 degrees.

[0008] In addition, the sprayer head comprises a nozzle from which fog is sprayed, and the nozzle is selectively covered by a shutter. The shutter comprises a stepping motor with an output shaft and a shutting plate connected to the output shaft of the stepping motor; and the shutting plate is disposed at the front of the sprayer head. The shutting plate may be made of aluminum. Moreover, a heating element may be attached on the shutting plate to avoid liquid drops condensed on the shutting plate.

[0009] Other aspects, features, and advantages of this invention will become apparent from the following detailed description when taken in conjunction with the accompanying drawings, which are a part of this disclosure and which illustrate, by way of example, principles of this invention.

[0010] The accompanying drawings facilitate an understanding of the various embodiments of this invention. In the drawings are shown:

- Fig. 1a a perspective view of a head-movable stage fog sprayer according to an embodiment of the invention;
- Fig. 1b a perspective view of the head-movable stage fog sprayer shown in Fig. 1a illustrating detailed structure thereof;
- Fig. 1c a side view of the head-movable stage fog sprayer shown in Fig. 1a;
- Fig. 1d a rotation of the head-movable stage fog sprayer shown in Fig. 1a around the widthwise axis;
- Fig. 1e a rotation of the head-movable stage fog sprayer shown in Fig. 1a around the longitudinal axis;
- Fig. 2a a perspective view of the head-movable stage fog sprayer shown in Fig. 1a illustrating the shutter thereof;
- Fig. 2b an enlarged view of portion A of the headmovable stage fog sprayer shown in Fig. 2a;
- Fig. 3a an liquid circuit configuration of a convention stage fog sprayer;
- Fig. 3b an liquid circuit configuration of the headmovable stage fog sprayer of Fig. 1a;
- Fig. 4a a front view of the head-movable stage fog sprayer of Fig. 1a illustrating the structure of a nozzle;
- Fig. 4b a front view of the nozzle of Fig. 4a illustrating a plurality of colorful LEDs mounted thereon according to an embodiment of the invention;
- Fig. 4c a front view of a nozzle of Fig. 4a illustrating a plurality of colorful bulbs mounted thereon according to another embodiment of the invention;
- Fig. 4d a front view of a nozzle of Fig. 4a illustrating a plurality of colorful laser lights mounted thereon according to another embodiment of the invention; and

Fig. 4e a perspective view of the head-movable stage fog sprayer of Fig. 4a showing light emitted from the head-movable stage fog sprayer;

Fig. 5 a connection relationship between multiple head-movable stage fog sprayers according to an embodiment of the invention;

Fig. 6 a perspective view of the head-movable stage fog sprayer shown in Fig. 1a, illustrating an liquid circuit connection thereof;

Fig. 7a a side view of the head-movable stage fog sprayer shown in Fig. 1a, illustrating a fan mounted thereon in a close state; and

Fig. 7b a side view of the head-movable stage fog sprayer shown in Fig. 1a, illustrating a fan mounted thereon in an open state.

[0011] Figs. 1a-1e illustrate a head-movable stage fog sprayer 100 according to an embodiment of the invention. As illustrated, the head-movable stage fog sprayer 100 comprises a base body 102, a pair of support brackets 104 mounted on the base body 102 and a sprayer head 106 pivotally mounted on the pair of support brackets 104 for spraying fog. The sprayer head 106 has a nozzle 128 formed thereon, from which foggy substance for example carbon dioxide can be ejected.

[0012] Referring to Fig. 1a, the sprayer 100 has a longitudinal axis 185 and a widthwise axis 187 perpendicular to the longitudinal axis 185. The sprayer 100 is able to rotate around both the axes 185, 187, because two stepping motors are equipped in the sprayer 100.

[0013] More specifically, one stepping motor 108 is mounted on the base body 102 and connected to the sprayer head 106 so as to drive the sprayer head 106 swaying around the longitudinal axis 185. Referring to Fig. 1b, the stepping motor 108 has a gear 112 mounted thereon. The gear 112 can be driven by an output shaft (not labeled) of the motor 108. In addition, a transfer belt 114 engages the gear 112 and a driven gear (not shown) of the sprayer head 106, such that the motor 108 can drive the sprayer head 106 rotating around the longitudinal axis 185. As shown in Fig. 1e, the stepping motor 108 can make the sprayer head 106 rotate around longitudinal axis 185 in an angle range of 0-540 degrees.

[0014] The other stepping motor 110 is mounted on one of the support brackets 104 and located at a lateral side of the sprayer head 106. The motor 110 is connected with the sprayer head 106 so that the head 106 can be driven to rotate around the widthwise axis 187. More concretely, a gear (not labeled) is provided on the motor 110. The gear engages a transfer belt 103, which further engages a gear 101 of the sprayer head 106. When in operation, the stepping motor 110 drives the transfer belt 103 to rotate, and then, the transfer belt 103 drives the gear 101 to rotate, thus causing rotation of the sprayer head 106. Referring to Fig. 1d, by this manner, the sprayer head 106 can be driven by the motor 110 to sway from 0-270 degrees around the widthwise axis 187.

[0015] As the sprayer head 106 is connected with the stepping motors 108, 110, and rotation speed and positions of stop of the motors are only determined by the frequency and pulse count of the pulse signal and are free from influence of the load change. Namely, when a pulse signal is applied to a stepping motor, the motor will rotate a step angle; accordingly, by setting and controlling the stepping motor, the demand of special stage design may be achieved easily, that is, the fog spraying direction can be changed according to desire.

[0016] Compared to a conventional stage fog sprayer, since multiple motors, for example two stepping motors are assembled into the sprayer, the sprayer is able to sway its sprayer head around both longitudinal and widthwise axles at a bigger range of rotation angle; hence, by swaying the head and spraying fog at the same time, a dynamic foggy effect is obtained as well.

[0017] Normally, for a conventional sprayer, after it stops spraying fog, residual liquid drops formed by condensation will drip down from the nozzle of the sprayer and fall down to the ground, thus getting the ground contaminated. Moreover, when a set of sprayers is together used to produce an amount of fog, these sprayers cannot stop spraying fog simultaneously; because these sprayers have different pressures remained in their heaters respectively. The different pressure is caused by tolerance of the liquid pumps and temperature of the heaters. Consequently, it looks not very perfect visually if a little fog is still coming out from the nozzles of the sprayers after the whole sprayers have stopped working.

[0018] To solve the above problems, as shown in Figs. 2a-2b, a shutter 120 is disposed at a front end of the sprayer head 106 of the sprayer 100. The shutter 120 comprises a stepping motor 122 having an output shaft 124 and a shutting plate 126. One end of the shutting plate 126 is mechanically connected to the output shaft 124 of the stepping motor 122, while the other end covers the nozzle 128 of the sprayer head 106. The shutting plate 126 functions as a baffle to obstruct the nozzle 128 according to need. That is, when the stage fog sprayer 100 stops spraying, the stepping motor 122 drives the output shaft 124, and in turn, the output shaft 124 drives the shutting plate 126 such that the shutting plate 126 rotates to a position where it obstructs spraying of fog from the nozzle 128. Selectively, when the sprayer 100 starts to work, the shutting plate 126 will be rotated to another position so as not to obstruct spraying of the fog. Therefore, by engagement of the shutter 120 with the nozzle 128, when the sprayer 100 stops work, spraying of the fog is also stopped at once.

