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(54) **DISPENSER ASSEMBLY FOR SELECTIVELY DISPENSING SHEET MATERIAL**

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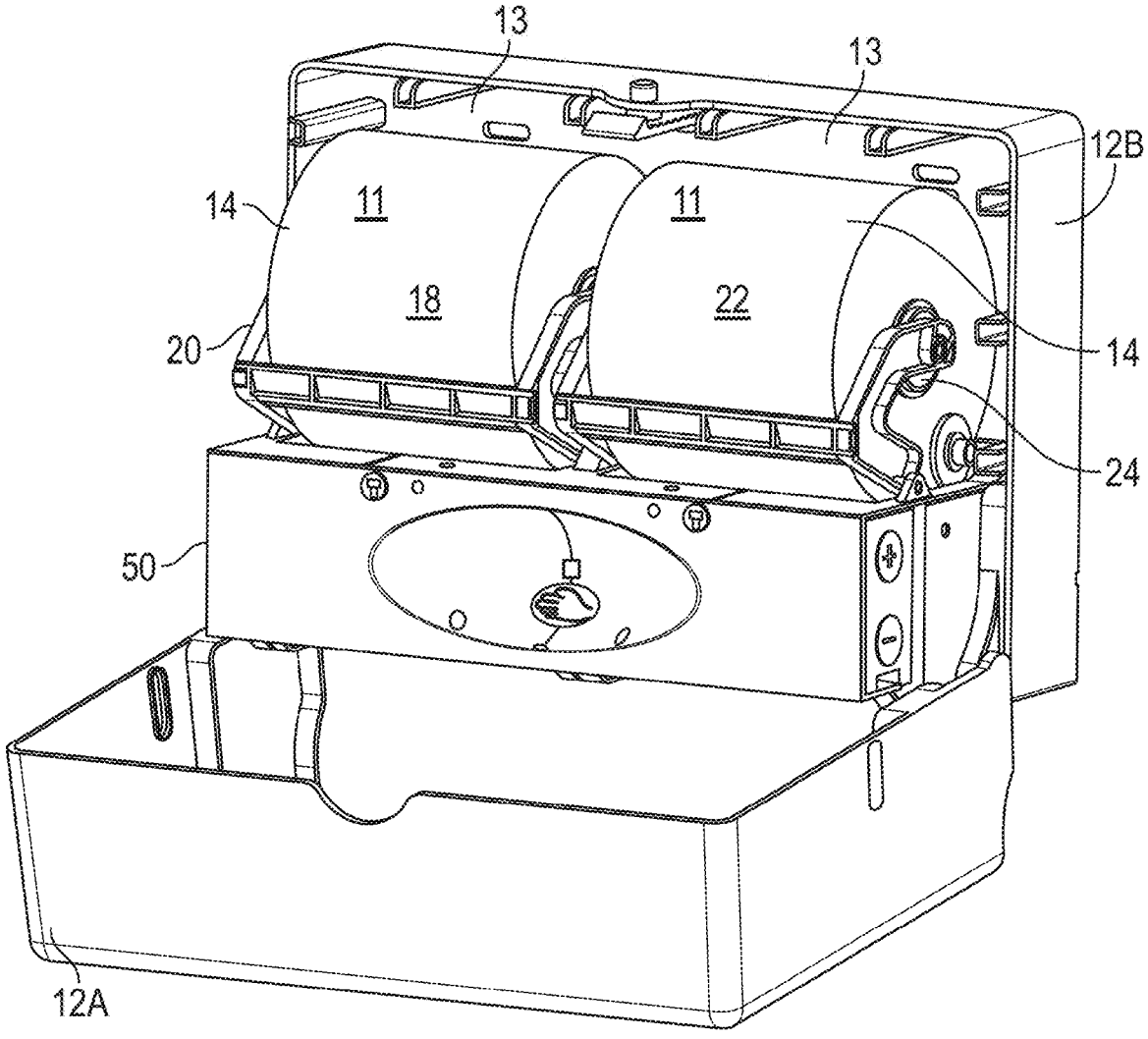
(52) **U.S. Cl.**
CPC ***A47K 10/36*** (2013.01); *A47K 2010/3668* (2013.01); *A47K 2010/3675* (2013.01); *A47K 2010/3681* (2013.01)

