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(54) **AN APPARATUS FOR GENERATING PARTICLE SPRAY**

(57) Disclosed is an apparatus for generating and delivering dispersed dry ice particles, comprising a rotary cutting mechanism, a tray and a linkage device. The linkage device comprises a driving device and a reversing linkage device. The driving device drives the tray to rotate in a horizontal direction. The reversing linkage device reverses the output of the driving device from the horizontal rotation to a vertical rotation and drives the rotary

cutting mechanism to rotate in the vertical direction. The present invention further discloses an apparatus for generating particle spray, which comprises a dry ice container, a rotary cutting mechanism, a tray and the linkage device mentioned above. The present invention further discloses a linkage device for a rotary mechanism and a tray for forming an interlock relationship between the rotary mechanism and the tray.

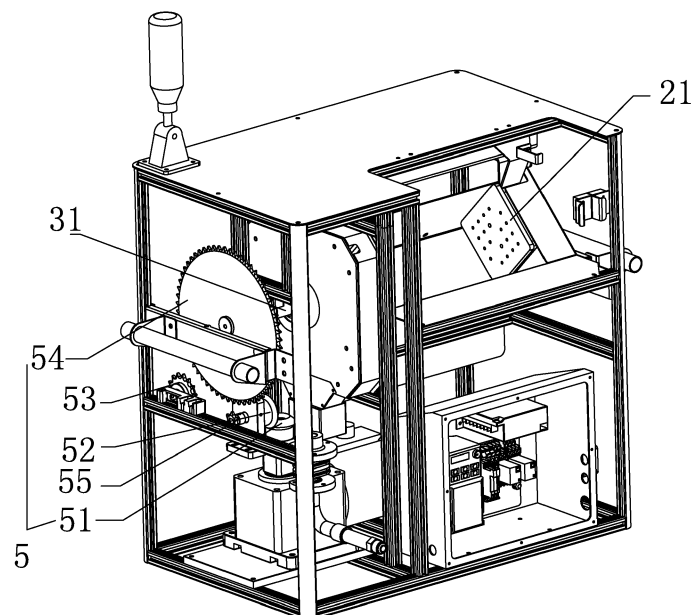


FIG. 2

Description

TECHNICAL FIELD

[0001] The present invention relates to an apparatus for grinding dry ice to particles and delivering the particles.

BACKGROUND OF THE INVENTION

[0002] Dry ice has a property of sublimation and is used in the fields of grinding of precision parts molded by injecting, cleaning of electronic components and so on. The dry ice products are generally block-shaped. Therefore, it is necessary to grind carbon dioxide blocks into small particles. Then a spraying device is used to spray the carbon dioxide particles through an accelerating air pump toward workpieces. A dry ice rotary cutting device is disclosed in US 2003/0064665A1, in which a dry ice block is placed on a rotary cutting plate and a blade is provided on one side of the rotary cutting plate. The rotary cutting plate is provided with an opening. The blade is disposed above the opening. The dry ice block is sliced by the rotary cutting plate and the sliced dry ice particles enter the other side of the rotary cutting plate from the opening of the rotary cutting plate and fall into a collection area of a receiving tray for transporting the dry ice particles. The rotary cutting device grinds the dry ice particles substantially evenly out of the dry ice block and uniformly transports the dry ice particles to workpieces to be cleaned. The workpieces to be cleaned are not always the same. In some cases, larger impact strength is required or more dry ice particles are required for cleaning the workpieces. This requires better dry ice particle delivery equipment.

[0003] In order to achieve these effects, a receiving tray needs to be rotated in conjunction with a rotary cutting mechanism to ensure that while the rotary cutting mechanism rotates and cuts, the receiving tray is correspondingly transferred to the receiving position for adjusting the receiving amount.

SUMMARY OF THE INVENTION

[0004] The technical problem to be solved is that the amount of dry ice particles delivered is not adjustable.

[0005] To solve above mentioned technical problem, the present invention provides an apparatus for generating and delivering dispersed dry ice particles comprising a rotary cutting mechanism, a tray and a linkage device. The linkage device comprises a driving device and a reversing linkage device. The driving device drives the tray to rotate in a horizontal direction. The reversing linkage device reverses the output of the driving device from the horizontal rotation to a vertical rotation and drives the rotary cutting mechanism to rotate in the vertical direction.

[0006] In this way, the rotary cutting mechanism and

the tray can be interlocked and dry ice particles can therefore be adjusted to be more collectively delivered.

[0007] In another preferred embodiment, the reversing linkage device comprises a first gear that is linked to a rotating shaft of the driving device and a second gear that is vertically placed and engaged with the first gear.

[0008] In another preferred embodiment, the linkage device further comprises a movable third gear, which moves between a first position and a second position. When the third gear is in an engaged position, the second gear and the rotary cutting mechanism are connected by the third gear. When the third gear is in a non-engaged position, the connection between the second gear and the rotary cutting mechanism is released.

[0009] The present invention further provides an apparatus for generating particle spray comprising a dry ice container, a rotary cutting mechanism, a tray and the linkage device above mentioned.

[0010] In another preferred embodiment, the tray is disposed with a storage area, and the storage area moves to a blanking position or a discharging position in conjunction with the rotation of the tray. When the tray moves to the blanking position, the storage area is connected to the back side of the rotary cutting mechanism through a blanking passage. When the tray moves to the discharge position, one side of the storage area is connected to an accelerating air pump, and the other side is connected to a discharge nozzle.

[0011] In another preferred embodiment, the cross section of the container in the vertical direction is a quadrangle, and the two diagonal lines thereof extend in the horizontal direction and the vertical direction respectively.

[0012] In another preferred embodiment, a first side of the container is disposed with a pressing device for pushing dry ice toward a second side opposite to the first side. The rotary cutting mechanism is disposed on the second side. The rotary cutting mechanism comprises a rotary cutting plate, on which a blade and a support plate are fixed. The blade is inclined in the direction from the second side toward the first side and beyond the support plate. A gap is provided between the blade, the support plate and the rotary cutting mechanism. The bottom surface of the container is correspondingly disposed with an opening below the gap. The sliced dry ice particles drop from the opening into the blanking passage.

[0013] In another preferred embodiment, the container is disposed with a vent above the rotary cutting mechanism.

[0014] In another preferred embodiment, the blade and the support plate are in the same plane, and the blade edge of the blade extends outward from the support plate by 0.5-2 mm.

[0015] In another preferred embodiment, a first side of the container is provided with a pressing device for pushing dry ice toward a second side opposite to the first side. The rotary cutting mechanism is disposed on the second side. The rotary cutting mechanism comprises a rotary

cutting plate, on which a scraper is fixed. The scraper comprises a plane, an opening and a blade edge, and the blade edge extends out of the opening. A gap is disposed between the scraper and the rotary cutting mechanism. The bottom surface of the container is correspondingly disposed with an opening under the gap. The sliced dry ice particles drop from the opening into the blanking passage.

[0016] Compared with the prior art, the technical solution of the present invention has the following beneficial effects:

1. The present invention provides an apparatus for generating and delivering dispersed dry ice particles, which employs a tray instead of a delivering shaft to deliver dry ice, so that the dry ice particles can be more concentrated and sprayed, thereby improving the dry ice particles processing. The amount of the dry ice particles is larger and the impact force provided is greater. Furthermore, it is possible to design trays in different sizes with different quantity of hoppers. The dry ice particles delivered by a tray with fewer hoppers can be more concentrated. The impact force is, therefore, greater. However, the impacts are not continuous. The trays can be adjusted according to the process requirements. The linkage device of a rotary cutting mechanism and a tray drives the rotary cutting mechanism and the tray to rotate in different directions by the same driving device and the reversing linkage device. The amount of dry ice collected by the tray after one rotation of the rotary cutting mechanism can be adjusted.

2. The present invention provides an apparatus for generating particle spray, in which the container has a quadrangular cross section in the vertical direction, and two diagonal lines thereof extend in a horizontal direction and a vertical direction, respectively. This can effectively prevent the dry ice from rotating during the rotary cutting process.

