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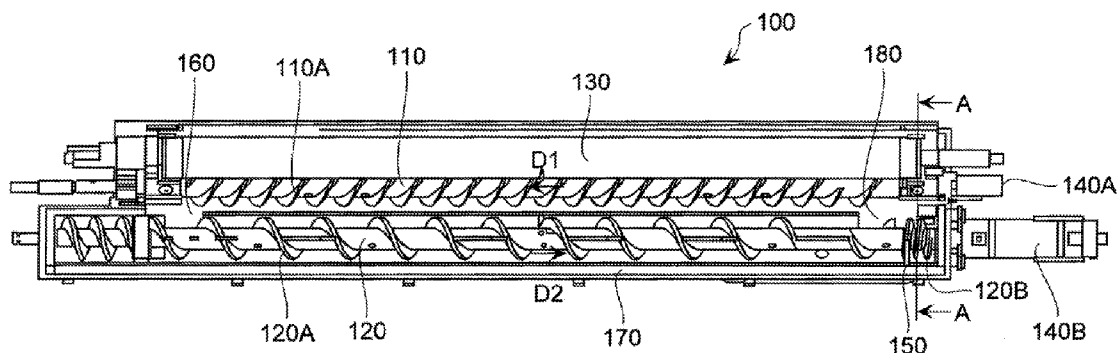
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(54) Title: REGULATING DISCHARGE OF DEVELOPER

Fig.1



(57) Abstract: A developing device includes a stir-and-transport member for stirring and transporting a developer, a developer discharging section disposed at an end of the stir-and-transport member on a downstream side of a developer transport direction, and a regulating structure for regulating a discharge amount of developer to be discharged to the developer discharging section. The stir-and-transport member has a spiral structure for transporting the developer and a reverse spiral structure disposed adjacent to the spiral structure on the downstream side of the developer transport direction. The regulating structure is disposed on an upstream side of the developer transport direction within a transport range associated with the reverse spiral structure formed along a rotational axis direction of the stir-and-transport member.

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- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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REGULATING DISCHARGE OF DEVELOPER

BACKGROUND

[0001] Some developing devices used in image forming apparatuses such as printers and multifunctional machines use a two-component developer containing toner and carrier, and have a developer roller, a layer regulating member, a stir-and-transport member, a developer container and the like. In these developing devices, during their operations, a developer held in a developer container is stirred and transported by a stir-and-transport member, magnetically adsorbed by a rotating developer roller, and further shaped into a thin layer of developer by a layer regulating member. From the thin layer of developer, toner is adsorbed onto an electrostatic latent image on a rotating photosensitive body, so that the electrostatic latent image is developed.

[0002] From the viewpoint of cost reduction and resource reduction, some of such developing devices using a two-component developer employ a developer replenishing-discharging technique or device for achieving an extended service life by replenishing and discharging the developer.

BRIEF DESCRIPTION OF DRAWINGS

[0003] Fig. 1 is a plan view illustrating an example developing device.

Fig. 2 is a cross-sectional view taken along A-A of the example developing device of Fig. 1.

Fig. 3 is an enlarged plan view illustrating an example regulating member.

Fig. 4 is a graph illustrating a relationship between an axial position of a regulating member and a discharge amount of developer in the example

developing device of Fig. 3.

Fig. 5 is a plan view illustrating an outer diameter of an example reverse spiral structure on a stir-and-transport member, and a width of the reverse spiral structure covered by a regulating member.

Fig. 6 is a graph illustrating an example relationship between a coverage ratio of the reverse spiral structure, and a discharge amount of developer and an amount of developer in a container in the example developing device of Fig. 5.

Fig. 7 is an illustrative view of an example developing device.

Fig. 8 is a graph illustrating example discharge amounts of developer for a regulating member disposed on the developer transport surface side and a regulating member disposed on the developer non-transport surface side as illustrated in Fig. 7.

Fig. 9 is an illustrative view of a side surface of an example regulating member facing a reverse spiral structure and an outer periphery of the reverse spiral structure.

Fig. 10 is a graph illustrating an example relationship between a discharge amount of developer, and the distance between a side surface of the regulating member facing the reverse spiral structure and an outer periphery of the reverse spiral structure as illustrated in Fig. 9.

Fig. 11 is a cross-sectional view illustrating an example upper cover disposed adjacent to a regulating member on a downstream side of a developer transport direction.

Fig. 12 is a plan view illustrating the upper cover of Fig. 11.

DETAILED DESCRIPTION

[0004] A developing device may be provided with a developer replenishing section for replenishing a developer into a developer container, and a developer discharging section for discharging, out of the developer container, a developer that has become excessive after the replenishment. Along with the speedup of the printing performance of an image forming apparatus, each functional member inside such a developing device may rotate at a much higher speed.

[0005] An example developing device may have a stir-and-transport member for stirring and transporting a developer composed of two components and a developer discharging section disposed at an end of the stir-and-transport member on a downstream side of a developer transport direction. Additionally, the developing device may have a regulating member for regulating a discharge amount of developer to be discharged to the developer discharging section. The stir-and-transport member may have a spiral structure for transporting the developer and a reverse spiral structure disposed adjacent to the spiral structure on the downstream side of the developer transport direction. The developer discharging section may be disposed at the end of the stir-and-transport member on a side of the developer transport direction that is further downstream than the reverse spiral structure. The regulating member may be disposed at an upstream side of the developer transport direction within a transport range where the reverse spiral structure is formed along a rotational axis direction of the stir-and-transport member to regulate an amount of the developer that flows or is otherwise transmitted into the reverse spiral structure from the spiral structure.

[0006] In some examples, the regulating member may be positioned on a

developer transport surface side of the stir-and-transport member.

[0007] An upper cover may be disposed above the reverse spiral structure so as to restrict a flow path of the developer above the reverse spiral structure. The upper cover may be placed adjacent to the regulating member on a downstream side of the developer transport direction and an undersurface of the upper cover has the same height as an upper surface of the regulating member.

[0008] In some examples, the regulating member may extend in a direction orthogonal to the rotational axis of the reverse spiral structure from an inner wall of a developer container adjacent to an outer periphery of the reverse spiral structure so as to cover 19 to 50% of an outer diameter of the reverse spiral structure.

[0009] A distance between a side surface of the regulating member facing the reverse spiral structure and the outer periphery of the reverse spiral structure may be 0.5 to 2.0 mm.

[0010] In some examples, the developer may include a first stir-and-transport member for transporting the developer to a developer roller and a second stir-and-transport member for transporting the developer to the first stir-and-transport member. Additionally, the stir-and-transport member may be the second stir-and-transport member.

[0011] In some examples, the developer composed of two components may include toner and carrier, the developer may be replenished by a developer replenishing section, and an excessive developer generated as a result of the replenishment may be discharged by the developer discharging section.

[0012] An example developing device may have a stir-and-transport member

for stirring and transporting a developer composed of two components, and a developer discharging section disposed at an end of the stirring-conveyance member on a downstream side of a developer transport direction. A regulating structure may be configured to regulate a discharge amount of developer to be discharged to the developer discharging section. The stir-and-transport member may have a spiral structure for transporting the developer and a reverse spiral structure disposed adjacent to the spiral structure on the downstream side of the developer transport direction. The regulating structure may be composed of a blocking section positioned on a developer transport surface side of the stir-and-transport member to block an inflow of the developer from the spiral structure to the reverse spiral structure, and an opening positioned opposite to the developer transport surface side across the stir-and-transport member. The regulating structure may be disposed on an upstream side of the developer transport direction within a transport range where the reverse spiral structure is formed along a rotational axis direction of the stir-and-transport member to regulate an amount of the developer that flows or is transmitted into the reverse spiral structure from the spiral structure.

[0013] In some examples, an upper cover may be disposed above the reverse spiral structure so as to restrict a flow path of the developer above the reverse spiral structure. The upper cover may be positioned adjacent to the blocking section of the regulating structure on a downstream side of the developer transport direction, and an undersurface of the upper cover may have the same height as a top surface of the blocking section of the regulating structure.

[0014] The blocking section of the regulating structure may extend in a direction

orthogonal to the rotational axis of the reverse spiral structure from an inner wall of a developer container adjacent to an outer periphery of the reverse spiral structure so as to cover 19 to 50% of an outer diameter of the reverse spiral structure.

[0015] In some examples, the distance between a side surface of the blocking section of the regulating structure facing the reverse spiral structure and the outer periphery of the reverse spiral structure may be 0.5 to 2.0 mm.

[0016] Additionally, an image forming apparatus may include the example developing device.

[0017] An example method for manufacturing a developing device may include disposing a stir-and-transport member for stirring and transporting a developer composed of two components, and disposing a developer discharging section at an end of the stir-and-transport member on a downstream side of a developer transport direction. Additionally, the method may include disposing a regulating member for regulating a discharge amount of developer to be discharged to the developer discharging section. The stir-and-transport member may have a spiral structure for transporting the developer and a reverse spiral structure disposed adjacent to the spiral structure on the downstream side of the developer transport direction. The regulating member may be disposed at an upstream side of the developer transport direction within a transport range where the reverse spiral structure is formed along a rotational axis direction of the stir-and-transport member to regulate an amount of the developer that flows or is transmitted into the reverse spiral structure from the spiral structure.