(57) **ABSTRACT**

A dispenser assembly facilitating selective dispensing of sheet material from a plurality of supplies of sheet material can be provided. The dispenser assembly can include a drive system to facilitate dispensing of the sheet material from the dispenser. The dispensing system can include a plurality of driven rollers each configured to move sheet material from a respective supply of sheet material, and a drive mechanism selectively driving driven rollers of the plurality of driven rollers and positioned between the driven rollers. The dispenser assembly includes an auto-assist paper dispensing system configured to allow a user to electronically activate a minimum quantity of paper to be supplied and allow for the user to supplement the quantity of paper being supplied.



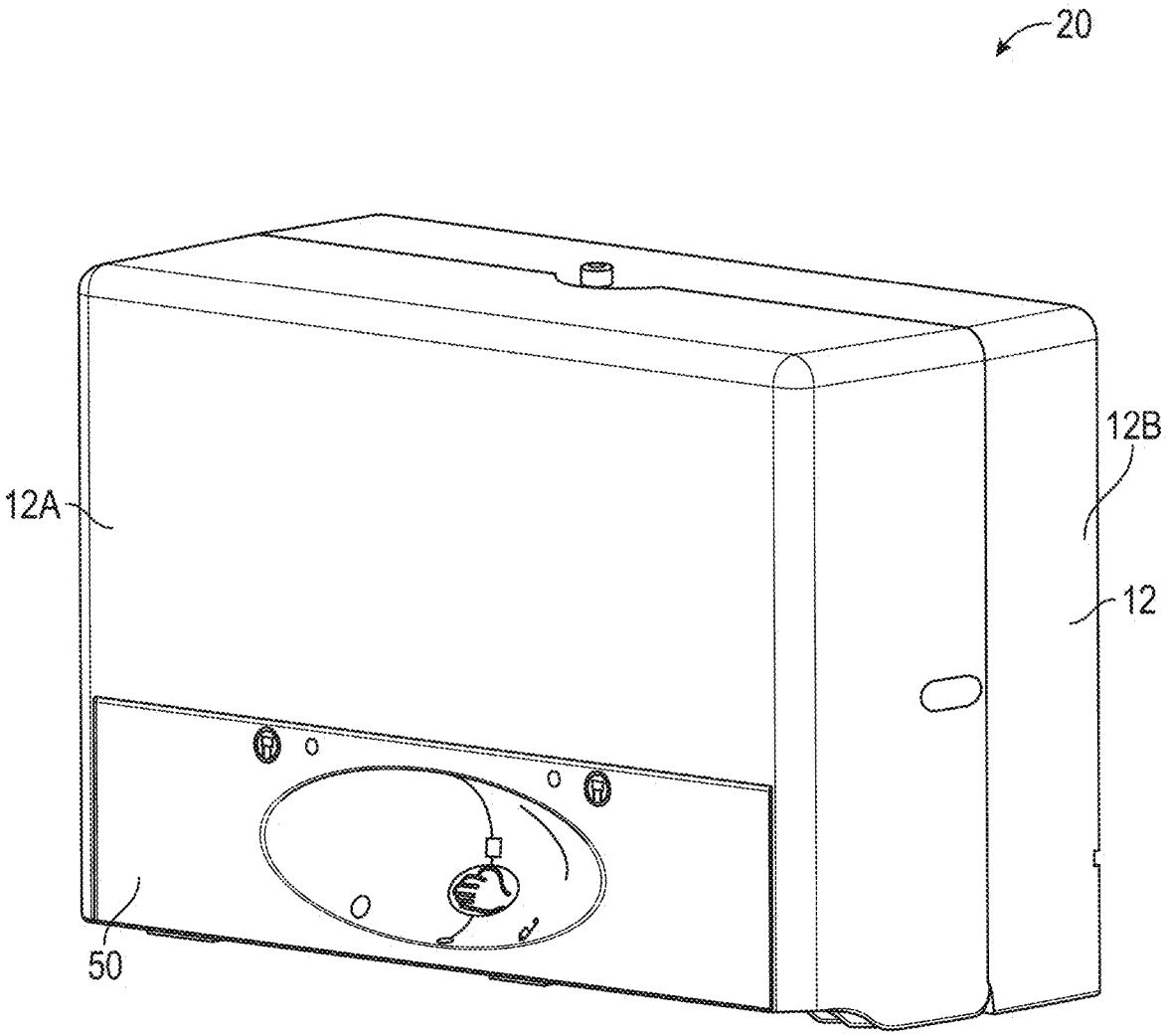


FIG. 1

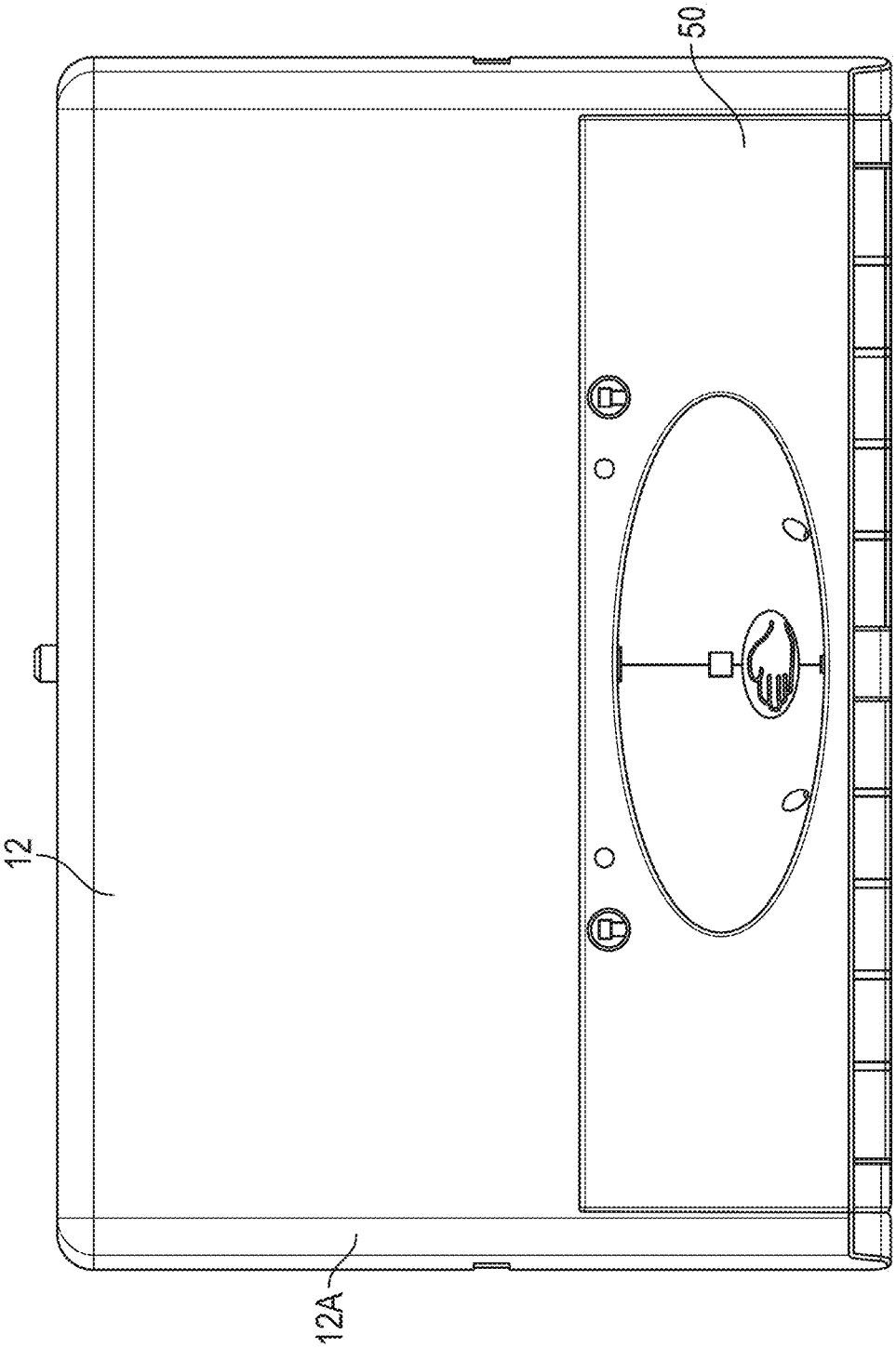


FIG. 2

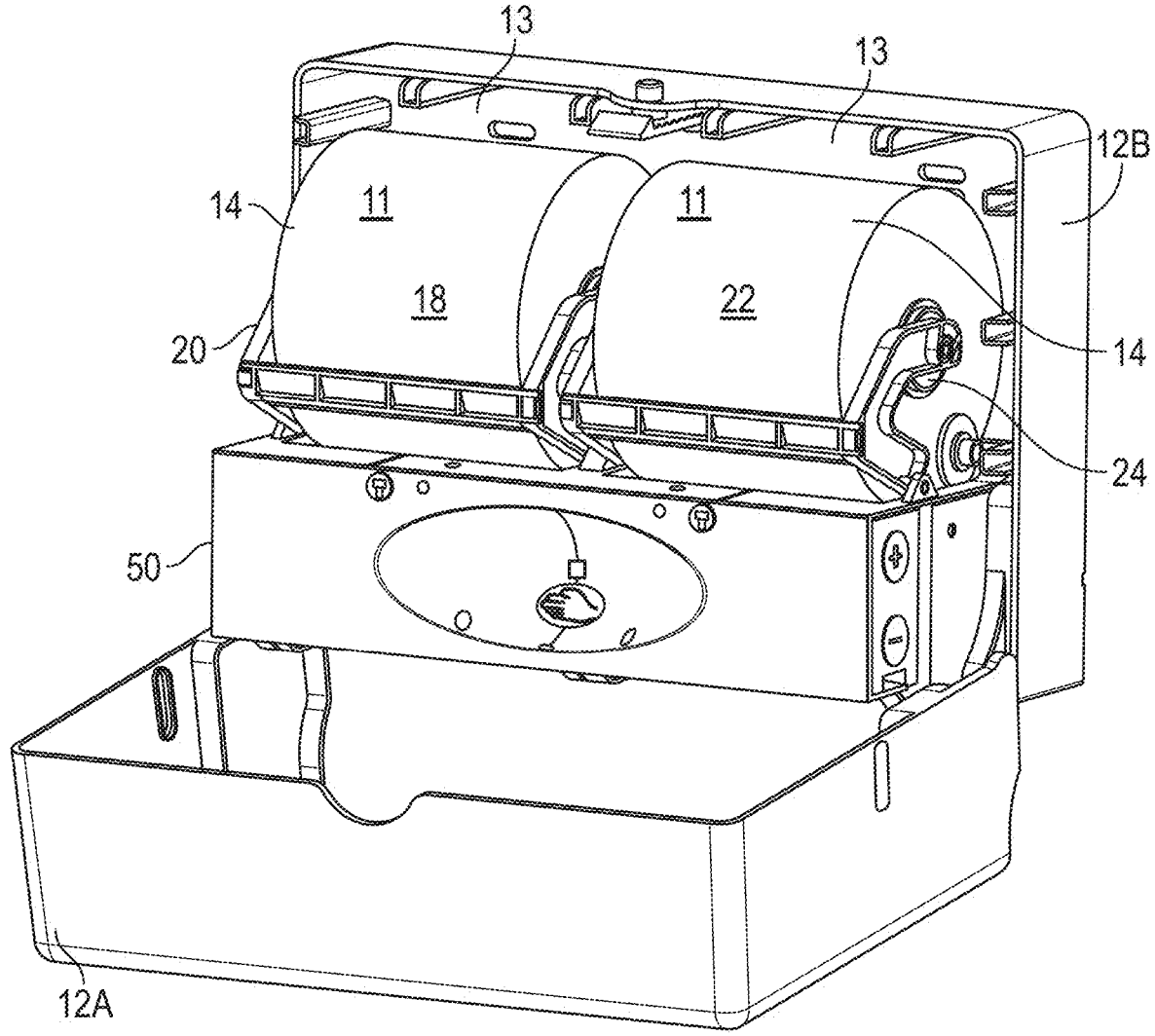


FIG. 3