3. The present invention provides an apparatus for generating particle spray, in which the dry ice is cut rotationally in the container and an exit for a collection region is provided at the bottom of the container. The path is simple and controllable. The entire channel can be sealed, so that the negative pressure of an injection pump is introduced into the rotary cutting environment to make the transport of dry ice particles uniform. Furthermore, as the transport path of the dry ice particles is simple and controllable and kept sealed, the injection pump can provide a greater force on the dry ice particles, whereby the impact of the finally formed dry ice particle spray is greater, and the spray impact in comparison with thereof the conventional dry ice cleaner can be increased by more than 15%.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

- FIG. 1 illustrates a schematic diagram of the apparatus for generating particle spray in Embodiment 1 of the present invention;
 FIG. 2 illustrates a schematic diagram of the apparatus for generating particle spray in Embodiment 1 of the present invention in another perspective view;
 FIG. 3 illustrates a schematic diagram of the third gear in the engagement position in Embodiment 1 of the present invention;
 FIG. 4 illustrates a schematic diagram of the third gear in the engagement position in Embodiment 1 of the present invention in another perspective view;
 FIG. 5 illustrates a sectional diagram of the tray in a blocking position in Embodiment 1 of the present invention;
 FIG. 6 illustrates a schematic diagram of the rotary cutting mechanism in Embodiment 1 of the present invention;
 FIG. 7 illustrates an exploded diagram of the rotary cutting mechanism in Embodiment 1 of the present invention;
 FIG. 8 illustrates a side view of the apparatus for generating particle spray in Embodiment 1 of the present invention;
 FIG. 9 illustrates an exploded diagram of the apparatus for generating particle spray in Embodiment 1 of the present invention;
 FIG. 10 illustrates a schematic diagram of the rotary cutting mechanism in Embodiment 2 of the present invention;
 FIG. 11 illustrates an exploded diagram of the rotary cutting mechanism in Embodiment 2 of the present invention; and
 FIG. 12 illustrates a sectional diagram of the scraper in Embodiment 2 of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0018] The technical solution of the present invention is further described below in conjunction with the accompanying drawings and specific embodiments.

Embodiment 1

[0019] Referring to FIGS 1-7, an apparatus for generating particle spray comprises a container 2 for placing dry ice 1, a rotary cutting mechanism 3, a tray 4 and a linkage device 5 for linking the rotary cutting mechanism 3 and the tray 4. The linkage device 5 is configured to rotate the rotary cutting mechanism 3 and the tray 4 in conjunction with each other. Since a linkage relationship is formed between the rotary cutting mechanism 3 and the tray 4, by setting a speed difference between them, the tray 4 is just moved to the blanking position after the

rotary cutting mechanism 3 has completed a rotary cut, and thereby completing a process of rotary cutting and blanking. Once these speeds have been set, the speeds of them are constant. During a long-term movement, a constant speed difference between them can be maintained, which makes the rotary cutting process and the blanking process continuous. The work process is very efficient.

[0020] The linkage device 5 comprises a driving device and a reversing linkage device. Said driving device drives the tray 4 to rotate in a horizontal direction. The reversing linkage device reverses the output of the driving device from the horizontal rotation to a vertical rotation, thereby driving the rotary cutting mechanism 3 to rotate in the vertical direction.

[0021] In detail, the reversing linkage device comprises a first gear 51 that is linked to a rotating shaft of the driving device and a second gear 52 that is placed perpendicular to the first gear 51 and engaged with the first gear 51. The second gear 52 is arranged coaxially to a transmission shaft, and the other end of the transmission shaft is coupled with a fifth gear 55. The apparatus for generating particle spray further comprises a movable third gear 53. The rotary cutting mechanism 3 is coaxially linked to a fourth gear 54 by a rotating shaft 31. When the third gear 53 moves to an engaged position, the third gear 53 is engaged with the fifth gear 55 and the fourth gear 54, respectively, so that the driving device drives the first gear 51 to rotate in the horizontal direction, and the first gear 51 drives the second gear 52 to rotate in the vertical direction. The second gear 52 drives the fifth gear 55 to rotate by the transmission shaft, and the fifth gear 55 drives the fourth gear 54 to move by the third gear 53, thereby forming a linkage engagement to drive the cutting mechanism 3 to rotate. When the rotary cutting mechanism 3 has to be stopped, it is only necessary to remove the third gear 53 from the engaged position. In this embodiment, the third gear 53 is driven by a cylinder between an engaged position and a non-engaged position along a guide rail moveable. By the above-mentioned reversing linkage device, it allows that two components are driven by a same driving device to rotate in different directions, which can ensure that the relative speed between the two components is stable after a long period of operation, and one driving device can be reduced, so as to achieve a reduced volume and reduced costs.

[0022] The tray 4 is disposed with a storage area 41. The storage area 41 moves to a blanking position or a discharging position in conjunction with the rotation of tray 4; when the tray 4 moves to the blanking position, the storage area 41 is connected to the back side of the rotary cutting mechanism 3 through a blanking passage 30, thereby collecting the dry ice sliced by the rotary cutting mechanism 3 in the tray; when the tray 4 moves to the discharge position, one side of the storage area 41 is connected to an accelerating air pump, and the other side is connected to a discharge nozzle. Therefore, when the tray 4 moves to the discharge position, the dry

ice particles in the tray 4 are ejected from the discharge nozzle after being accelerated by the accelerating air pump. In detail, the upper surface of the tray 4 is provided with a blanking opening. When the tray 4 moves to the blanking position, the particles fall from the blanking passage 30 into the storage area 41.

[0023] The above-mentioned device can be used as a cleaning machine. In operation, as long as the discharge nozzle is placed in the container to be cleaned, the high-pressure dry ice particles enter into the container and blow out the dirty matter in the container, thereby achieving the purpose of cleaning. Due to the above-mentioned structure, the moving path of the particles is short, and the moving path of the particles is kept closed, so that the gas blown from the air pump accelerates the dry ice particles and the impact force of the dry ice spray is increased by more than 15%.

[0024] The cross section of the container 2 in the vertical direction is a quadrangle, and the two diagonal lines thereof extend in a horizontal direction and a vertical direction, respectively. Since the container 2 is diamond-like, when the dry ice block is placed in the container, the dry ice is limited by the inner wall of the container in either the clockwise or counterclockwise direction. In this way, during the rotary cutting process, the dry ice 1 can be effectively prevented from rotating due to the rotational friction caused by the rotary cutting.

[0025] A first side of the container 2 is disposed with a pressing device 21 for pushing dry ice toward a second side opposite to the first side. The rotary cutting mechanism 3 is disposed on the second side. The rotary cutting mechanism 3 comprises a rotary cutting plate 34, on which a blade 32 and a support plate 33 are fixed. The support plate 33 and the rotary cutting plate 34 are arranged to be parallel to each other with a space between them. The blade 32 and the support plate 33 are in the same plane. The blade 32 is inclined in the direction from the second side towards the first side and beyond the support plate 33. The blade edge of the blade extends outwardly out of the support plate 33 by 0.5-2 mm.

[0026] A gap is provided between the blade 32, the support plate 33 and the rotary cutting mechanism 34. The bottom surface of the container 2 is correspondingly disposed with an opening below the gap, so that the sliced dry ice particles can drop from the opening into the blanking passage 30.

[0027] The container 2 is disposed with a vent 22 above the rotary cutting mechanism 3. A wind pressure pumped at the inlet end of the vent 22 can facilitate the blanking of the dry ice particles, so that an agglomeration of the dry ice particles and an uneven discharge can be avoided.

[0028] In this embodiment, in order to further increase the degree of automation of the production process, a dry ice remaining alarm device is provided, so that an operator can add dry ice in time. In detail, referring to FIG. 8, the remaining alarm device comprises a first sensing component 6, a second sensing component 7, a trig-

gering member 8 and a usage tracking component. The triggering component 8 is disposed at the usage tracking component. The first sensing component 6 is disposed in the container 2 near the first side. The second sensing component 7 is disposed on the first side of the container 2. The first sensing component 6, the second sensing component 7, the usage tracking component and an indicator light 9 are connected to a control circuit, respectively.