[0019] In the embodiment, the shutting plate 126 may be constructed of any suitable material such as aluminum. Moreover, a heating element 127 may be attached on the shutting plate 126, and heat generated by the heating element 127 keeps the shutting plate 126 in a high

temperature. Therefore, even if some little liquid drops exist, they can be vaporized right away, and accordingly, no drop will fall down to the ground and thus ground contamination problem being avoided completely.

[0020] As an alternative embodiment, an improvement can be made to a liquid circuit of the sprayer so as to better solve the problem mentioned above, namely, to more effectively prevent residual fog from being sprayed after the sprayer stops works and to prevent condensation of liquid drops.

[0021] More specifically, as shown in Fig. 3a, in a conventional liquid circuit of a sprayer 200, liquid is stored in a tank 233. A pump 238 is used to propel the liquid from the tank 233 to a nozzle 228 across a liquid-leading pipe 236. At a distal end of the pipe 236 adjacent the nozzle 228, the liquid is heated by a heater 232 having a plurality of heating members 234, such that the liquid can be transformed to gas and then be sprayed from the nozzle 228. However, since no liquid return structure is provided, when the sprayer 200 stops spraying, residual liquid will be retained on the nozzle 228, thus causing the above questions.

[0022] In contrast, as shown in Figs. 1b, 3b and 6, liquid stored in a tank 133 is propelled via a liquid-leading pipe 136 to the nozzle 128 and heated by a heater 132 having a heating member 134. In addition, a liquid return pipe 131 is provided, one end of which is connected with the tank 133, while the other end is connected with the liquid-leading pipe 136 via a three holes tie-in 135. Preferably, the three holes tie-in 135 is disposed on the pipe 136 and between the pump 138 and the nozzle 128. Moreover, an electromagnetism valve 137 is mounted on the liquid return pipe 131 so as to selectively switch the pipe 131 on or off. When the pump 138 stops working, the electromagnetism valve 137 will open, such that the remaining liquid in the heater 132 and the liquid leading pipe 136 will reflow into the tank 133 from the liquid return pipe 131 through the three holes tie-in 135 and the electromagnetism valve 137. After complete return of the residual liquid into the tank 133, the electromagnetism valve 4137 will close after several seconds. Alternatively, when external liquid supply equipment is chosen, liquid will reflow to the equipment through the pipe 131. Therefore, in both cases, there will be no remaining fog sprayed from the nozzle 128 immediately when the sprayer 100 stops working.

[0023] Referring to Figs. 4a-4e, for obtaining color-changeable stage effect in use, a number of colorful light members 142 may be provided at positions around the nozzle 128 of the sprayer 100. Fig. 4b shows a number of Ultra-bright LEDs 144 arranged in a circle shape; Fig. 4c shows a number of bulbs 146 arranged in a circle shape; and Fig. 4d shows a number of laser lights 148 arranged in a circle shape. All these colorful light members can make the fog colorful, and a decorative effect of the light members is illustrated in Fig. 4e. In addition, it is noted that the light members may also be mounted any other suitable positions of the sprayer 100.

[0024] The head movable stage fog sprayer 100 of the invention may be used singly or a set of the sprayers 100 may be used cooperatively at the same time. For example, as shown in Fig. 5, a group of sprayers 100 is provided and they work jointly to get much fog simultaneously. These sprayers 100 each are connected to a common external tank 151 through a plurality of pipes 153, 156 and certain number of three holes tie-ins 154, 156. In addition, liquid used to form fog is contained in the tank 151. A control unit 152 is connected with the sprayers 100 and the external tank 151 for controlling purpose. By control of the control unit 152, liquid in the tank 151 is propelled to each sprayer 100 so as to form fog.

[0025] Notably, the sprayer of the invention can use a built in liquid supply such as a tank 133 mounted on the base body 102 (as that shown in Fig. 6) or just placed at a location close to the sprayer. However, an external liquid supply may also be used, and in case when an external liquid supply is utilized, electric circuits of the supply will be relevant to the sprayer. Namely, a liquid pump of the supply will output the liquid to the sprayer only when the sprayer is in operation. Moreover, the sprayer of the invention is able to spray fog in both situations where the sprayer is stationary or moving. Furthermore, the sprayer may also work when it is placed on the ground or hung upside down or even hung at its lateral sides.

[0026] Moreover, as shown in Fig. 1b, a conduit joint 139 may be provided on the base body 102. This conduit joint 139 can be used to connect the sprayer 100 with an external liquid supply (not shown) when the sprayer 100 is hung at a high place. Generally, an external liquid supply may comprise a barrel for storing liquid used to generate fog and a pump to propel the liquid in the barrel to the sprayer of the invention. Of course, the external liquid supply may also comprise corresponding electric circuit boards and other components.

[0027] When the sprayer 100 of the invention is in operation, the fog produced may be very dense initially and then becomes scattered after a while. The thick fog degrades decorative effect, and therefore, it is desired to get sparse fog at initial in order to obtain a good stage effect. Accordingly, as shown in Figs. 7a-7b, a fan such as a mini fan 192 is mounted on the sprayer head 106 near the nozzle 128 of the sprayer 100. When sparse yet uniform fog is needed, just switch on the fan 192 and the fog will be dispersed at once, that is to say, the thin and uniform fog is gotten. On the other situation, when density of the fog becomes suitable, the fan 192 may be switched off.

[0028] While the invention has been described in connection with what are presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not to be limited to the disclosed embodiments, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the invention.

LIST OF REFERENCE SIGNS

[0029]

100	head-movable stage fog sprayer
101	gear
102	base body
103	transfer belt
104	pair of support brackets
106	sprayer head
106	sprayer head
108	stepping motor
110	other stepping motor
112	gear
114	transfer belt
120	shutter
122	stepping motor
124	output shaft
126	shutting plate
127	heating element
128	nozzle
131	liquid return pipe
132	heater
133	tank
134	heating member
135	three holes tie-in
136	liquid-leading pipe
137	electromagnetism valve
138	pump
139	conduit joint
142	colorful light members
144	number of Ultra-bright LEDs
146	number of bulbs
148	number of laser lights
151	external tank
152	control unit
153, 156	plurality of pipes
154, 156	certain number of three holes tie-ins
185	longitudinal axis
187	widthwise axis
192	mini fan
200	sprayer
228	nozzle
232	heater
233	tank
234	heating members
236	liquid-leading pipe
238	pump

Claims

1. A head-movable stage fog sprayer, comprising:

a base body;
a pair of support brackets mounted on the base body; and
a sprayer head pivotally supported by the two support brackets for spraying fog, wherein
the head-movable stage fog sprayer further comprises a stepping motor connected with the sprayer head to cause rotation of the sprayer head.