[0018] An example method for manufacturing a developing device may include

disposing a stir-and-transport member for stirring and transporting a developer composed of two components, and disposing a developer discharging section at an end of the stir-and-transport member on a downstream side of a developer transport direction. Additionally, the method may include disposing a regulating structure for regulating a discharge amount of developer to be discharged to the developer discharging section. The stir-and-transport member may have a spiral structure for transporting the developer and a reverse spiral structure disposed adjacent to the spiral structure on the downstream side of the developer transport direction. The regulating structure may be composed of a blocking section positioned on a developer transport surface side of the stir-and-transport member to block an inflow of the developer from the spiral structure to the reverse spiral structure, and an opening positioned on a developer non-transport surface side of the stir-and-transport member. The regulating structure may be disposed on an upstream side of the developer transport direction within a transport range where the reverse spiral structure is formed along a rotational axis direction of the stir-and-transport member to regulate an amount of the developer that flows or is transmitted into the reverse spiral structure from the spiral structure.

[0019] In the following description, with reference to the drawings, the same reference numbers are assigned to the same components or to similar components having the same function, and overlapping description is omitted.

[0020] Fig. 1 is a plan view illustrating an example developing device 100. Fig. 2 is a cross-sectional view taken along A-A of the developing device 100 of Fig. 1. The developing device 100 has, for example, stir-and-transport members 110,

120 for stirring and transporting a developer composed of two components (for example, toner and carrier), a developer roller 130 for magnetically adsorbing the developer transported by the stir-and-transport member 110, a developer replenishing section 140A for replenishing a developer, a developer discharging section 140B for discharging a developer, and a regulating member 150 for regulating a discharge amount of developer to be discharged to the developer discharging section 140B.

[0021] The stir-and-transport member 110 has a spiral structure 110A for transporting a developer to the developer roller 130, and the developer replenishing section 140A is disposed at an end of the stir-and-transport member 110, positioned on an upstream side of a developer transport direction (indicated by arrow D1) by the spiral structure 110A. A developer container 170 has an opening 160 for delivering a developer from the stir-and-transport member 110 to the stir-and-transport member 120, wherein the opening is adjacent to an end of the spiral structure 110A of the stir-and-transport member 110 on a downstream side of the developer transport direction D1.

[0022] The stir-and-transport member 120 has a spiral structure 120A for stirring and transporting a developer to be delivered to the stir-and-transport member 110, and a reverse spiral structure 120B disposed adjacent to the spiral structure 120A on a downstream side of a developer transport direction (indicated by arrow D2) by the spiral structure 120A. The developer discharging section 140B is disposed at an end of the stir-and-transport member 120, which is positioned at a side of the developer transport direction D2 further downstream than the reverse spiral structure 120B. The developer container

170 has an opening 180 for delivering a developer from the stir-and-transport member 120 to the stir-and-transport member 110, wherein the opening is adjacent to an end of the spiral structure 120A of the stir-and-transport member 120 on a downstream side of the developer transport direction D2.

[0023] The regulating member 150 is disposed on an upstream side of the developer transport direction D2 within a transport range where the reverse spiral structure 120B is formed along a rotational axis direction of the stir-and-transport member 120. The regulating member 150 is also positioned above the reverse spiral structure 120B.

[0024] When toner in a developer is reduced to a predetermined amount or smaller amount by a printing operation of the developing device 100, new developer is replenished from the developer replenishing section 140A. The new developer contains toner in an amount equivalent to a reduced amount of toner by the printing operation, and new carrier in an amount equivalent to an amount of deteriorated carrier, which should be exchanged. When the new developer is replenished from the developer replenishing section 140A, the amount of toner reduced by the printing operation is replenished, and the same amount of developer in the developer container 170 as the amount of the new carrier overflows. As a result, old developer (that is, containing a reduced amount of toner and deteriorated carrier by the printing operation) positioned further downstream in the developer transport direction than the replenished new developer is transported by the spiral structure 110A of the stir-and-transport member 110. The developer is then transported by the spiral structure 120A of the stir-and-transport member 120, and after the developer

goes over the reverse spiral structure 120B, it is discharged from the developer discharging section 140B out of the developer container 170.

[0025] The developing device 100 having the developer discharging section 140B includes an increased speed. For such an increased speed, functional members such as the developer roller 130 and the stir-and-transport members 110, 120 in the developing device 100 may rotate at a high speed.

[0026] Even when the stir-and-transport member 120 rotates at a high speed, resulting in an increased speed of the developing device 100, the regulating member 150 may be configured to regulate an amount of developer that flows or is otherwise transmitted into the reverse spiral structure 120B from the spiral structure 120A to prevent an excessive amount of developer from being discharged. Hereafter, the regulating member 150 is explained in further detail, including example graphs that illustrate measurement results when the stir-and-transport members 110, 120 are rotated at higher rotation speeds, for example about 170% faster than existing developing devices.

[0027] Fig. 3 is an enlarge plan view illustrating the regulating member 150 and proximity. Reference "a" represents a distance from an inner wall of the developer container 170 positioned at a downstream end of the developer transport direction D2 of the stir-and-transport member 120 to the regulating member 150 (hereinafter, referred to as axial position "a"). Fig. 4 is a graph illustrating an example relationship between the axial position "a" of the regulating member 150 and the discharge amount of developer in the example developing device 100 of Fig. 3. The regulating member 150 is disposed on an upstream side of the developer transport direction D2 within a transport range

where the reverse spiral structure 120B is formed along the rotational axis direction of the stir-and-transport member 120. As illustrated in Fig. 4, when the axial position “a” of the regulating member 150 is 12.5 to 15 mm, the discharge amount of developer is 0 (or approximately 0) g/min and a maximum or suitable regulating effect can be produced. The example regulating member 150 regulates or blocks the developer that enters from the spiral structure 120A to the reverse spiral structure 120B through a space between a side surface, facing the reverse spiral structure 120B, of the regulating member 150 and an outer periphery of the reverse spiral structure 120B, and thereby, an excessive discharge of developer can be prevented. The deteriorated, excessive developer generated as a result of the replenished new developer is transported from the spiral structure 120A to the reverse spiral structure 120B through a space around the reverse spiral structure 120B not covered by the regulating member 150, and is discharged through the developer discharging section 140B.

[0028] Fig. 5 is a plan view illustrating a radial length “b” indicating a transport range of the reverse spiral structure 120B, covered by the regulating member 150, and an outer diameter “c” of the reverse spiral structure 120B in the example developing device 100. The regulating member 150 extends from an inner wall of the developer container 170 adjacent to the outer periphery of the reverse spiral structure 120B in a direction orthogonal to the rotational axis of the stir-and-transport member 120 so as to cover the transport range of the radial length “b” of the reverse spiral structure 120B. In some examples, the transport range or radial length “b” extends from the rotations axis of the stir-and-transport

member 120 to the outer perimeter of the reverse spiral structure 120B

[0029] Fig. 6 is a graph illustrating an example relationship between a coverage ratio b/c (%) of the reverse spiral structure 120B by the regulating member 150, and the discharge amount of developer and the amount of developer present in the developer container 170 in the example developing device 100 of Fig. 5. As can be understood from the figure, a coverage ratio b/c of less than 19% of the reverse spiral structure 120B by the regulating member 150 causes the developer in the developer container 170 to be discharged excessively (e.g., the discharge amount of developer exceeds 0.02 g/min). On the other hand, a coverage ratio of greater than 50% causes an excessive amount of developer to be maintained in the developer container 170, that is, an excessive developer is not discharged but accumulated in the developer container 170 (e.g., the amount of developer in the container exceeds 400 g). When the coverage ratio b/c of the reverse spiral structure 120B by the regulating member 150 is in the range of 19 to 50%, the excessive discharge of the developer is prevented (e.g., the discharge amount of developer is 0.02 g/min or less), and the excessive developer may be reliably discharged (e.g., the amount of developer in the container is 400 g or less). As a result, the developer in the developer container 170 may be maintained in a predetermined amount.

[0030] Fig. 7 is an illustrative view of an example developing device 100 including a developer transport surface 190 in a developer container 170, a developer 195 transported on a developer transport surface 190 side and a regulating member 150 disposed on the developer transport surface 190 side. Additionally, a developer non-transport surface 190' is positioned opposite to the

developer transport surface 190 across the stir-and-transport member 120, and a regulating member 150' is disposed on a developer non-transport surface 190' side. In some examples, the developer transport surface 190 may include a side surface mainly responsible for transporting a developer together with the spiral structure 120A at the time of rotation of the stir-and-transport member 120, of side surfaces in the developer container 170. For example, the amount of the developer 195 transported between the developer transport surface 190 and the stir-and-transport member 120 may be larger than the amount of the developer transported between the developer non-transport surface 190' and the stir-and-transport member 120. The example regulating member 150 may regulate the excessive discharge of the developer by preventing a large amount of developer from being stirred up due to the developer transported while being deviated toward the developer transport surface 190 side colliding with the reverse spiral structure 120B at a high speed. In some examples, an excessive discharge of developer may be regulated by preventing a large amount of the developer from going over the reverse spiral structure 120B by an inertia force.