[0029] In cases of heavy use of robotic arms for cleaning, a dry ice cleaning machine has three working states to facilitate the work of operators. Before an operation of the dry ice cleaning machine, the container 2 is filled with dry ice, and the usage tracking component is placed at the first end of the container 2. In operation, the remaining amount of the dry ice is gradually reduced from the first end to the second end of the container 2, and the usage tracking component and the trigger member 8 move from the first end to the second end of the container 2 with the reduced amount of the dry ice. Until the triggering member 8 reaches the position of the first sensing component 6, it indicates a sufficient amount of the dry ice in the dry ice cleaning machine, and the control circuit drives the indicator light 9 to light up a first color.

[0030] When the triggering member 8 moves to the position of the first sensing component 6, it indicates an insufficient amount of the dry ice in the dry ice cleaning machine, and the operator is required to replenish the dry ice in the container 2 in a timely manner. When the triggering member 8 triggers the first sensing component 6, the control circuit drives the indicator light 9 to light up a second color. Thereafter, until the triggering member 8 reaches the position of the second sensing component 7, the indicator light 9 still illuminates the second color.

[0031] When the triggering member 8 moves to the position of the second sensing component 7, it indicates that there is no dry ice in the dry ice cleaning machine. At this time, the dry ice cleaning machine stops working. The triggering member 8 triggers the second sensing component 7, and the control circuit drives the indicator light 9 to light up a third color.

[0032] By employing a large indicator light 9 that can displays three colors, the remaining amount of dry ice in the cleaning machine can be clearly indicated. An operator who controls remotely can more easily identify the working state of the dry ice cleaning machine. It facilitates the work for the operator and is conducive to the automated production.

[0033] Referring to FIG. 9, the dry ice cleaning machine according to the present invention further comprises a progress bar 10. The two ends of the progress bar 10 are connected to the first side and the second side of the container 2, respectively. The usage tracking component comprises a progress baffle 101 and a connecting member 102. The progress baffle 101 is disposed perpendicular to the progress bar 10. The progress baffle 101 is connected to the progress bar 10 through the connecting member 102, and the progress baffle 101 is connected

to the control circuit. The progress baffle 101 moves from the first end to the second end with the reduced amount of the dry ice and drives the connecting member 102 to move synchronously on the progress bar 10. The triggering member 8 is disposed on the connecting member 102.

[0034] Three connecting blocks are fixed together around the progress bar 10 to form the connecting member 102. One side of the connecting block located on the left and right sides of the progress bar 10 is screwed to the connecting block at the top of the progress bar 10, and the other side is attached to the progress baffle 101. The trigger member 8 is disposed on the connecting member 102 in parallel to the progress bar 10.

[0035] One side of the connecting block located on the left and right sides of the progress bar 10 is bent and extended to the connecting block at the top of the progress bar 10. The extended portion is provided with a screw hole. The connecting block at the top of the progress bar 10 is provided with a screw hole, too. The three connecting blocks are screwed together by screws.

[0036] In order to realise automatic production, the dry ice cleaning machine automatically detects the remaining amount of dry ice. The first sensing component 6 and the second sensing component 7 are both sensors. These sensors are connected to a control circuit. The sensors receive the signal sent by the triggering component 8. The control circuit determines the color of the indicator light 9.

[0037] The first color of the indicator light 9 is green. The second color of the indicator light 9 is yellow, and the third color of the indicator light 9 is red.

[0038] In order to enhance the alarm strength, the dry ice cleaning machine provided by the present invention further comprises a buzzer alarm. When the trigger member 8 reaches the position of the second sensing component 7, and the second sensing component 7 is therefore triggered, the buzzer alarm sounds.

[0039] In the prior art, the injection pressure provided by a dry ice cleaning machine can only be manually adjusted by a regulating valve, which brings great inconvenience to the automatic production. When a same product requires two levels of injection pressure, the conventional dry ice cleaners cannot meet the requirements of automated production. Therefore, the dry ice cleaning machine according to the present invention further comprises a pressure switching device which is connected to the control circuit. Control signals are issued by the control circuit to adjust the cleaning pressure of the cleaning machine currently in operation.

[0040] More specifically, the pressure switching device comprises a first pressure output module, a second pressure output module, a first regulating valve, a second regulating valve and a pressure regulating cylinder. The injection pressure of the pressure regulating cylinder is manually adjusted by the first regulating valve and the second regulating valve to form different dry ice injection pressures, so that the first pressure output module and

the second pressure output module can output different dry ice injection forces, respectively.

[0041] After having adjusted the two injection pressures, the operator sends a control signal using the control circuit to choose whether the first pressure output module or the second pressure output module is used. The injection pressure can be adjusted by remote control of the control circuit during cleaning.

Embodiment 2

[0042] Referring to FIG. 10 to FIG. 12, in the present embodiment, a first side of the container 2 is provided with a pressing device 21 for pushing the dry ice toward a second side opposite to the first side. The rotary cutting mechanism 3 is disposed on the second side. The rotary cutting mechanism 3 comprises a rotary cutting plate 34, on which a scraper 35 is fixed. The scraper 35 comprises a plane 351, an opening 352 and a blade edge 353. The blade edge 353 extends out of the opening 352. A gap is disposed between the scraper 35 and the rotary cutting mechanism 3. The bottom surface of the container 2 is correspondingly disposed with an opening under the gap. The scraper 35 rotates with the rotary cutting mechanism 3 with respect to the side surface of the dry ice 1. The sliced dry ice particles drop from the opening into the blanking passage 30.

[0043] Although the present invention has been described with reference to the preferred embodiments thereof for carrying out the patent for invention, it is apparent to those skilled in the art that a variety of modifications and changes may be made without departing from the scope of the patent for invention which is intended to be defined by the appended claims.

Claims

1. An apparatus for generating particle spray comprising a dry ice container, a rotary cutting mechanism, a tray and a linkage device, wherein the linkage device comprises a driving device and a reversing linkage device, wherein the driving device drives the tray to rotate in a horizontal direction, wherein the reversing linkage device reverses the output of the driving device from the horizontal rotation to a vertical rotation and drives the rotary cutting mechanism to rotate in the vertical direction.
2. The apparatus for generating particle spray according to claim 1, wherein the reversing linkage device comprises a first gear linked to a rotating shaft of the driving device and a second gear which is arranged perpendicular to the first gear and is engaged with the first gear.
3. The apparatus for generating particle spray according to claim 1 or 2, wherein the tray is disposed with

a storage area, and the storage area moves to a blanking position or a discharging position in conjunction with the rotation of the tray, wherein, when the tray moves to the blanking position, the storage area is connected to the back side of the rotary cutting mechanism through a blanking passage, wherein, when the tray moves to the discharge position, one side of the storage area is connected to an accelerating air pump, and the other side is connected to a discharge nozzle.

4. The apparatus for generating particle spray according to claim 1 or 2, wherein a cross section of the container in the vertical direction is a quadrangle, and the two diagonal lines thereof extend in the horizontal direction and the vertical direction, respectively.
5. The apparatus for generating particle spray according to any of claims 1-4, wherein a first side of the container is disposed with a pressing device for pushing dry ice toward a second side opposite to the first side, wherein the rotary cutting mechanism is disposed on the second side, wherein the rotary cutting mechanism comprises a rotary cutting plate, on which a blade and a support plate are fixed, wherein the blade is inclined in the direction from the second side towards the first side and beyond the support plate, wherein a gap is provided between the blade, the support plate and the rotary cutting mechanism, wherein the bottom surface of the container is correspondingly disposed with an opening below the gap, wherein the sliced dry ice particles drop from the opening into a blanking passage.
6. The apparatus for generating particle spray according to claim 5, wherein the container is disposed with a vent above the rotary cutting mechanism.
7. The apparatus for generating particle spray according to claim 5, wherein the blade and the support plate are in the same plane, and wherein the blade edge of the blade extends outward from the support plate by 0.5-2 mm.
8. The apparatus for generating particle spray according to any of claims 1-4, wherein a first side of the container is provided with a pressing device for pushing dry ice towards a second side opposite to the first side, wherein the rotary cutting mechanism is disposed on the second side, wherein the rotary cutting mechanism comprises a rotary cutting plate, on which a scraper is fixed, wherein the scraper comprises a plane, an opening and a blade edge, and the blade edge extends out of the opening, wherein a gap is disposed between the scraper and the rotary cutting mechanism, wherein the bottom surface of the container is correspondingly disposed with an

opening under the gap, wherein the sliced dry ice particles drop from the opening into the blanking passage.