2. The head-movable stage fog sprayer according to claim 1, **characterized in that** the stepping motor is mounted on the base body to cause rotation of the sprayer head around a longitudinal axis of the sprayer head.

3. The head-movable stage fog sprayer according to claim 1 or 2, **characterized in that** the sprayer head is driven by the stepping motor through transmission between a gear of the stepping motor, a driven gear of the sprayer head, and a transfer belt that interconnects the two gears.

4. The head-movable stage fog sprayer according to anyone of the preceding claims, **characterized in that** the rotation angle of the sprayer head ranges in 0-540 degrees.

5. The head-movable stage fog sprayer according to anyone of the preceding claims, **characterized in that** the stepping motor is mounted on one of the support brackets and located at a lateral side of the sprayer head to drive the sprayer head rotating around a widthwise axis of the sprayer head.

6. The head-movable stage fog sprayer according to claim 5, **characterized in that** the rotation angle of the sprayer head ranges in 0-270 degrees.

7. The head-movable stage fog sprayer according to anyone of the preceding claims, **characterized in that** the sprayer head comprises a nozzle from which fog is sprayed, and the nozzle is selectively covered by a shutter.

8. The head-movable stage fog sprayer according to claim 7, **characterized in that** the shutter comprises a stepping motor with an output shaft and a shutting plate connected to the output shaft of the stepping motor; and the shutting plate is disposed at the front of the sprayer head.

9. The head-movable stage fog sprayer according to claim 8, **characterized in that** the shutting plate is made of aluminum.

10. The head-movable stage fog sprayer according to claim 8 or 9, **characterized in that** a heating element is attached on the shutting plate.