[0031] Fig. 8 is a graph illustrating a discharge amount of developer for a first case in which the regulating member 150 is disposed on the developer transport surface 190 side, and a second case in which the regulating member 150' is disposed on the developer non-transport surface 190' side. In the first case in which the regulating member 150' is disposed on the developer non-transport surface 190' side, a large amount (0.1746 g/min) of developer, which is far larger than the discharge amount of developer serving as the reference for excessive discharge (e.g., 0.02 g/min), is discharged. In the second case in which the

regulating member 150 having completely the same shape and size as the regulating member 150' is disposed on the developer transport surface 190 side so as to create a mirror image with the regulating member 150' as illustrated in Fig. 7, the discharge amount of developer becomes zero. Disposing the regulating member 150 on the developer transport surface 190 side therefore may result in reducing the amount of discharged developer to zero.

[0032] Fig. 9 illustrates a distance “d” between a side surface of the regulating member 150 on the reverse spiral structure 120B side and an outer periphery of the reverse spiral structure 120B in the example developing device 100.

[0033] Fig. 10 is a graph illustrating an example relationship between the distance “d” illustrated in Fig. 9, and the discharge amount of developer. As can be understood from Fig. 10, the distance “d” of 0.5 to 2.0 mm may be provided to prohibit the transfer of developer from the spiral structure 120A to the reverse spiral structure 120B through a space having the distance “d” between the regulating member 150 and the reverse spiral structure 120B. The minimum distance “d” of 0.5 mm mentioned herein is a value determined so as to prevent the regulating member 150 from coming into contact with the reverse spiral structure 120B. The contact may result from bending or deformation of the stir-and-transport member 120 and/or the reverse spiral structure 120B caused by, for example, a load of developer, and from a deviation in shaping the stir-and-transport member 120 and/or the reverse spiral structure 120B. In addition, Fig. 9 illustrates that a side surface of the regulating member 150 on the reverse spiral structure 120B side has an arc shape; however, the shape is not limited thereto, and it may include other shapes such as a saw-toothed

shape, a sinusoidal wave-like shape, a rectangular wave-like shape and other shapes in which the numeral value range for the distance “d” is satisfied.

[0034] Fig. 11 is a cross-sectional view illustrating an upper cover 200 disposed inside the example developing device 100. Fig. 12 is a plan view of the upper cover 200. The upper cover 200 is disposed above the reverse spiral structure 120B so as to restrict a flow path for the developer above the reverse spiral structure 120B. The upper cover 200 is positioned adjacent to the regulating member 150 on a downstream side of the developer transport direction D2, and the upper cover 200 has an undersurface having the same height as an upper surface of the regulating member 150. In some examples, the upper cover 200 is used to regulate the flow path for the developer from the spiral structure 120A to the reverse spiral structure 120B of the stir-and-transport member 120, thereby preventing the developer from going over an upper portion of the regulating member 150 and flowing into the reverse spiral structure 120B side. The upper cover 200 also works in combination with the regulating member 150 to form an accumulation of developer on an upstream side of the regulating member 150. The accumulation fills an upper space of the stir-and-transport member and seals scattered developer generated inside the developing device 100 to prevent an excessive discharge of developer. The accumulation of the developer also produces a buffering effect on the developer delivered from the developer transport surface 190 side of the stir-and-transport member 120 to the stir-and-transport member 110, and this can prevent the developer from the developer transport surface 190 side from being scattered by high speed collision with the developer on the stir-and-transport member 110 side.

[0035] Further, the constituent elements are not limited to the regulating member 150, which is separately formed and disposed inside the developer container 170 as described above for the developing device 100. The regulating member 150 and a space not provided with the regulating member 150 may be configured to include a blocking section positioned on the developer transport surface 190 side of the stir-and-transport member 120 for blocking an inflow of developer from the spiral structure 120A to the reverse spiral structure 120B. Additionally, the regulating member 150 may include an opening positioned on the developer non-transport surface 190' side of the stir-and-transport member 120. The blocking section and the opening may be formed as part of the developer container 17 to reduce the number of parts and the production cost.

[0036] In some examples, the developing device 100 may not cause an excessive decrease of developer even under a condition for high-speed printing, and may not include any special part or control for achieving that effect. Additionally, the image quality may be maintained over a long period by a more inexpensive configuration including an image forming apparatus comprising the developing device 100.

[0037] It is to be understood that not all aspects, advantages and features described herein may necessarily be achieved by, or included in, any one particular example. Indeed, having described and illustrated various examples herein, it should be apparent that other examples may be modified in arrangement and detail is omitted.

CLAIMS

1. A developing device comprising:
 - a stir-and-transport member to stir and transport a developer;
 - a developer discharging section disposed at an end of the stir-and-transport member on a downstream side of a developer transport direction; and
 - a regulating structure to regulate a discharge amount of developer to be discharged to the developer discharging section,wherein the stir-and-transport member has a spiral structure to transport the developer and a reverse spiral structure disposed adjacent to the spiral structure on the downstream side of the developer transport direction, and
 - wherein the regulating structure is disposed on an upstream side of the developer transport direction within a transport range associated with the reverse spiral structure formed along a rotational axis direction of the stir-and-transport member.
2. The developing device according to claim 1, wherein the regulating structure is positioned on a developer transport surface side of the stir-and-transport member.
3. The developing device according to claim 1, wherein an upper cover is disposed above the reverse spiral structure so as to restrict a flow path of the developer above the reverse spiral structure, and

wherein the upper cover is positioned adjacent to the regulating structure on the downstream side of the developer transport direction, and an undersurface of the upper cover has the same height as an upper surface of the regulating structure.

4. The developing device according to claim 1, wherein the regulating structure extends in a direction orthogonal to the rotational axis of the stir-and-transport member from an inner wall of a developer container adjacent to an outer periphery of the reverse spiral structure so as to cover 19 to 50% of an outer diameter of the reverse spiral structure.

5. The developing device according to claim 1, wherein a distance between a side surface of the regulating structure facing the reverse spiral structure and the outer periphery of the reverse spiral structure is 0.5 to 2.0 mm.

6. The developing device according to claim 1, comprising a first stir-and-transport member to transport the developer to a developer roller and a second stir-and-transport member to transport the developer to the first stir-and-transport member, wherein the stir-and-transport member is the second stir-and-transport member.

7. The developing device according to claim 1, wherein the developer comprises toner and carrier,

wherein the developer is replenished by a developer replenishing section, and

wherein an excessive amount of developer generated as a result of the replenishment is discharged by the developer discharging section.

8. The developing device according to claim 1, wherein the regulating structure consists of a regulating member.

9. The developing device according to claim 1, wherein the regulating structure comprises a blocking section positioned on a developer transport surface side of the stir-and-transport member to block an inflow of the developer from the spiral structure to the reverse spiral structure, and an opening positioned on a developer non-transport surface side of the stir-and-transport member.

10. The developing device according to claim 9, wherein an upper cover is disposed above the reverse spiral structure so as to restrict a flow path of the developer above the reverse spiral structure, and

wherein the upper cover is positioned adjacent to the blocking section of the regulating structure on a downstream side of the developer transport direction, and an undersurface of the upper cover has the same height as a top surface of the blocking section of the regulating structure.

11. The developing device according to claim 9, wherein the blocking section of the regulating structure extends in a direction orthogonal to the rotational axis of the stir-and-transport member from an inner wall of a developer container adjacent to an outer periphery of the reverse spiral structure so as to cover 19 to 50% of an outer diameter of the reverse spiral structure.

12. The developing device according to claim 9, wherein a distance between a side surface of the blocking section of the regulating structure facing the reverse spiral structure and the outer periphery of the reverse spiral structure is 0.5 to 2.0 mm.

13. The developing device according to claim 9, wherein the transport range is determined, at least in part, by a radial length of the reverse spiral structure.