9. A linkage device of a rotary cutting mechanism and a tray, wherein the linkage device comprises a driving device and a reversing linkage device, wherein the driving device drives the tray to rotate in a horizontal direction, wherein the reversing linkage device reverses the output of the driving device from the horizontal rotation to a vertical rotation and drives the rotary cutting mechanism to rotate in the vertical direction. 5
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10. The linkage device according to claim 9, wherein the reversing linkage device comprises a first gear that is linked to a rotating shaft of the driving device and a second gear which is arranged perpendicular to the first gear and is engaged with the first gear. 15
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11. An apparatus for generating and delivering dispersed dry ice particles comprising a rotary cutting mechanism, a tray and a linkage device, wherein the linkage device comprises a driving device and a reversing linkage device, wherein the driving device drives the tray to rotate in a horizontal direction, wherein the reversing linkage device reverses the output of the driving device from the horizontal rotation to a vertical rotation and drives the rotary cutting mechanism to rotate in the vertical direction. 25
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12. The apparatus for generating and delivering dispersed dry ice particles according to claim 11, wherein the reversing linkage device comprises a first gear which is linked to a rotating shaft of the driving device and a second gear which is arranged perpendicular to the first gear and is engaged with the first gear. 35

13. The apparatus for generating and delivering dispersed dry ice particles according to claim 12, further comprising a movable third gear, which moves between a first position and a second position, wherein, when the third gear is in an engaged position, the second gear and the rotary cutting mechanism are connected by the third gear; wherein, when the third gear is in a non-engaged position, the connection between the second gear and the rotary cutting mechanism is released. 40
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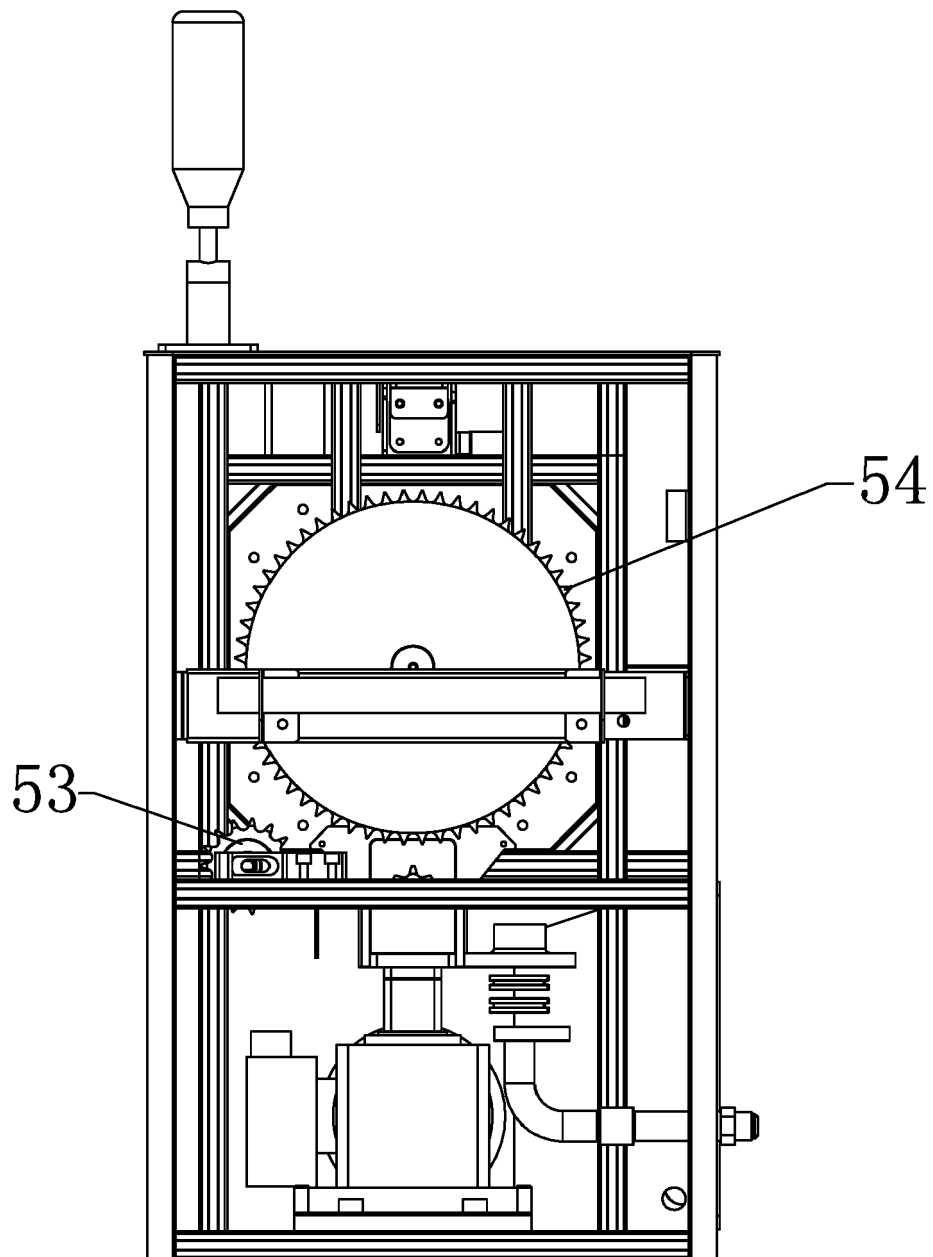