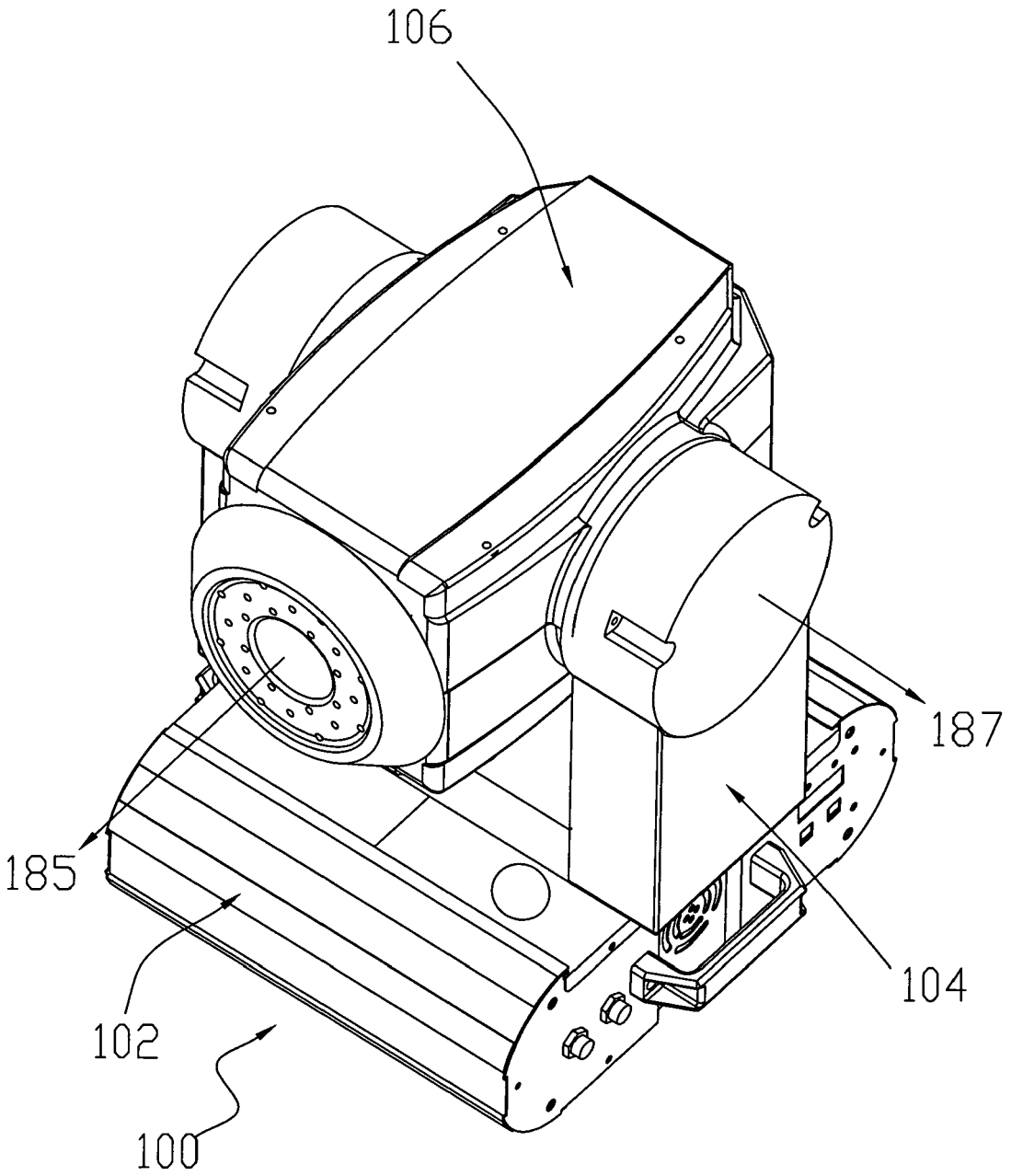

Fig. 1a

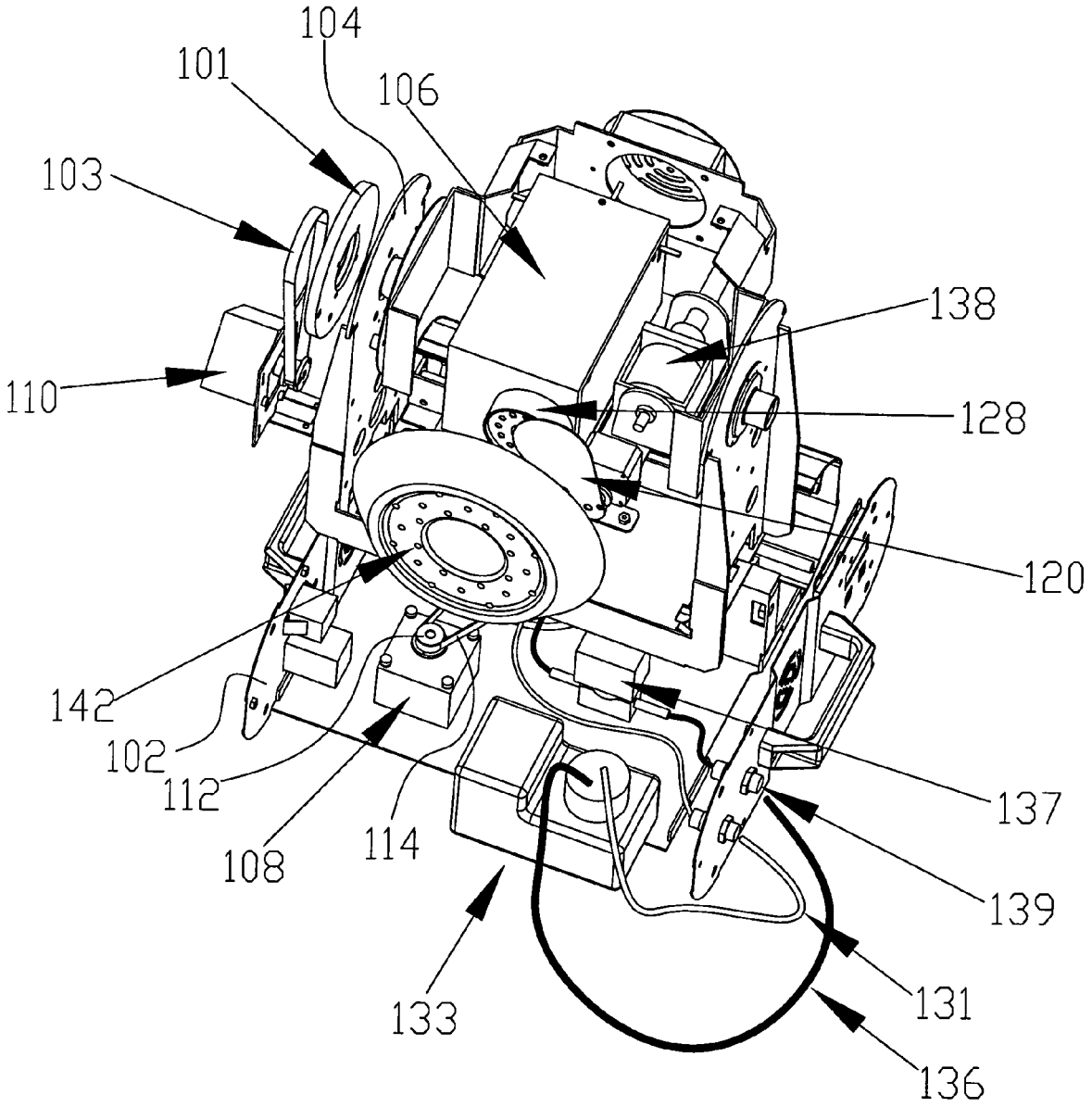
104
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Fig. 1b