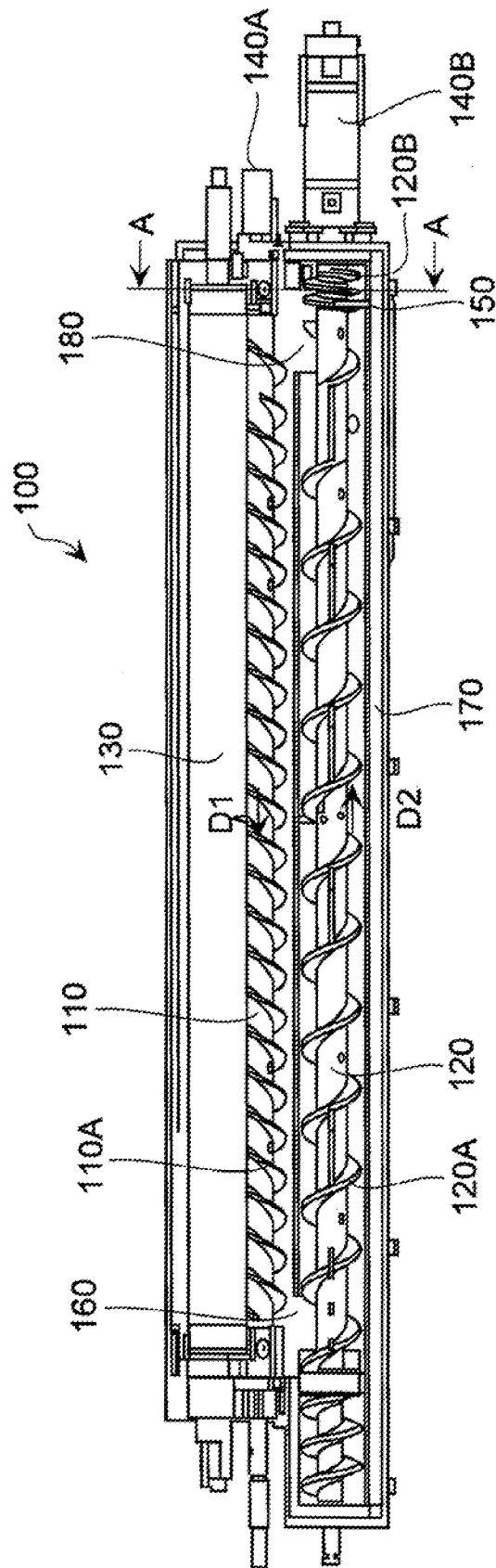
14. A method for manufacturing a developing device comprising:
disposing a stir-and-transport member to stir and transport a developer;
disposing a developer discharging section at an end of the stir-and-transport member on a downstream side of a developer transport direction; and

disposing a regulating structure to regulate a discharge amount of developer to be discharged to the developer discharging section,

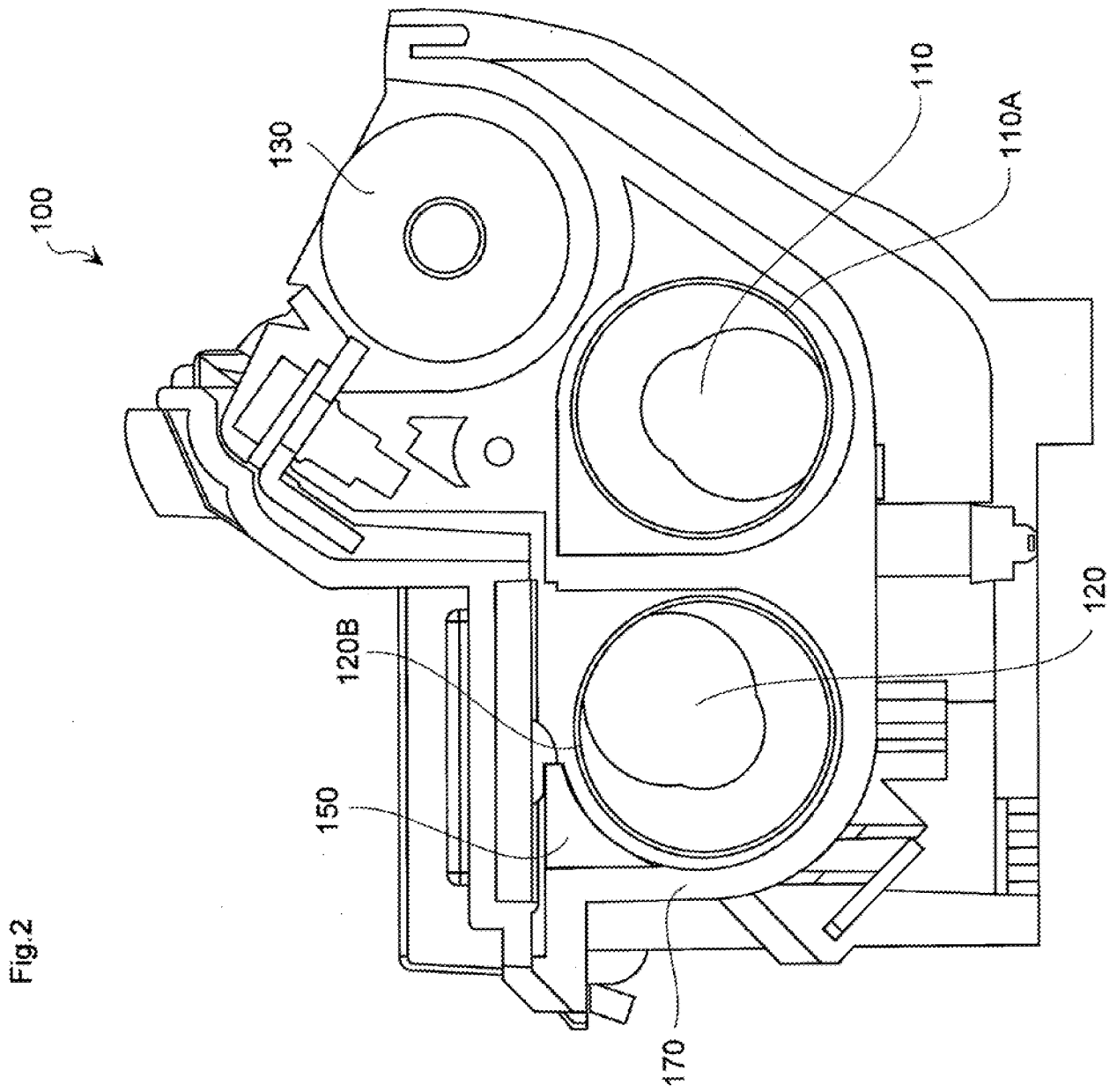
wherein the stir-and-transport member has a spiral structure to transport the developer and a reverse spiral structure disposed adjacent to the spiral structure on the downstream side of the developer transport direction, and

wherein the regulating structure is disposed on an upstream side of the developer transport direction within a transport range associated with the reverse spiral structure formed along a rotational axis direction of the stir-and-transport member.

15. The method according to claim 14, wherein the regulating structure comprises a blocking section positioned on a developer transport surface side of the stir-and-transport member to block an inflow of the developer from the spiral structure to the reverse spiral structure, and an opening positioned on a developer non-transport surface side of the stir-and-transport member.



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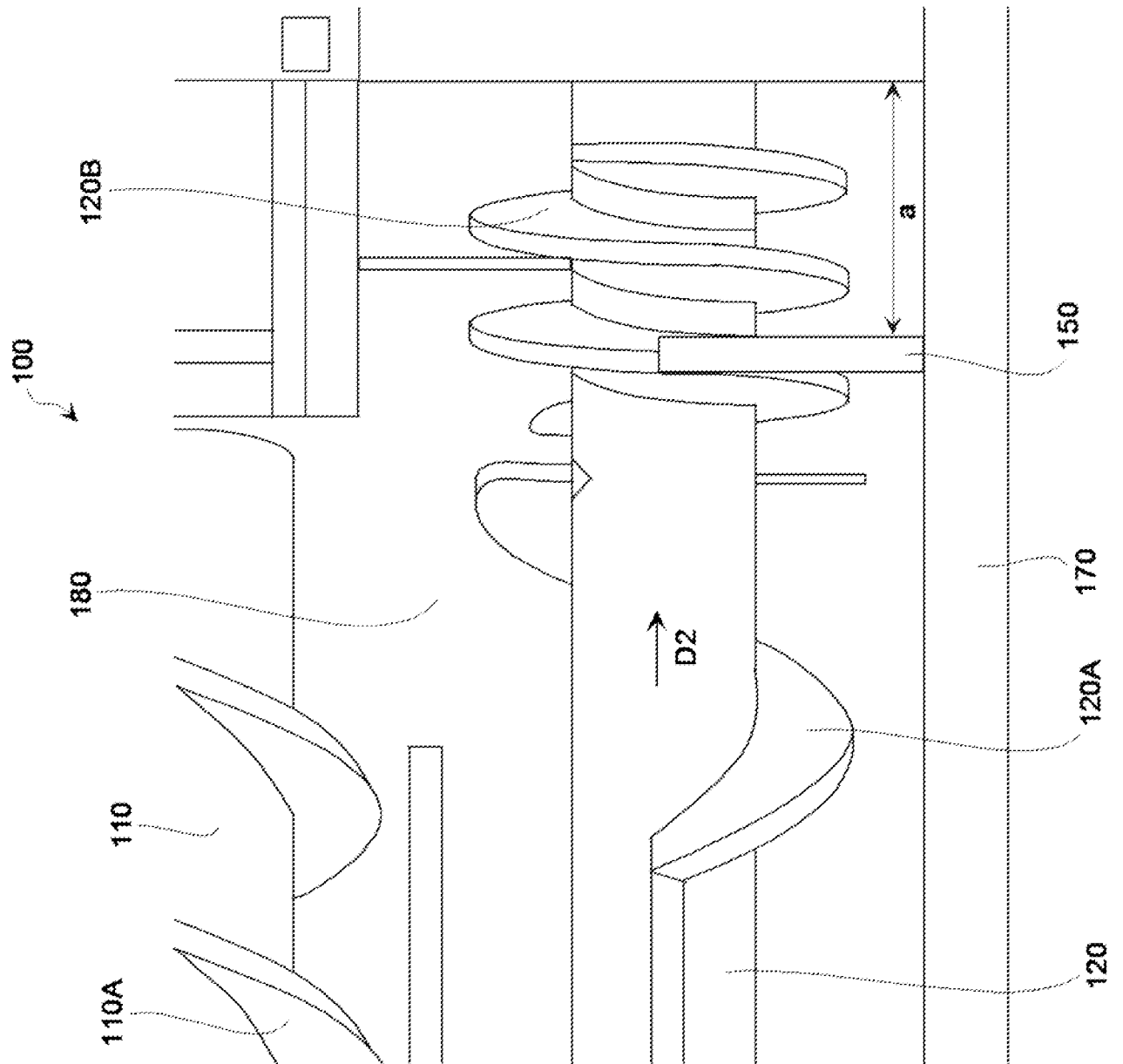