FIG. 1

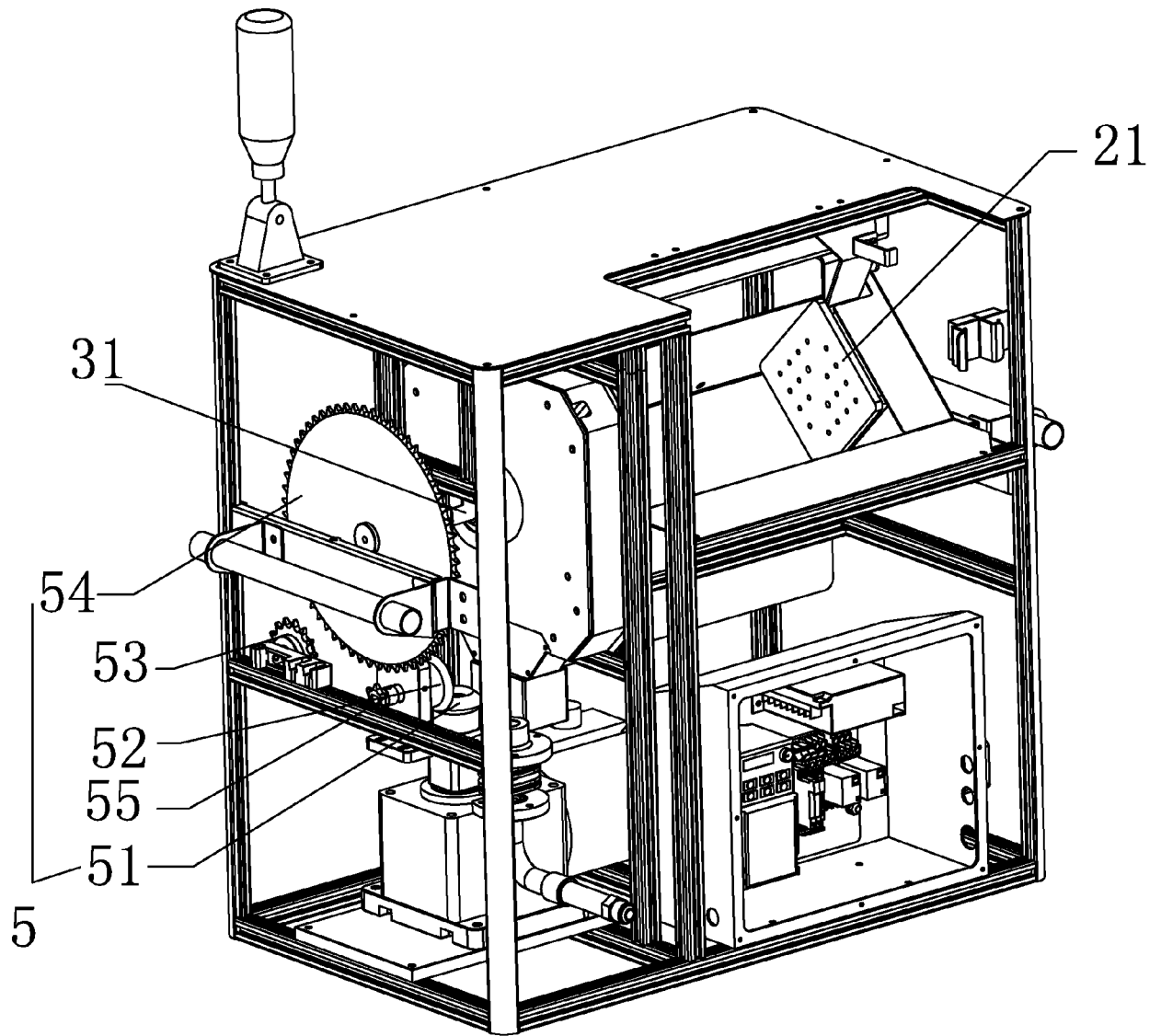


FIG. 2

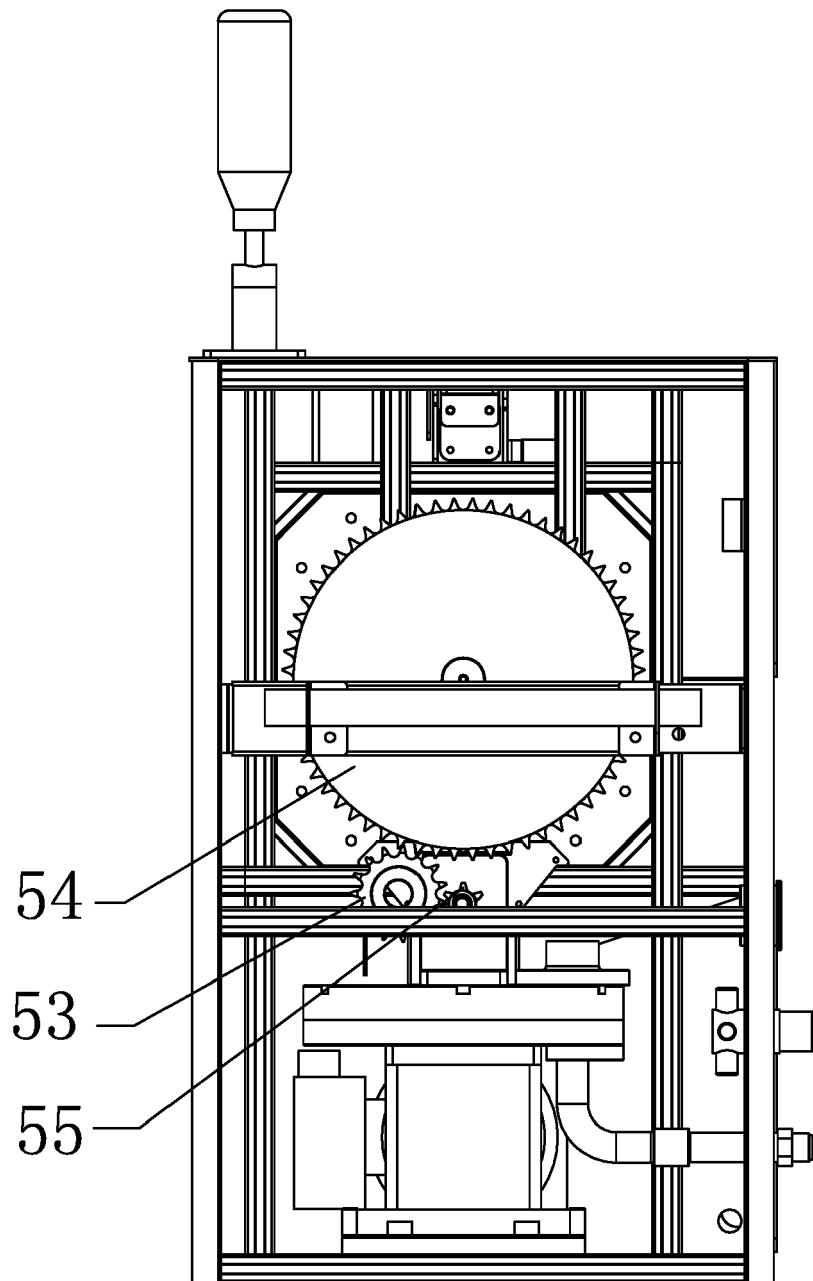


FIG. 3

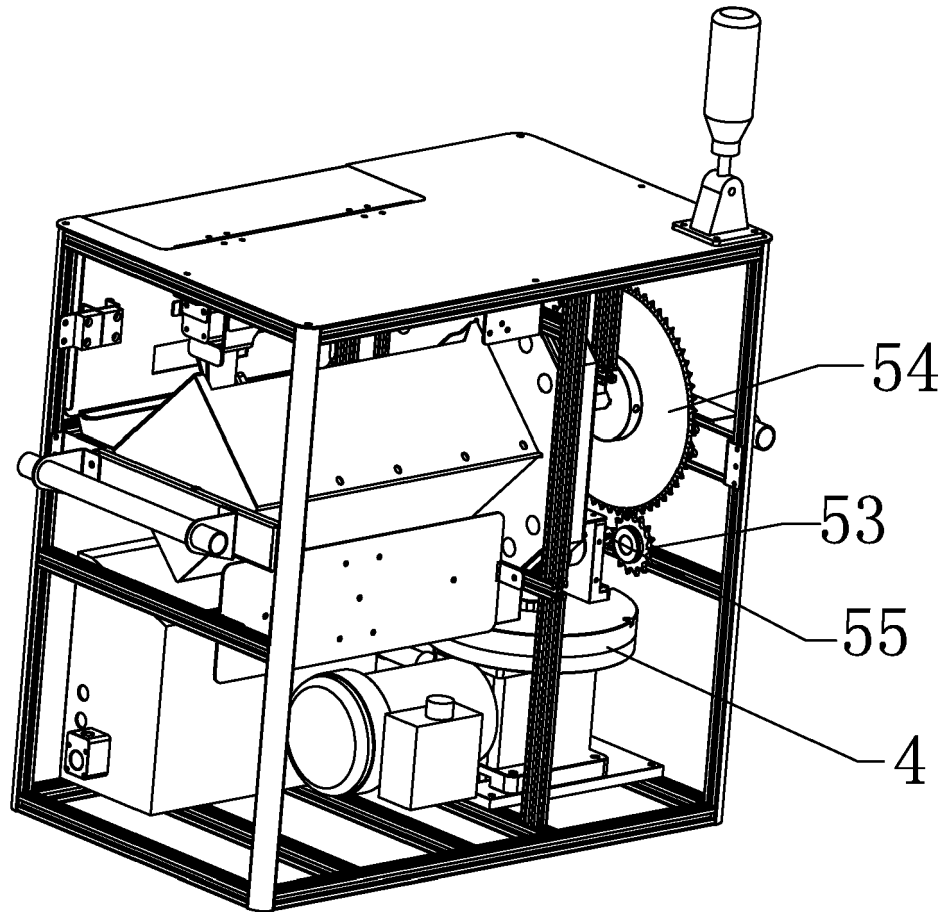


FIG. 4

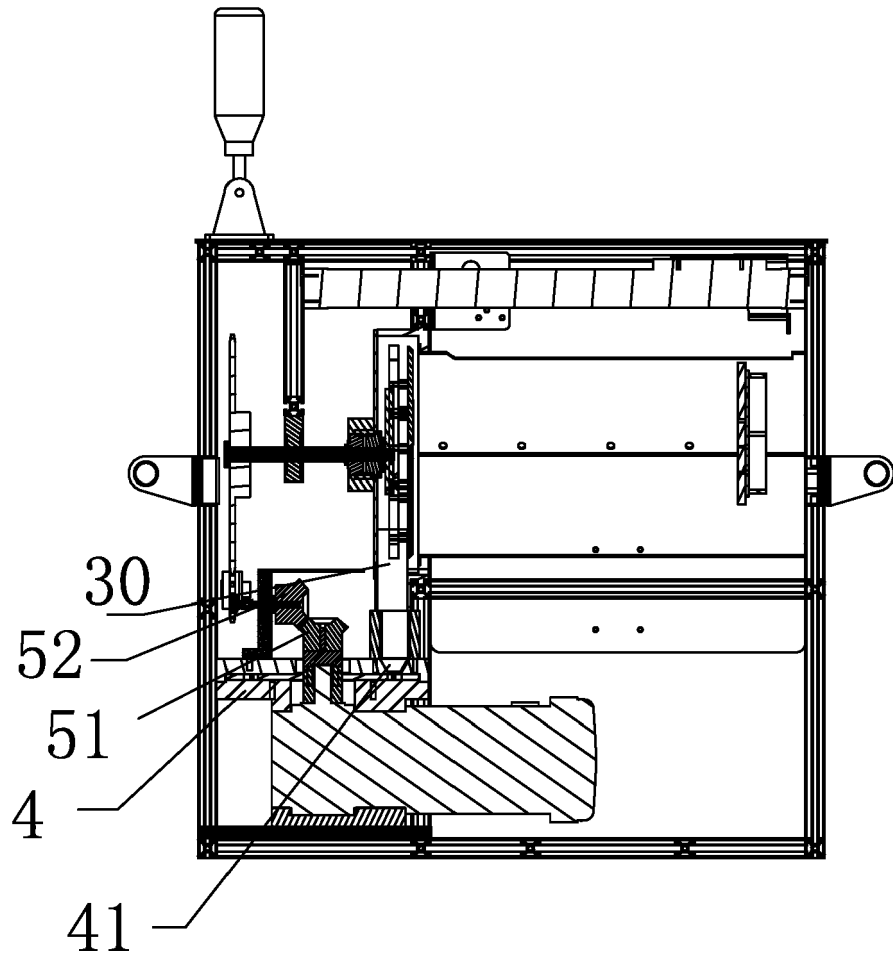


FIG. 5

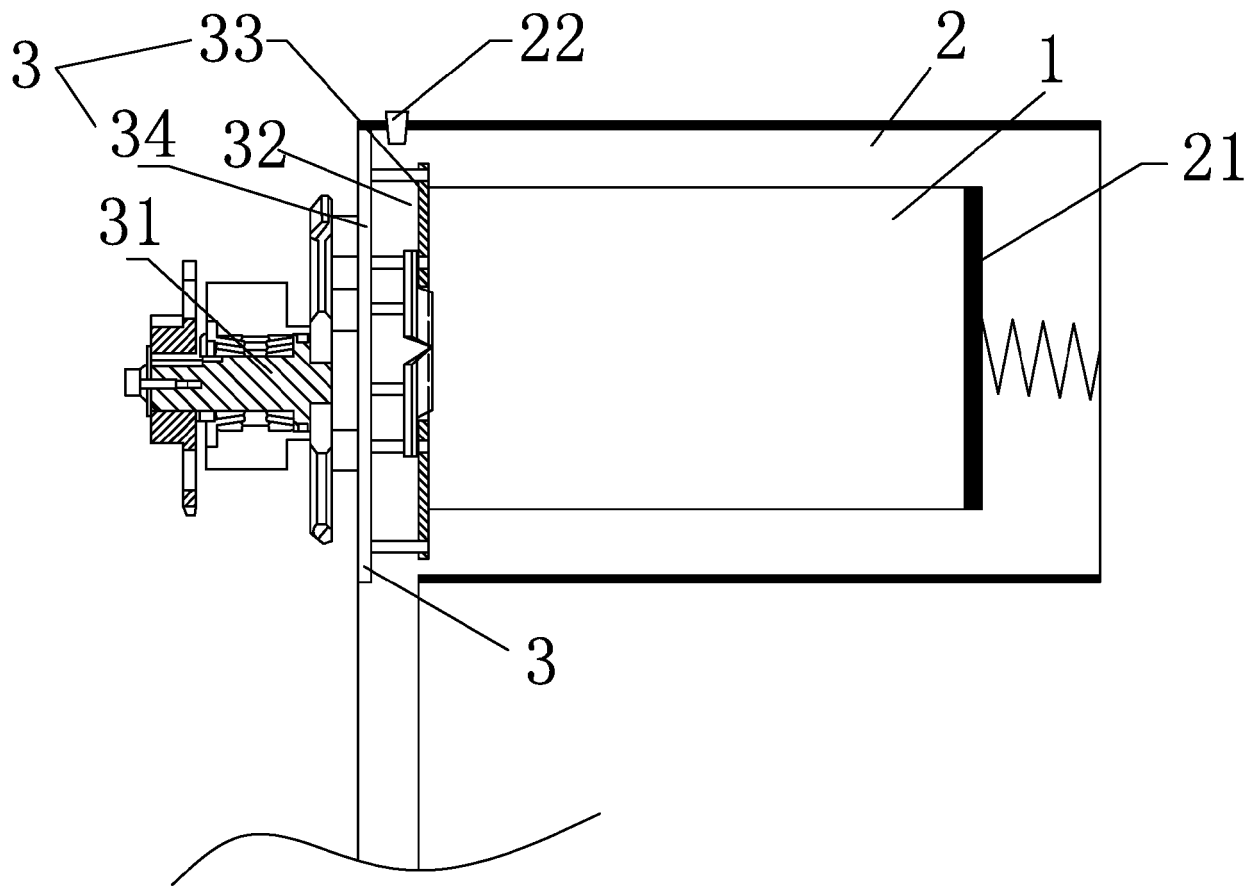


FIG. 6

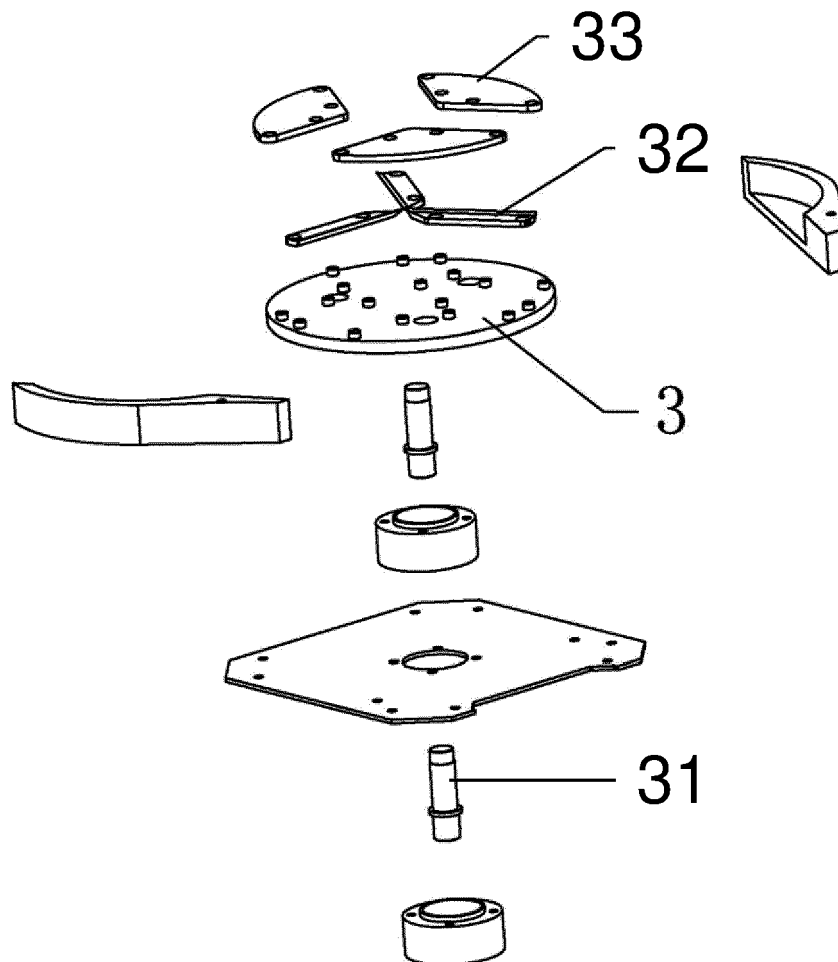


FIG. 7

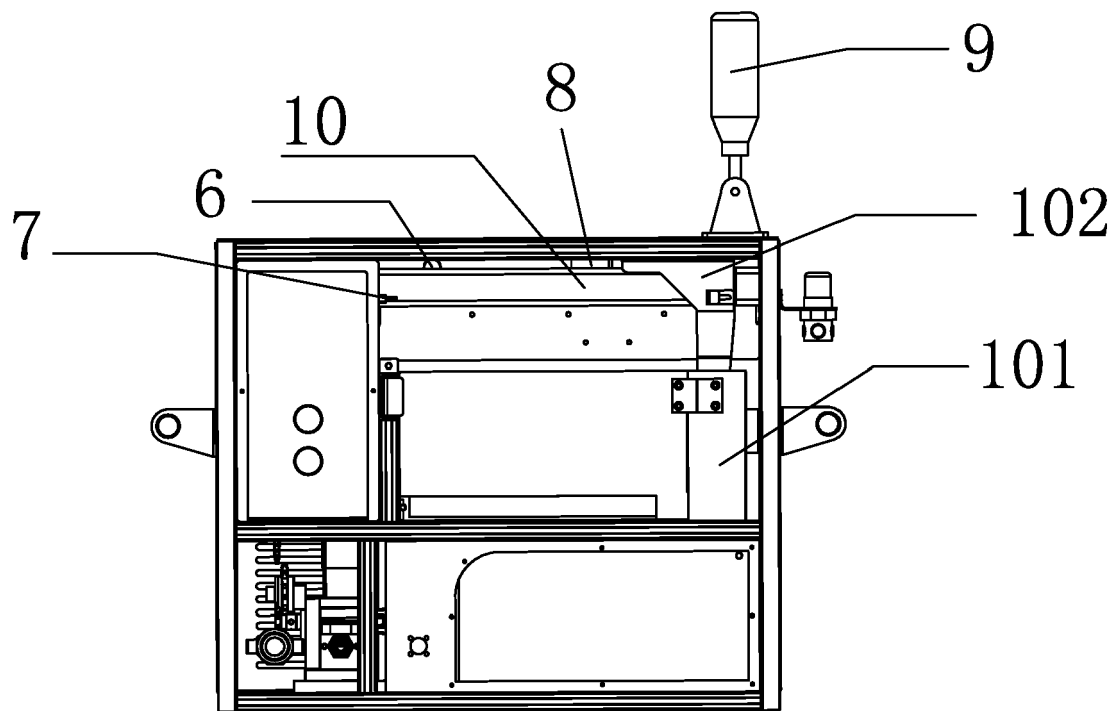


FIG. 8

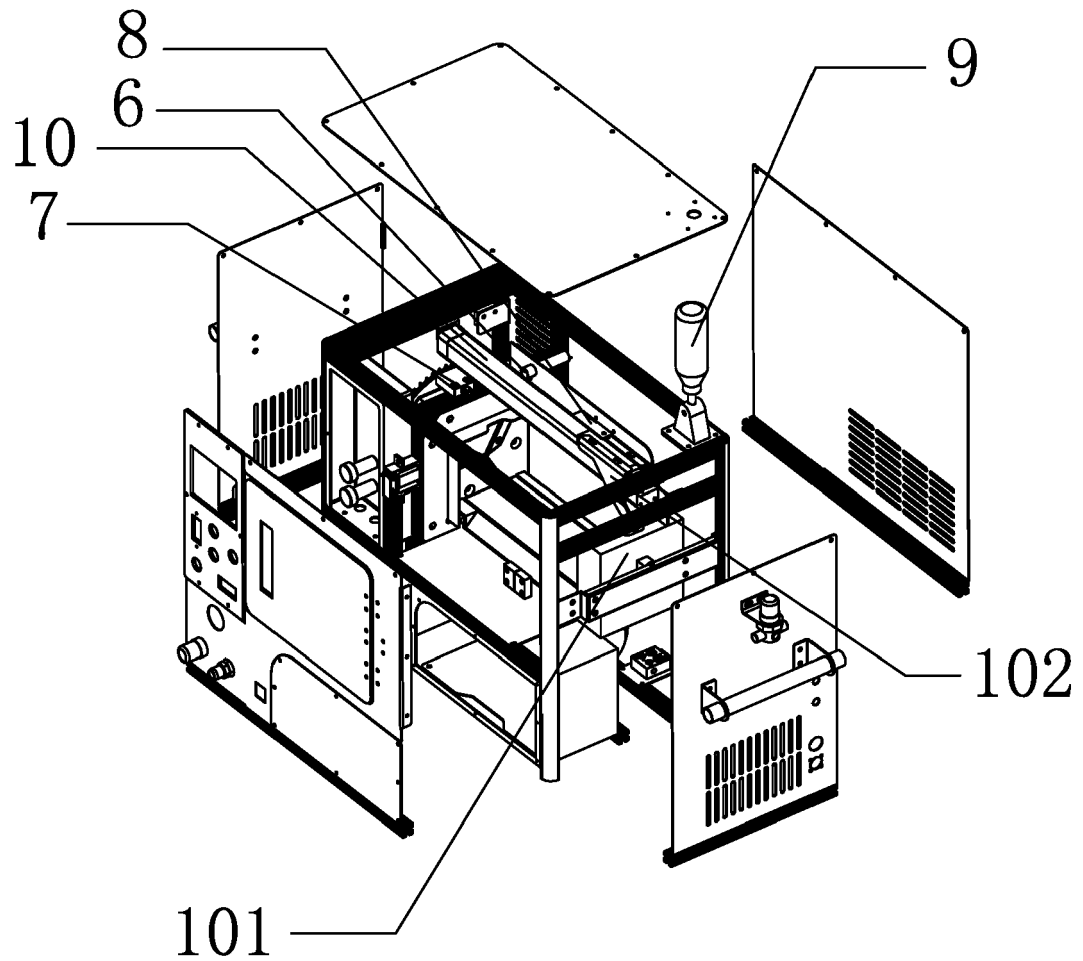


FIG. 9

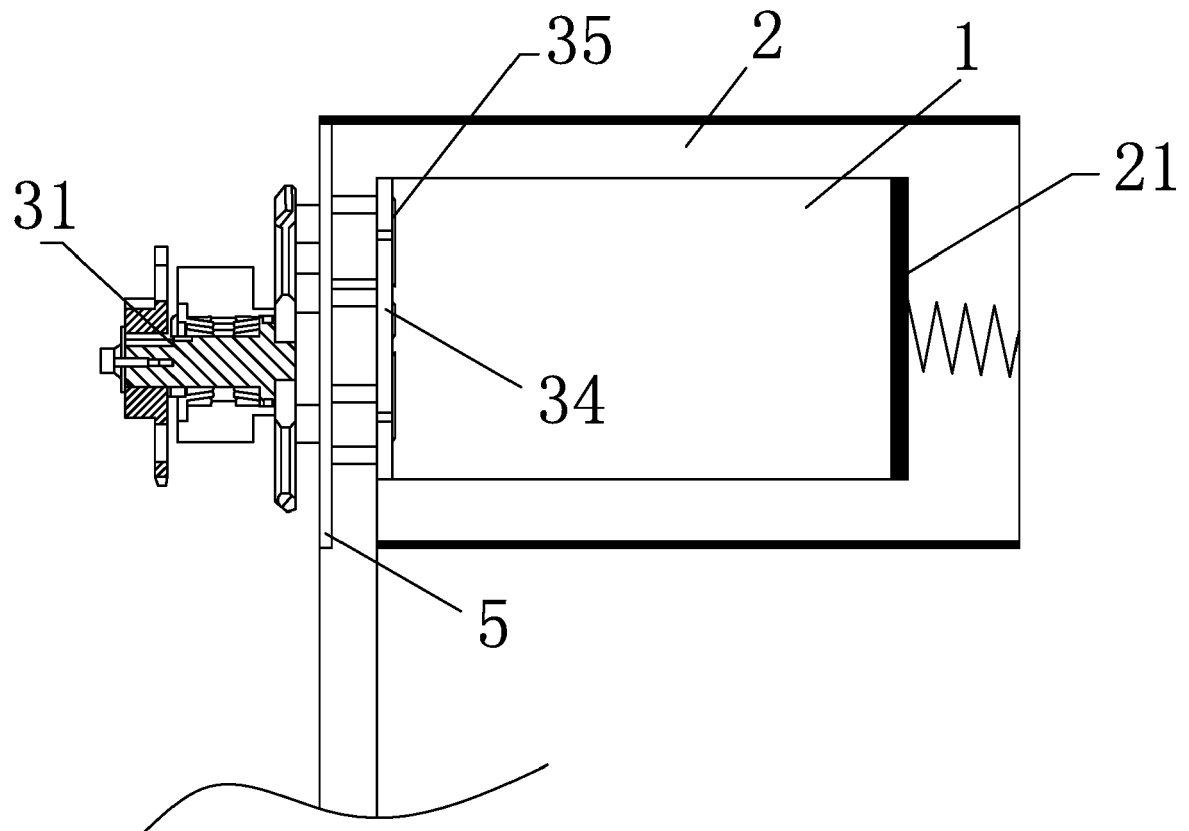


FIG. 10