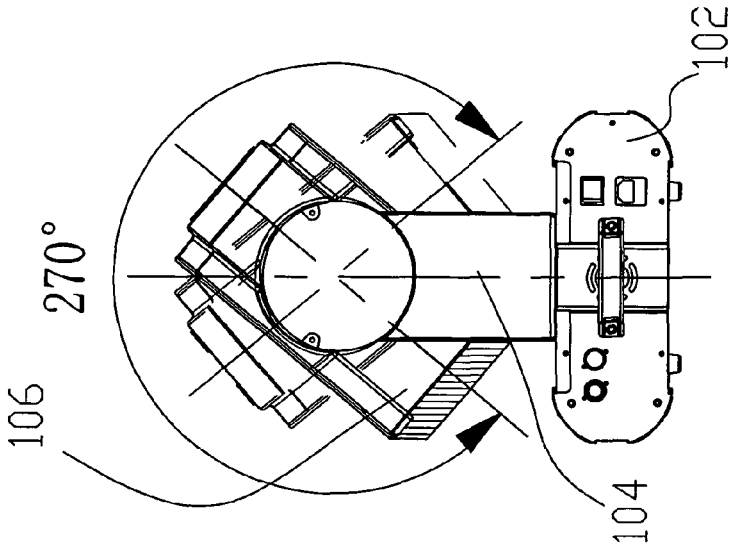

Fig. 1d

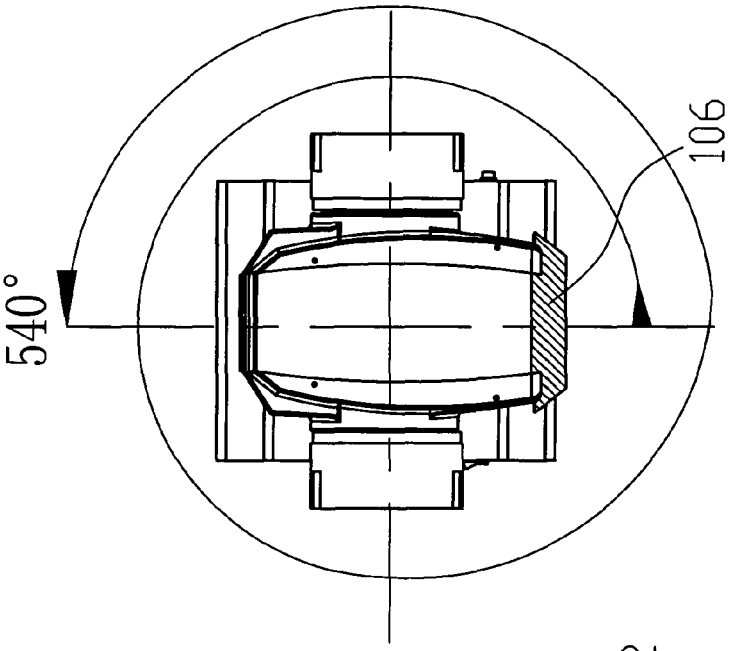

Fig. 1e

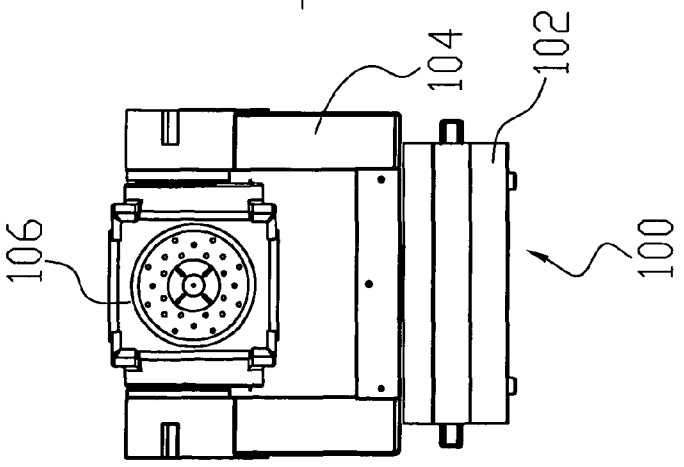

Fig. 1c

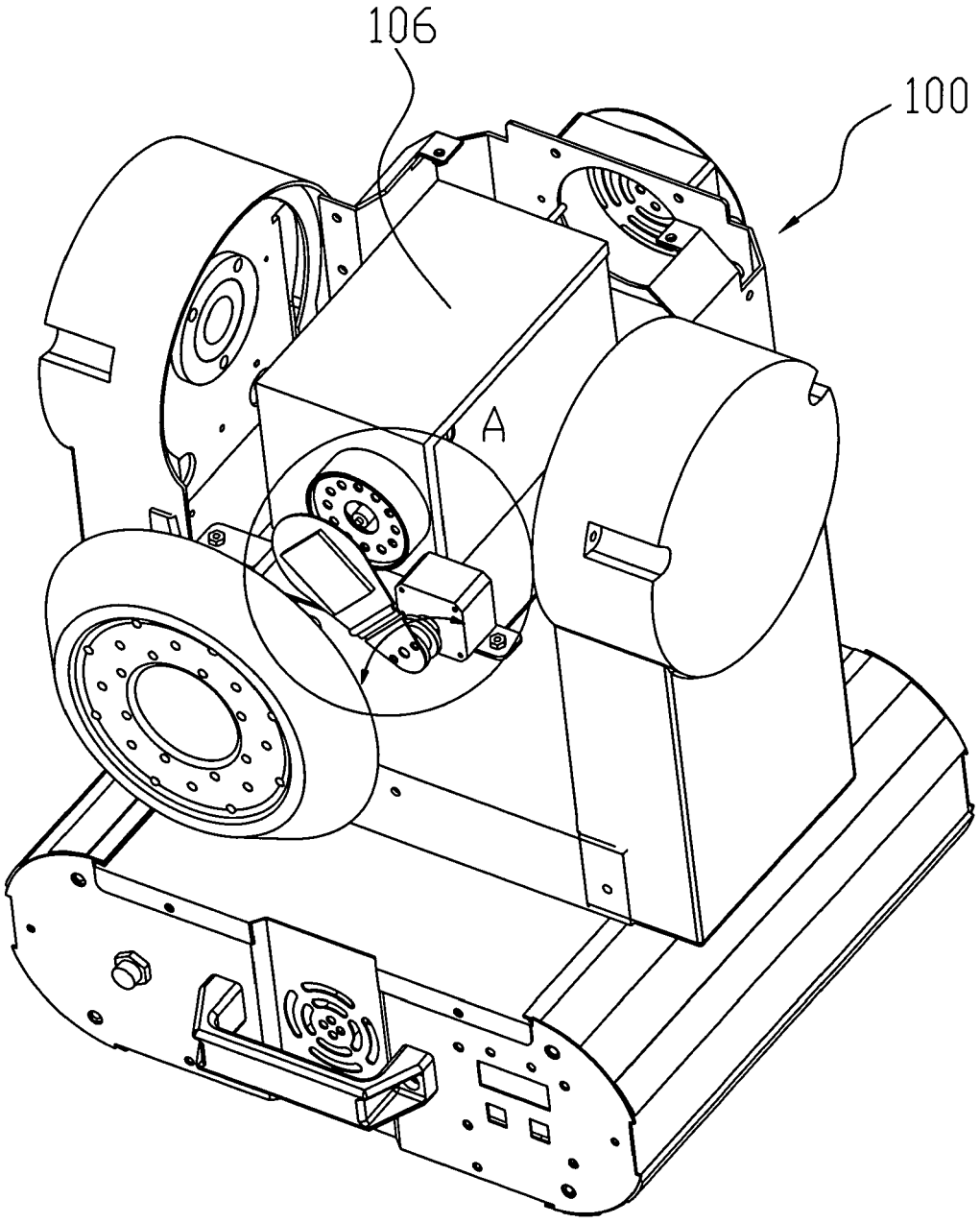

Fig. 2a

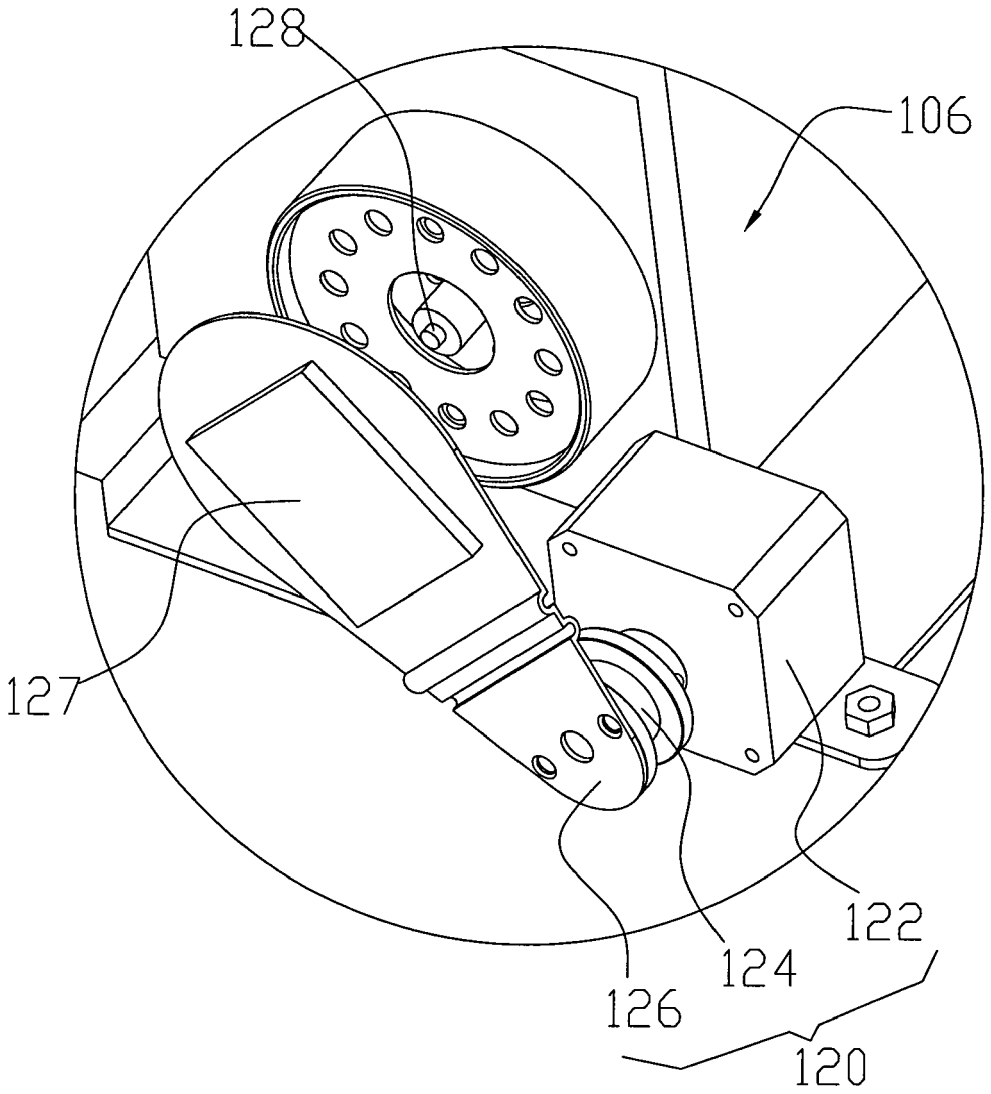

Fig. 2b

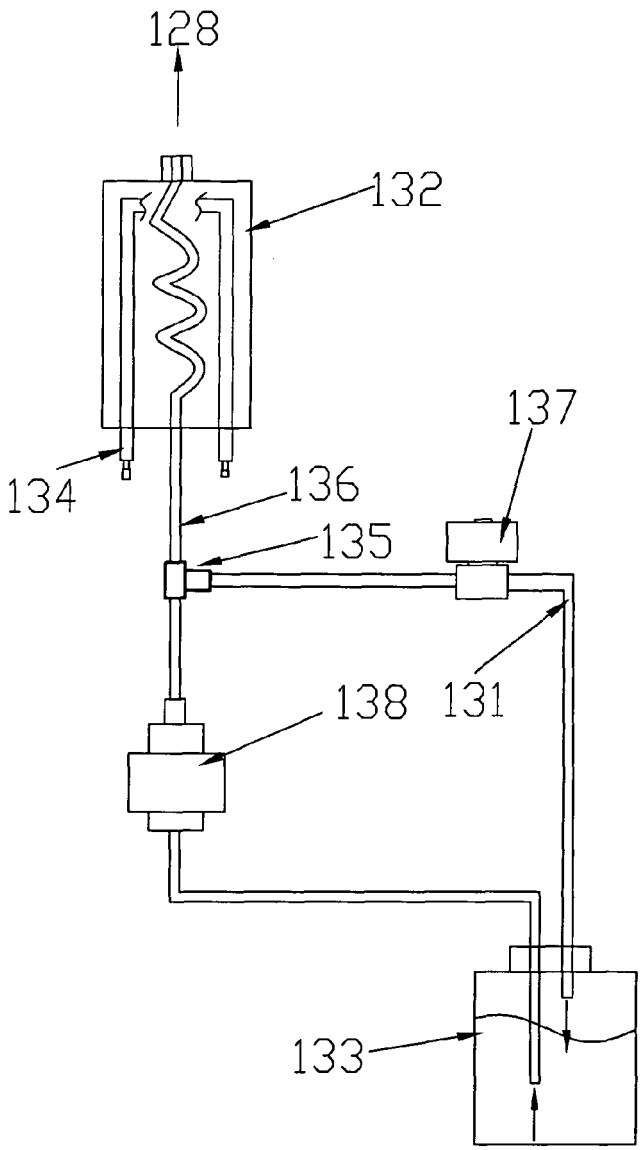

Fig. 3b

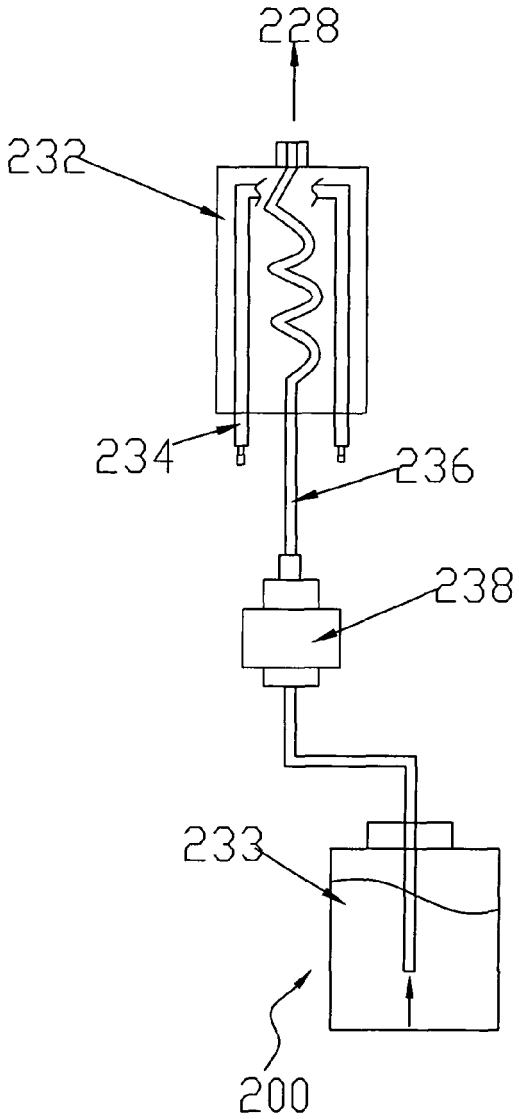

Fig. 3a

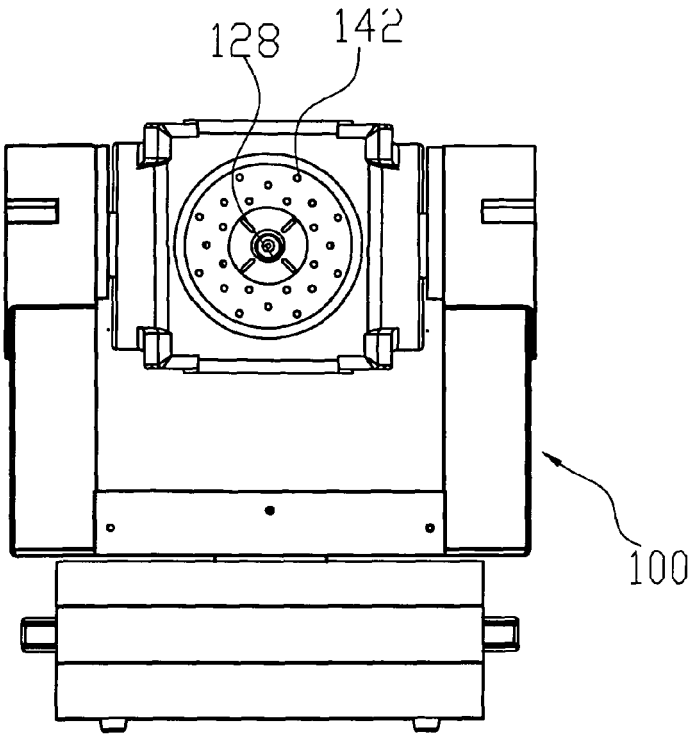

Fig. 4a

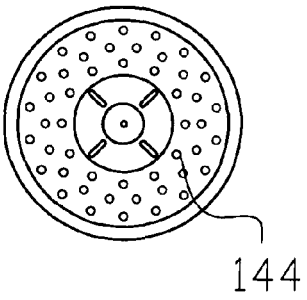

Fig. 4b