Fig.4

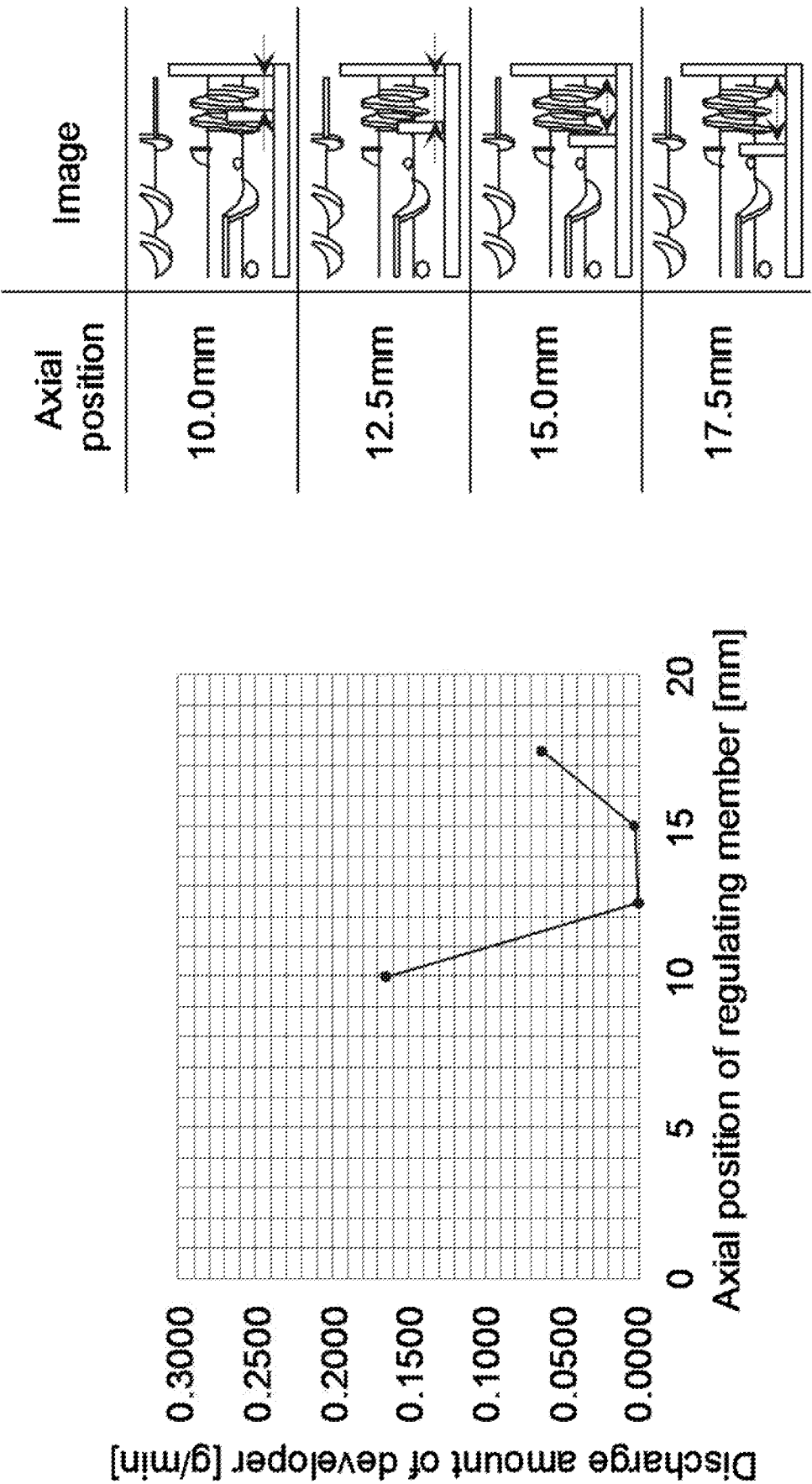


Fig. 5

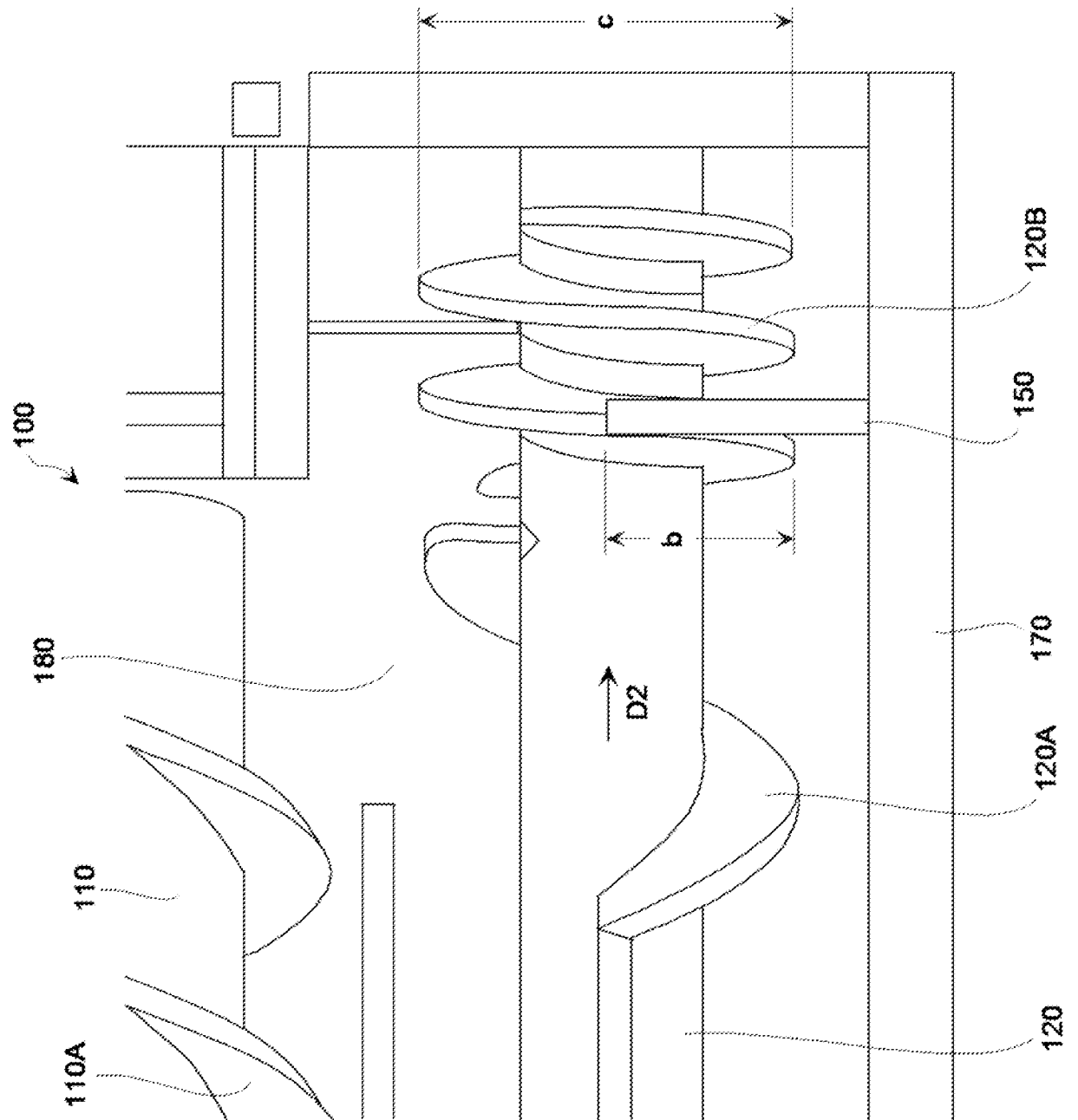


Fig.6

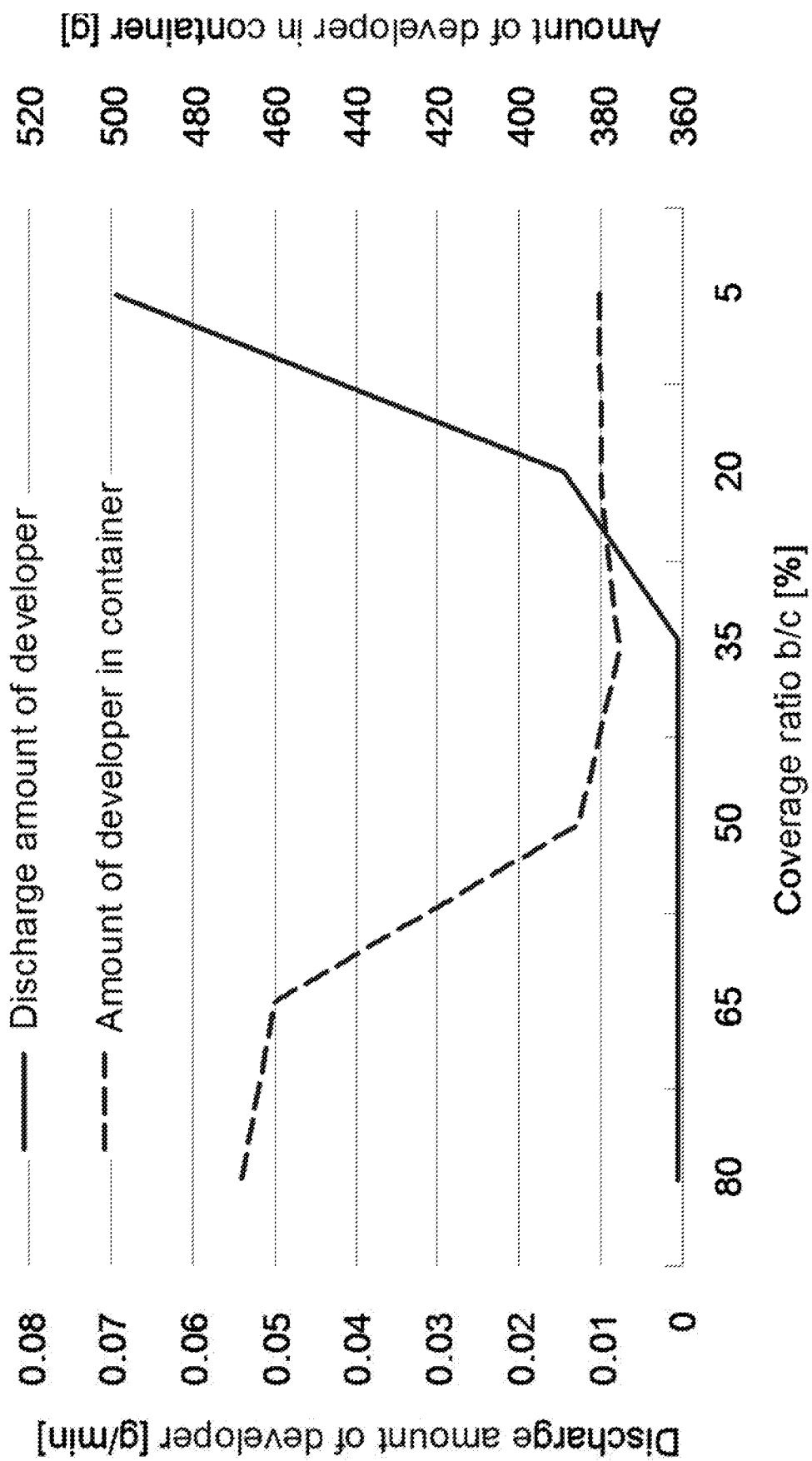


Fig. 7

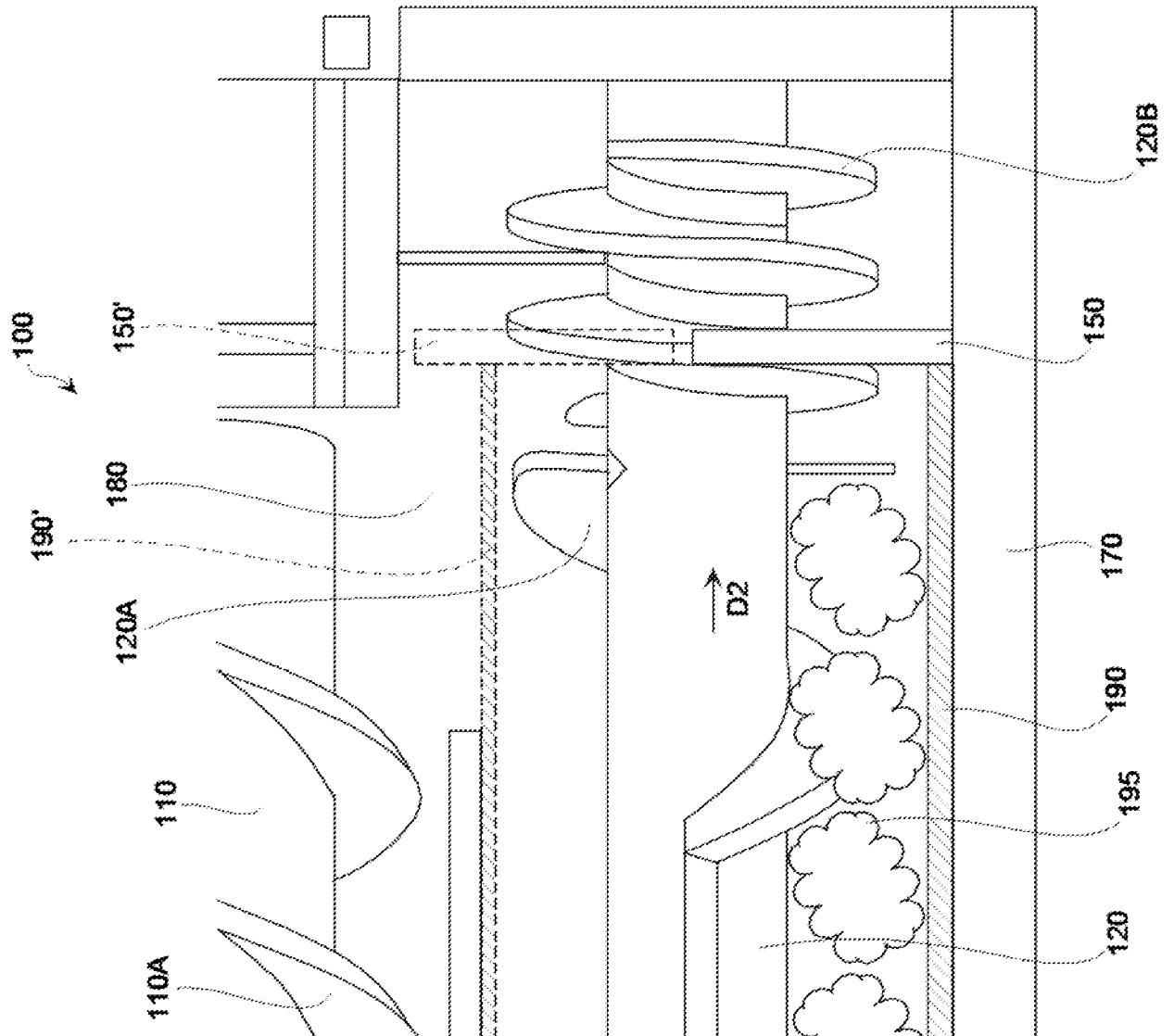


Fig.8

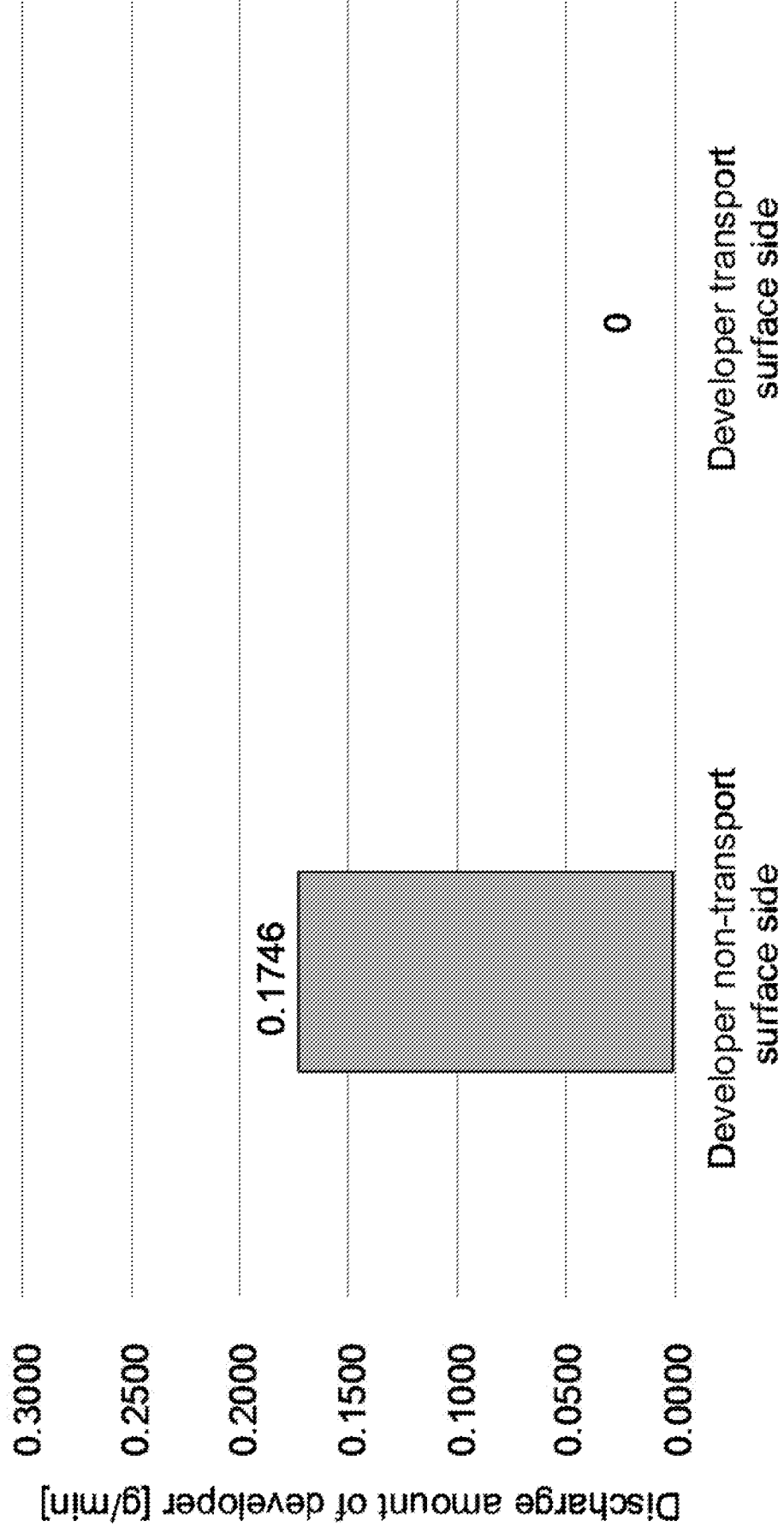


Fig. 9

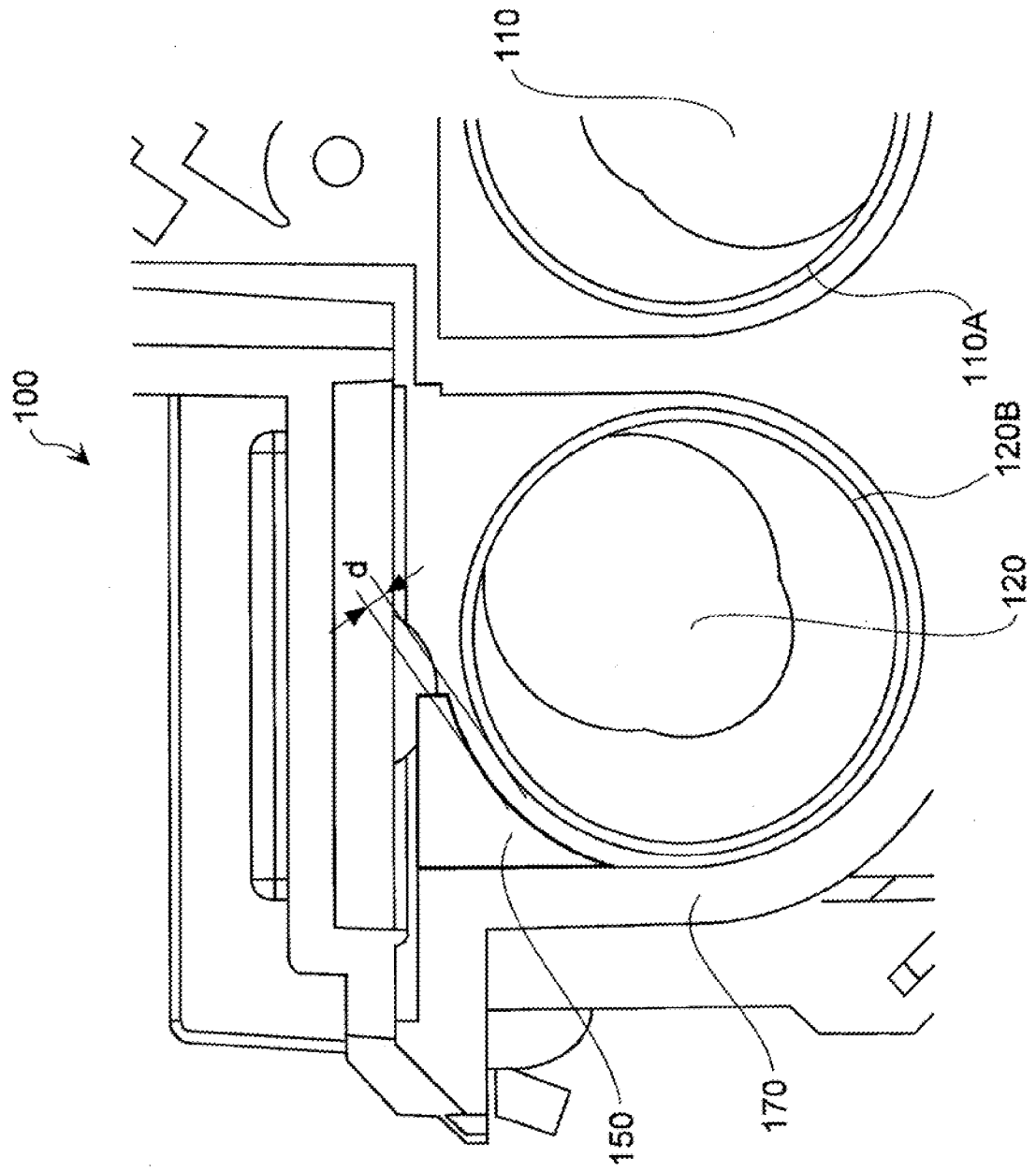


Fig.10

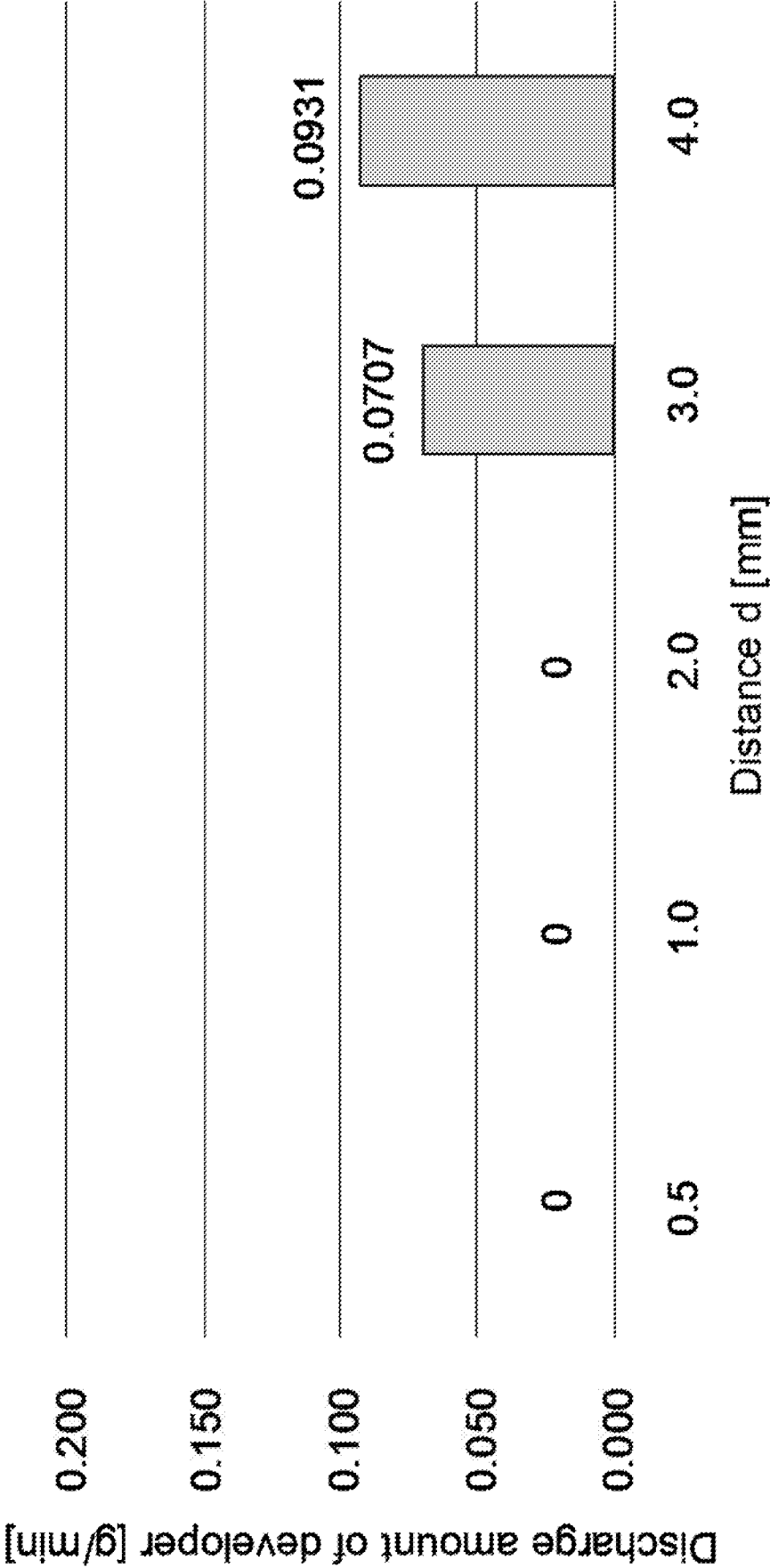


Fig.11

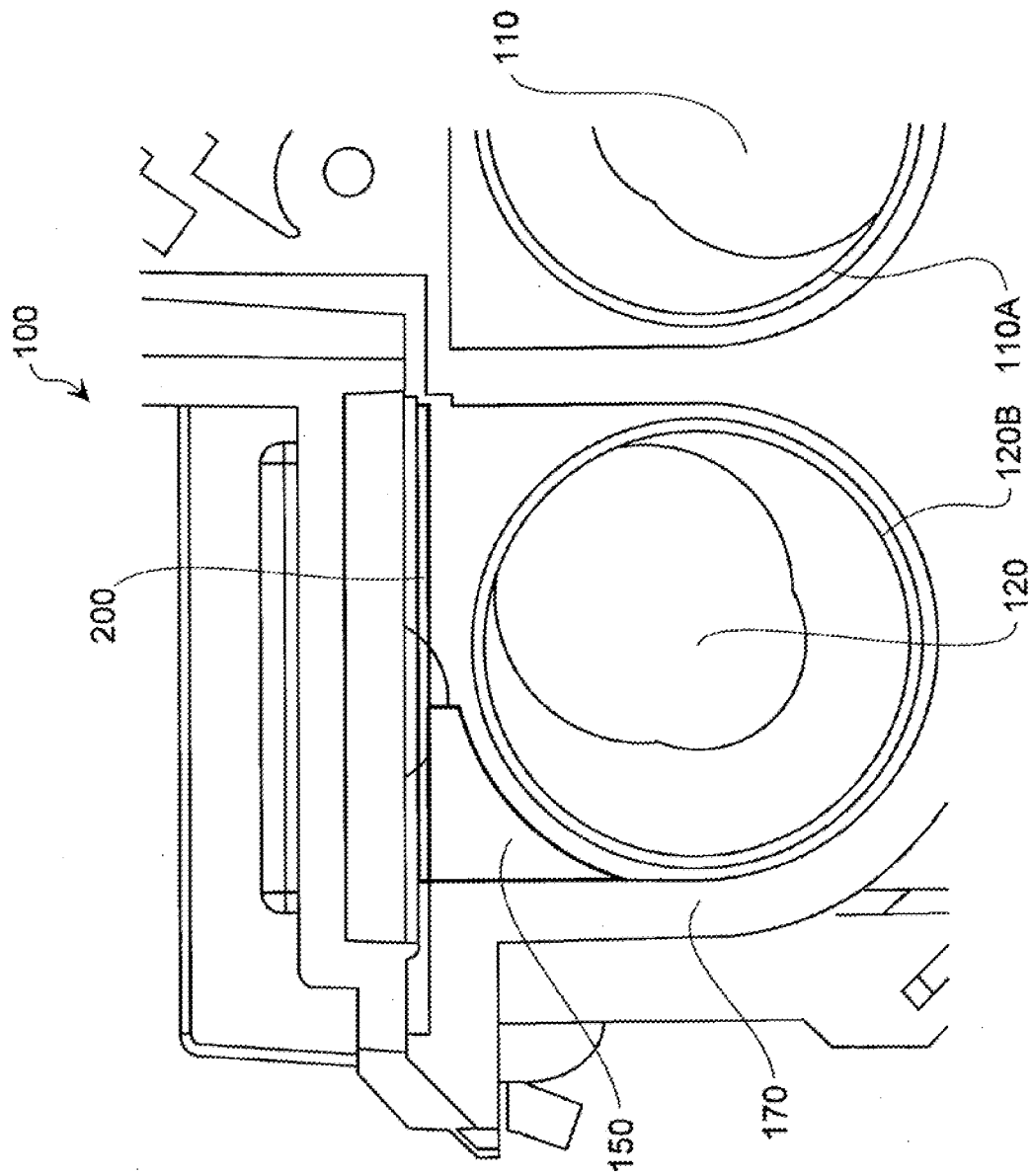
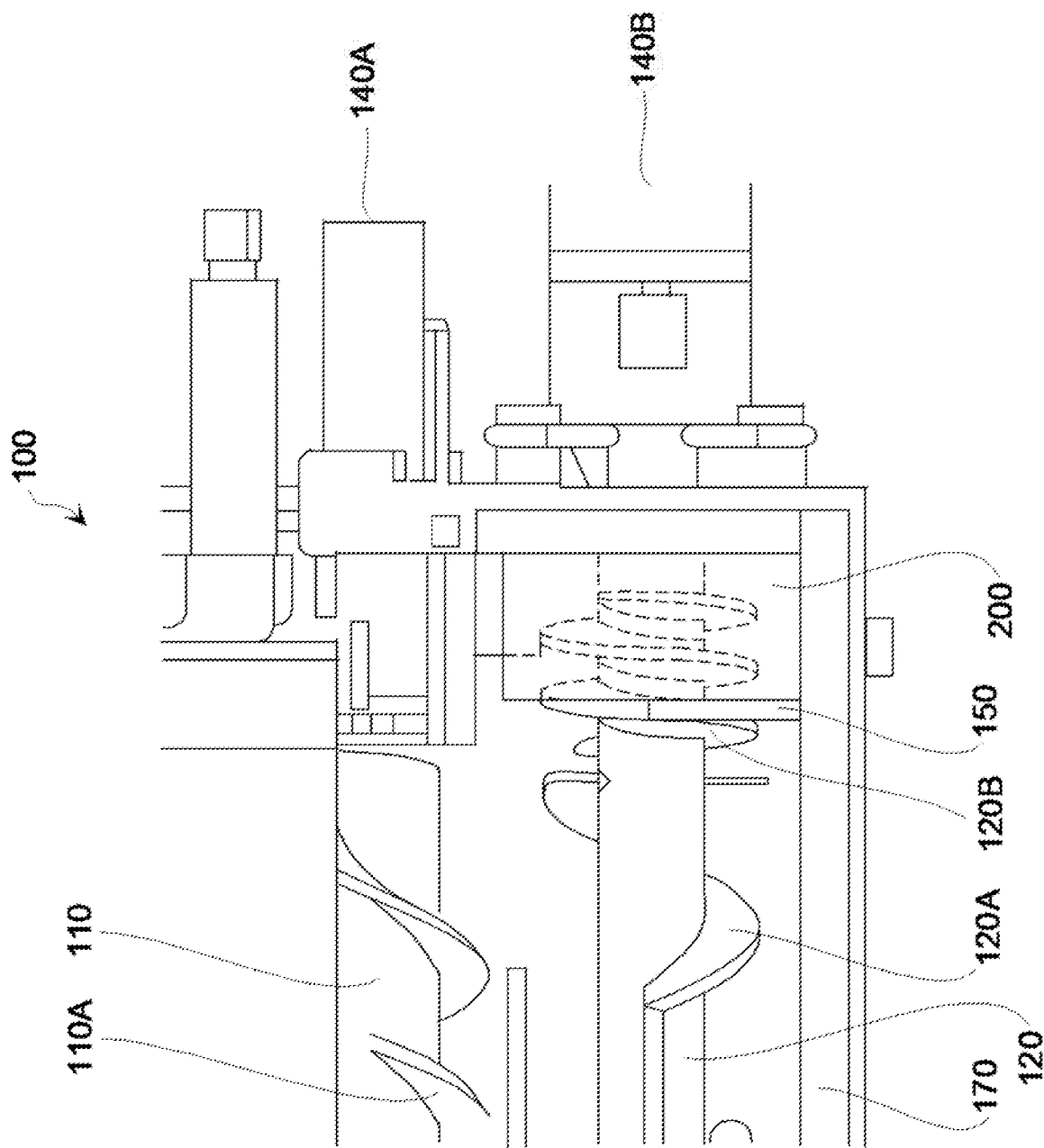


Fig.12



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2019/061721

A. CLASSIFICATION OF SUBJECT MATTER G03G15/08(2006.01) According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) G03G Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) Espacenet, PatSearch, PAJ, WIPO, USPTO, RUPTO		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/0165440 A1 (KATSUMI ADACHI) 27.07.2006, abstract, [0063]-[0129], fig. 1-17	1-15
A	US 2017/0003619 A1 (FUJI XEROX CO., LTD) 05.01.2017	1-15
A	EP 2341400 A2 (KYOCERA MITA CORPORATION) 06.07.2011	1-15
A	CN 106257338 A (KYOCERA DOCUMENT SOLUTIONS INC) 28.12.2016	1-15
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: “A” document defining the general state of the art which is not considered to be of particular relevance “E” earlier document but published on or after the international filing date “L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) “O” document referring to an oral disclosure, use, exhibition or other means “P” document published prior to the international filing date but later than the priority date claimed “T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention “X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone “Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art “&” document member of the same patent family		
Date of the actual completion of the international search 23 January 2020 (23.01.2020)		Date of mailing of the international search report 30 January 2020 (30.01.2020)
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37		Authorized officer I. Doroshenko Telephone No. 8(499)240-25-91