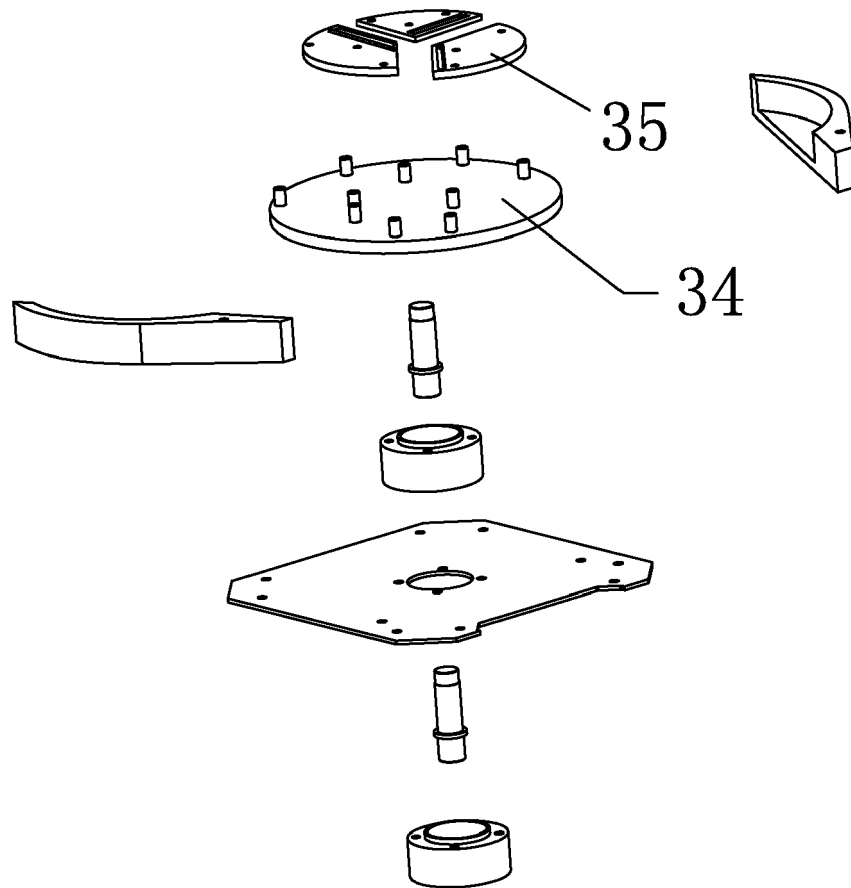


FIG. 11

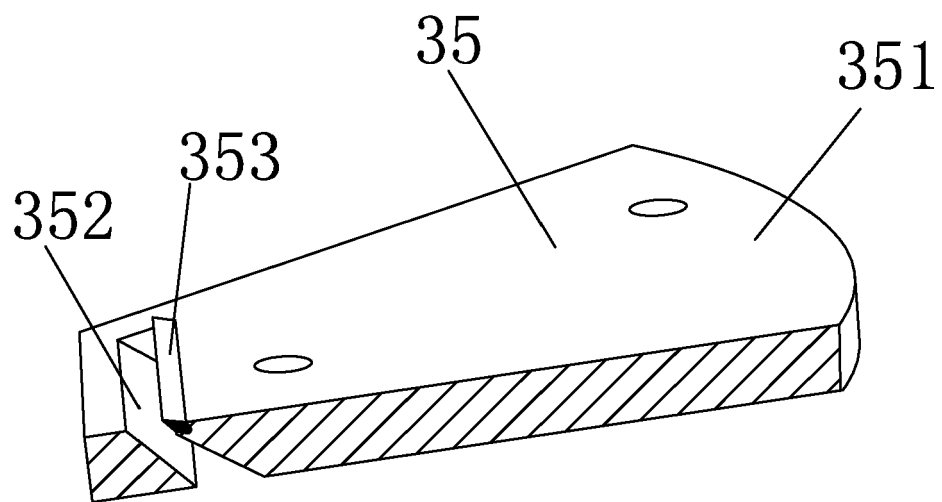


FIG. 12



EUROPEAN SEARCH REPORT

Application Number
EP 19 21 7101

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2 191 756 A (GRAY ALBERT C) 27 February 1940 (1940-02-27) * figures 1-7 *	9,10	INV. F25C5/12 B24C1/00
Y	----- US 2003/064665 A1 (OPEL ALAN E [US]) 3 April 2003 (2003-04-03) * figures 1-4 *	1-8, 11-13	
Y	----- CN 106 553 221 A (XIAMEN JFA IND AND TRADE CO LTD) 5 April 2017 (2017-04-05) * figures 1-8 *	1-8, 11-13	
Y	----- CN 206 357 318 U (XIAMEN JINRUIYI IND AND TRADE CO LTD) 28 July 2017 (2017-07-28) * figures 1-8 *	1-8, 11-13	
A	----- CN 207 188 365 U (XIAMEN JINRUIYI IND & TRADE CO LTD) 6 April 2018 (2018-04-06) * figures 1,2 *	1-13	
			TECHNICAL FIELDS SEARCHED (IPC)
			F25C B24C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 June 2020	Examiner Dezso, Gabor
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 21 7101

5

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The members are as contained in the European Patent Office EDP file on
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17-06-2020

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2191756 A	27-02-1940	NONE	
US 2003064665 A1	03-04-2003	US 2003064665 A1	03-04-2003
		US 2004121711 A1	24-06-2004
CN 106553221 A	05-04-2017	NONE	
CN 206357318 U	28-07-2017	NONE	
CN 207188365 U	06-04-2018	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 20030064665 A1 [0002]