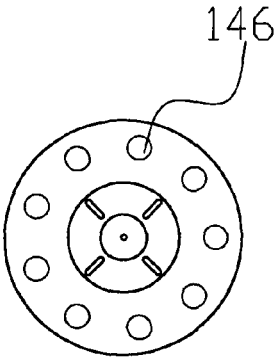

Fig. 4c

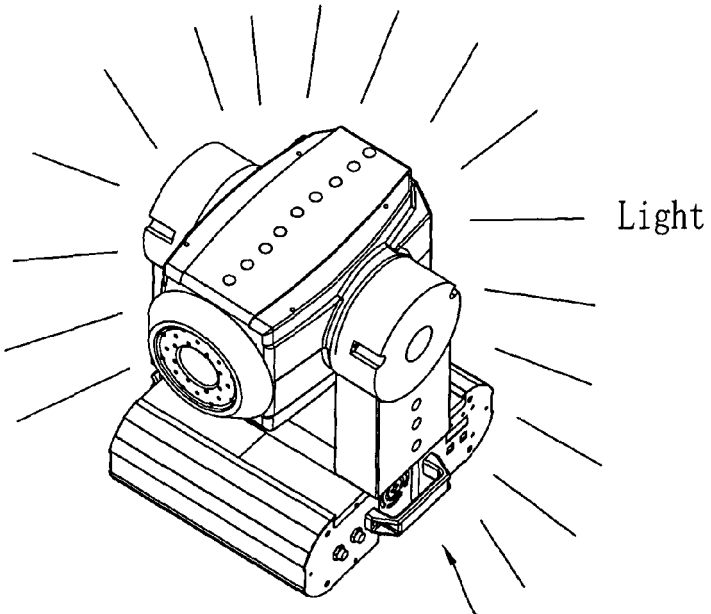

Fig. 4e

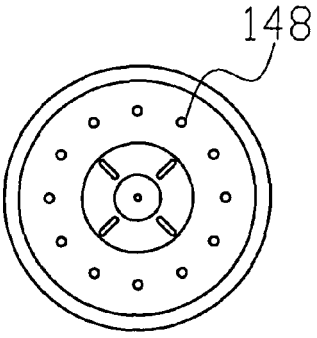

Fig. 4d

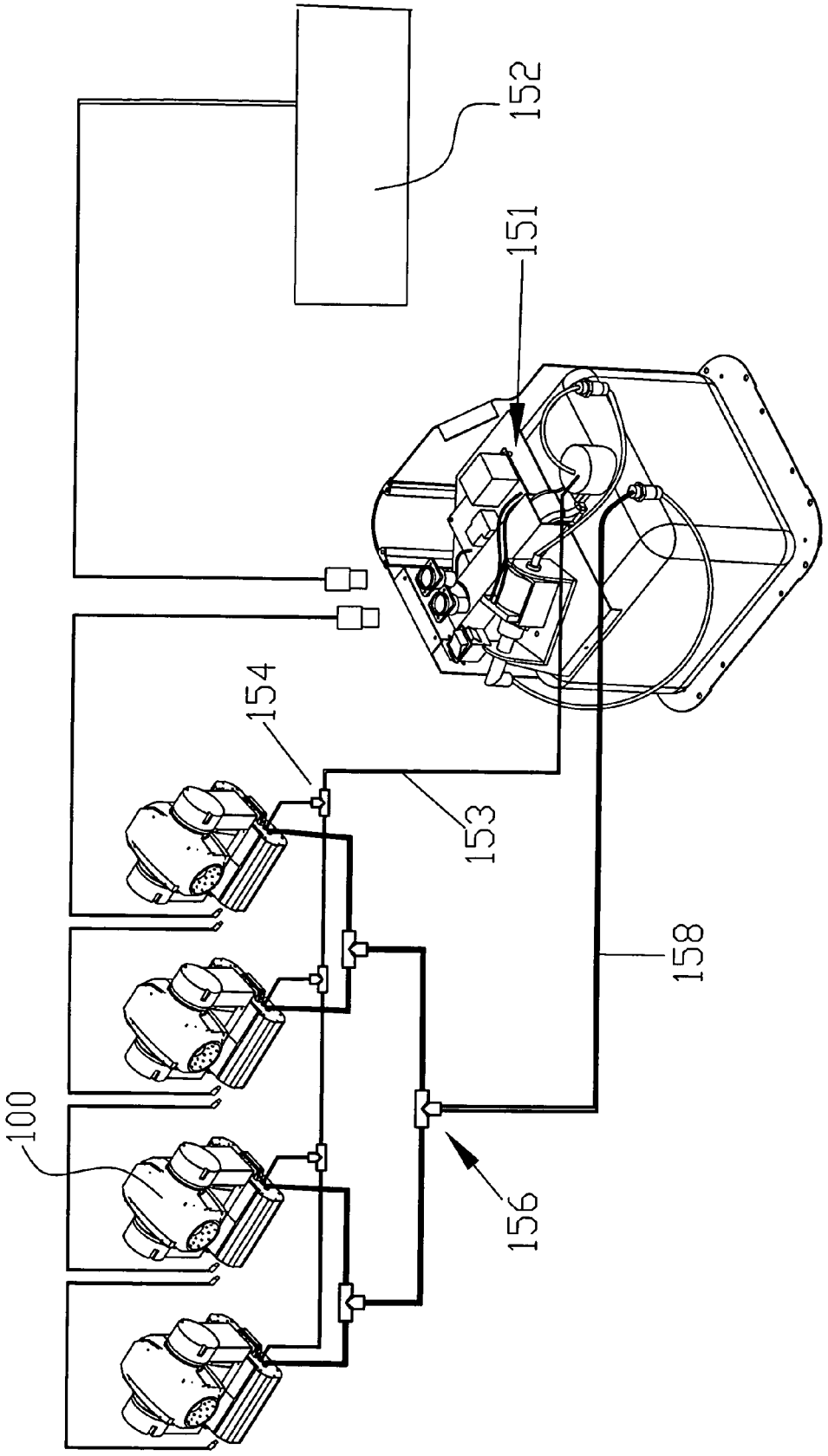

Fig. 5

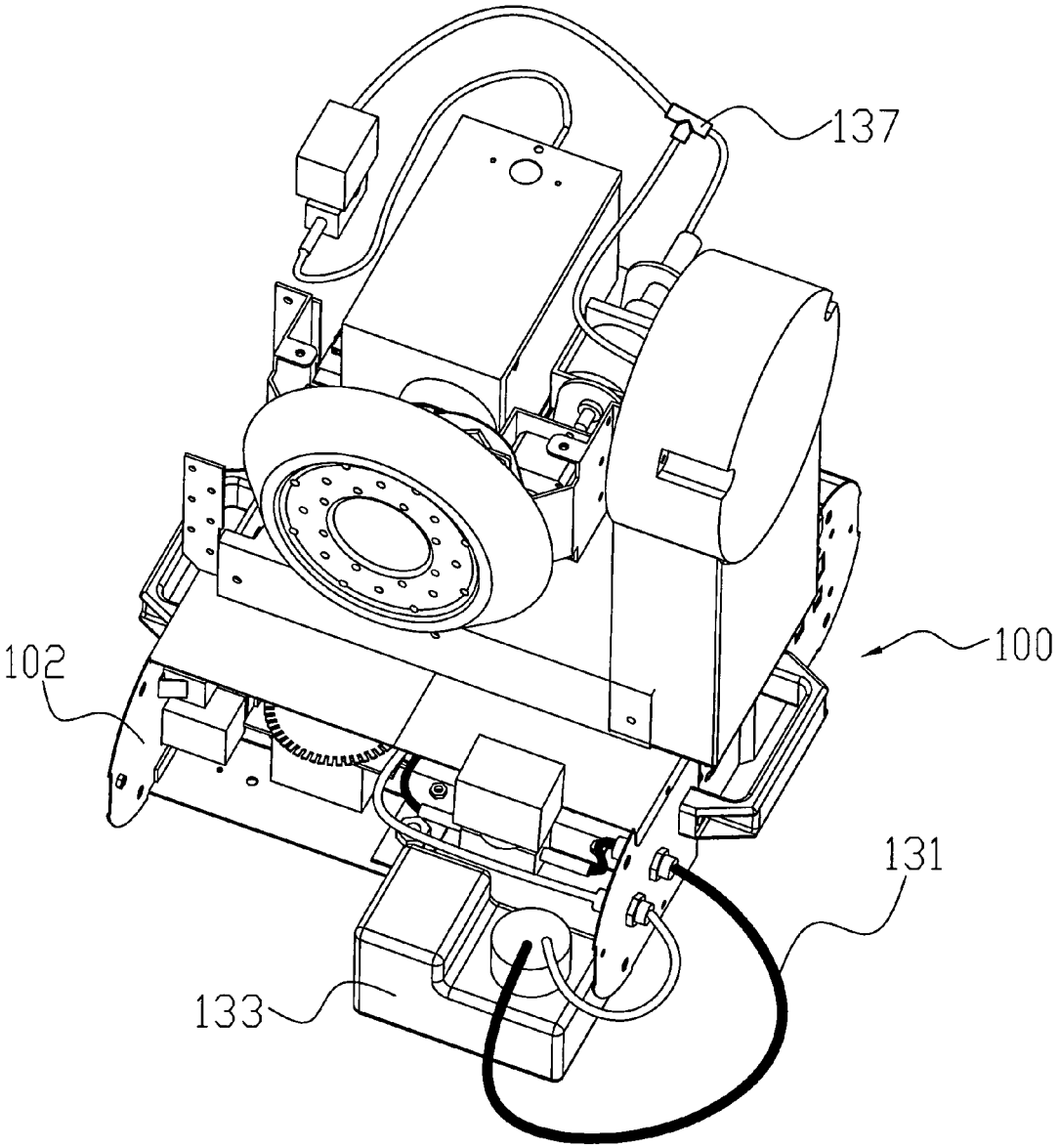

Fig. 6

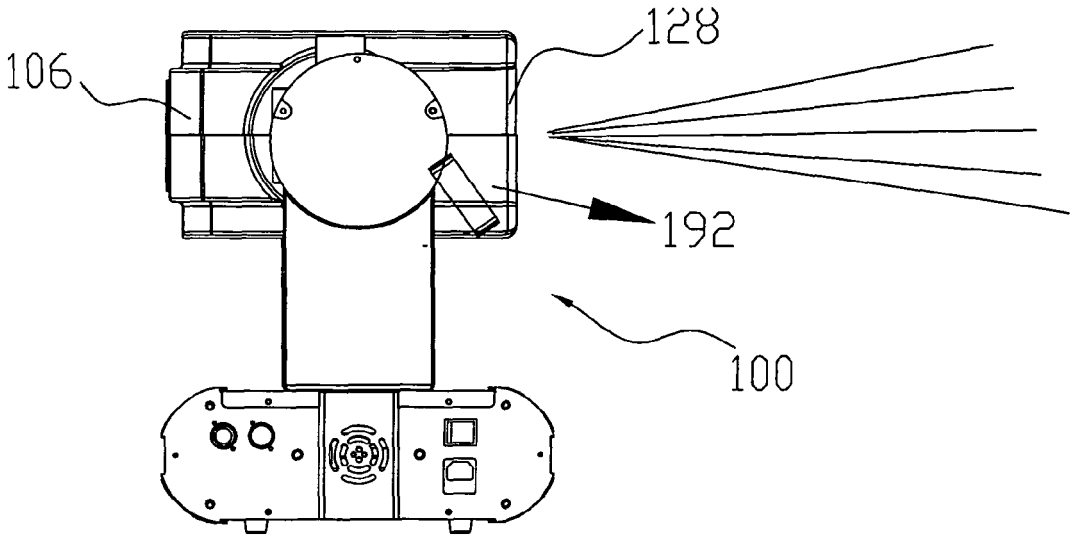

Fig. 7a

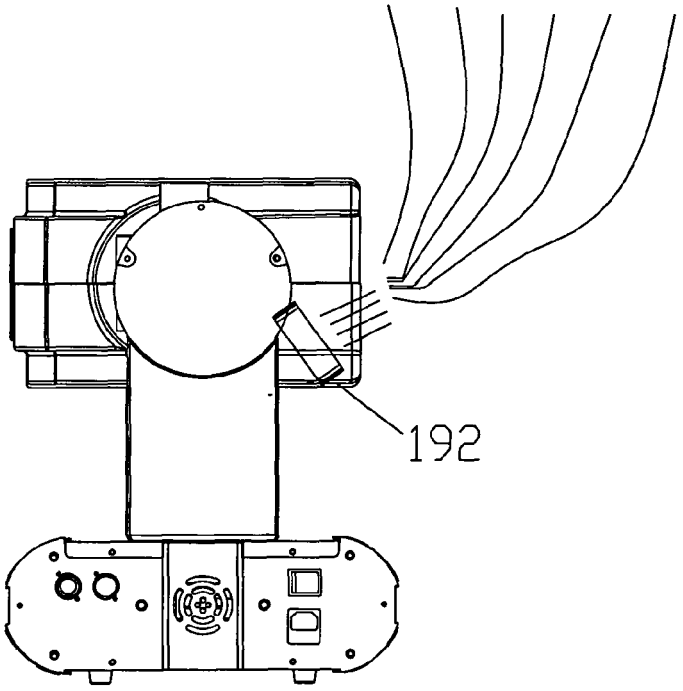

Fig. 7b

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 02 0427

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	FR 2 851 996 A1 (UNIVERSAL EFFECTS [FR]) 10 September 2004 (2004-09-10) * page 4, line 20 - page 5, line 13 * * page 8, line 37 - page 9, line 20; figures 1,2,6 *	1-10	INV. A63J5/02 B05B15/06
Y	US 5 598 207 A1 (KORMOS ALEX L [US] ET AL) 28 January 1997 (1997-01-28) * column 2, line 51 - column 3, line 67 * * column 4, line 57 - line 64; figures 1-3 *	1-10	
Y	DE 100 22 381 A1 (ZOSEL ALEXANDER [DE]) 5 July 2001 (2001-07-05) * column 4, line 39 - column 5, line 64; figures 1-5 *	1-10	
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A	US 5 011 522 A1 (SUZUKI TOSHIMITSU [JP]) 30 April 1991 (1991-04-30) * column 5, line 30 - column 6, line 18 * * column 7, line 29 - column 9, line 50; figures 1,3,4a,4b *	1-6	TECHNICAL FIELDS SEARCHED (IPC) A63J F41H B05B F16M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 March 2007	Rente, Tanja

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