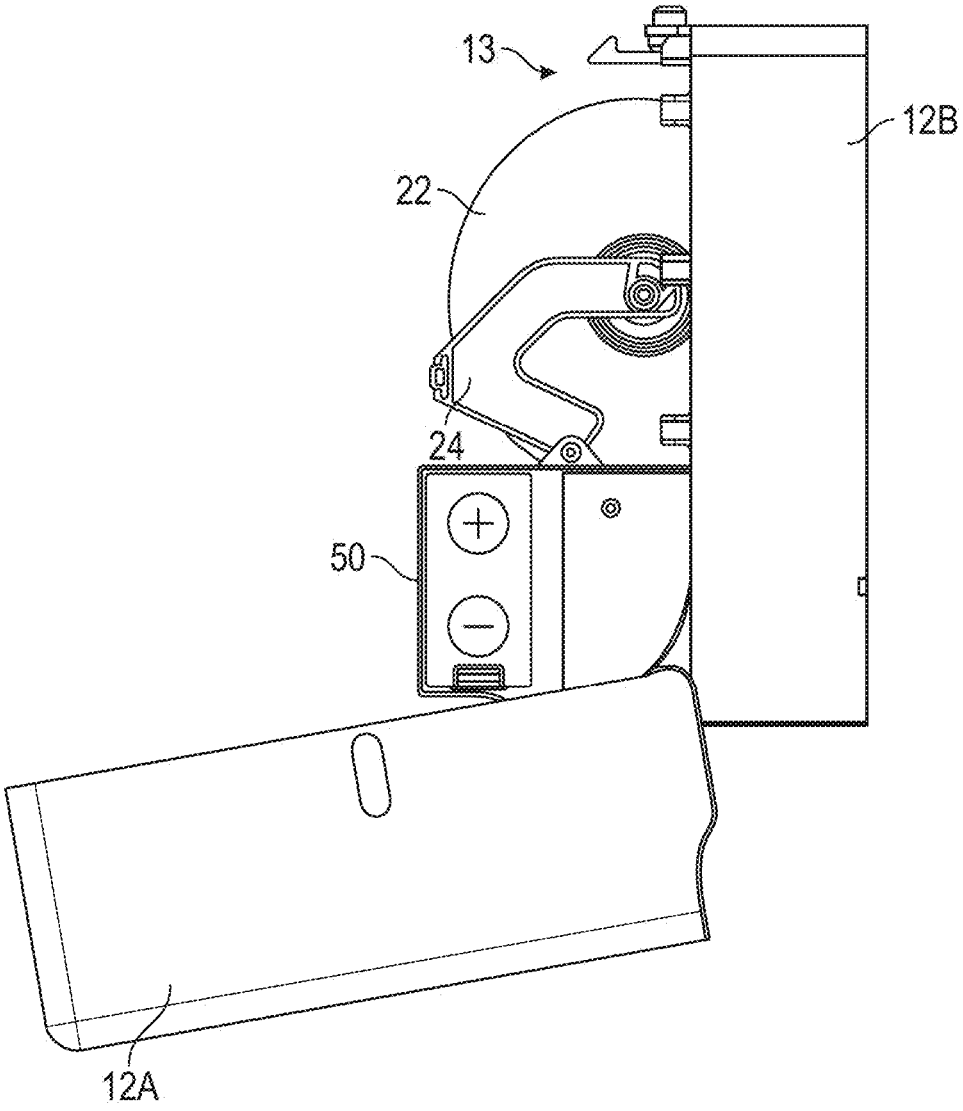


FIG. 4

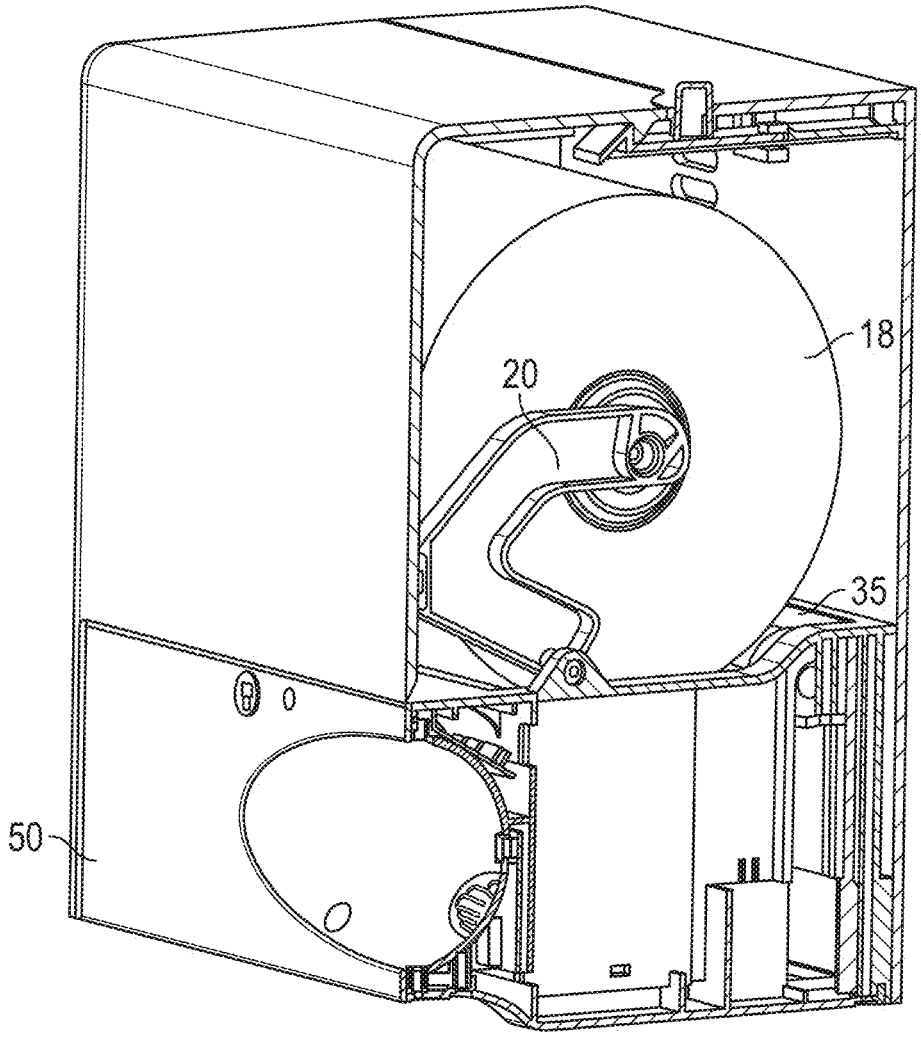
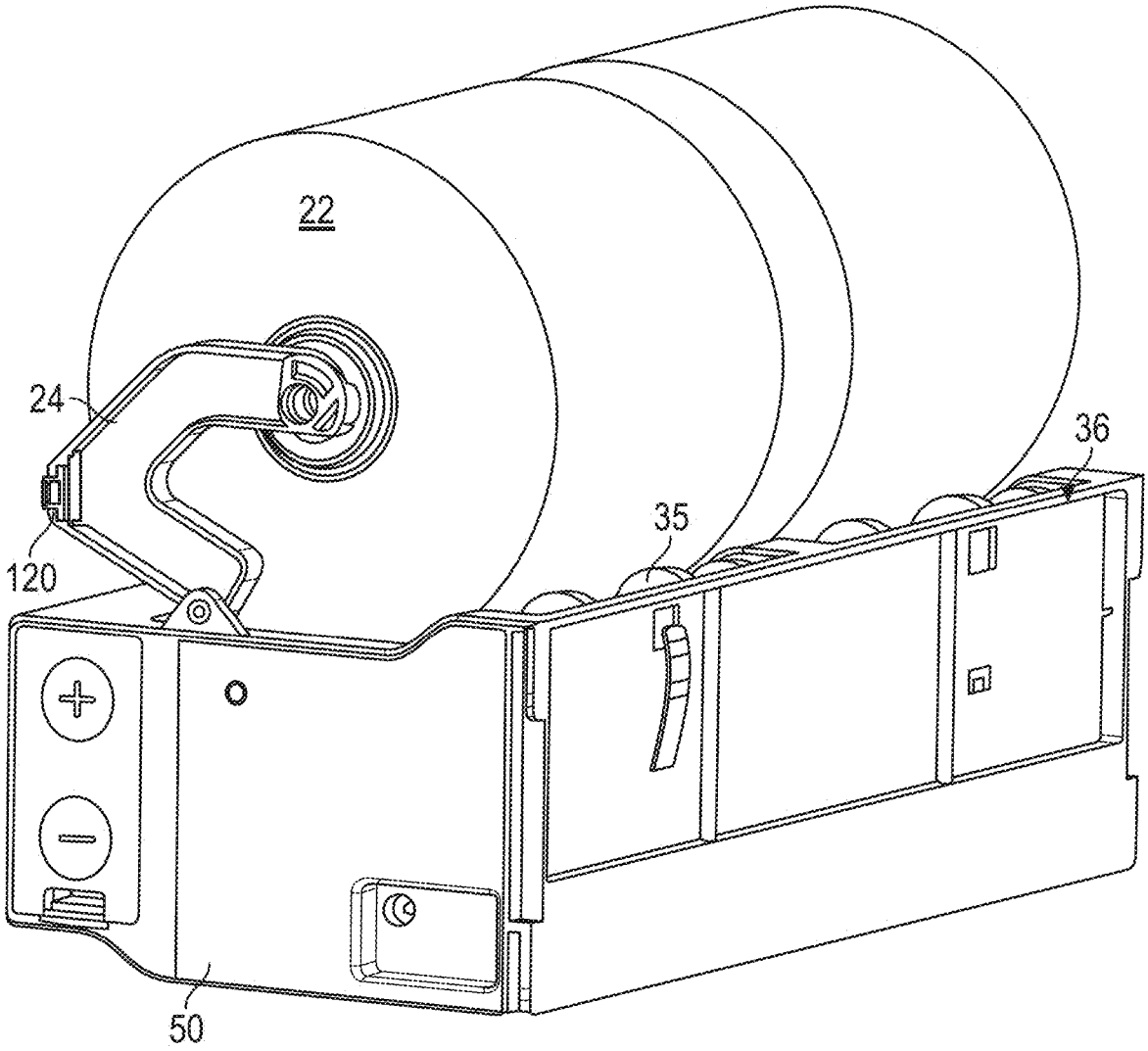


FIG. 5



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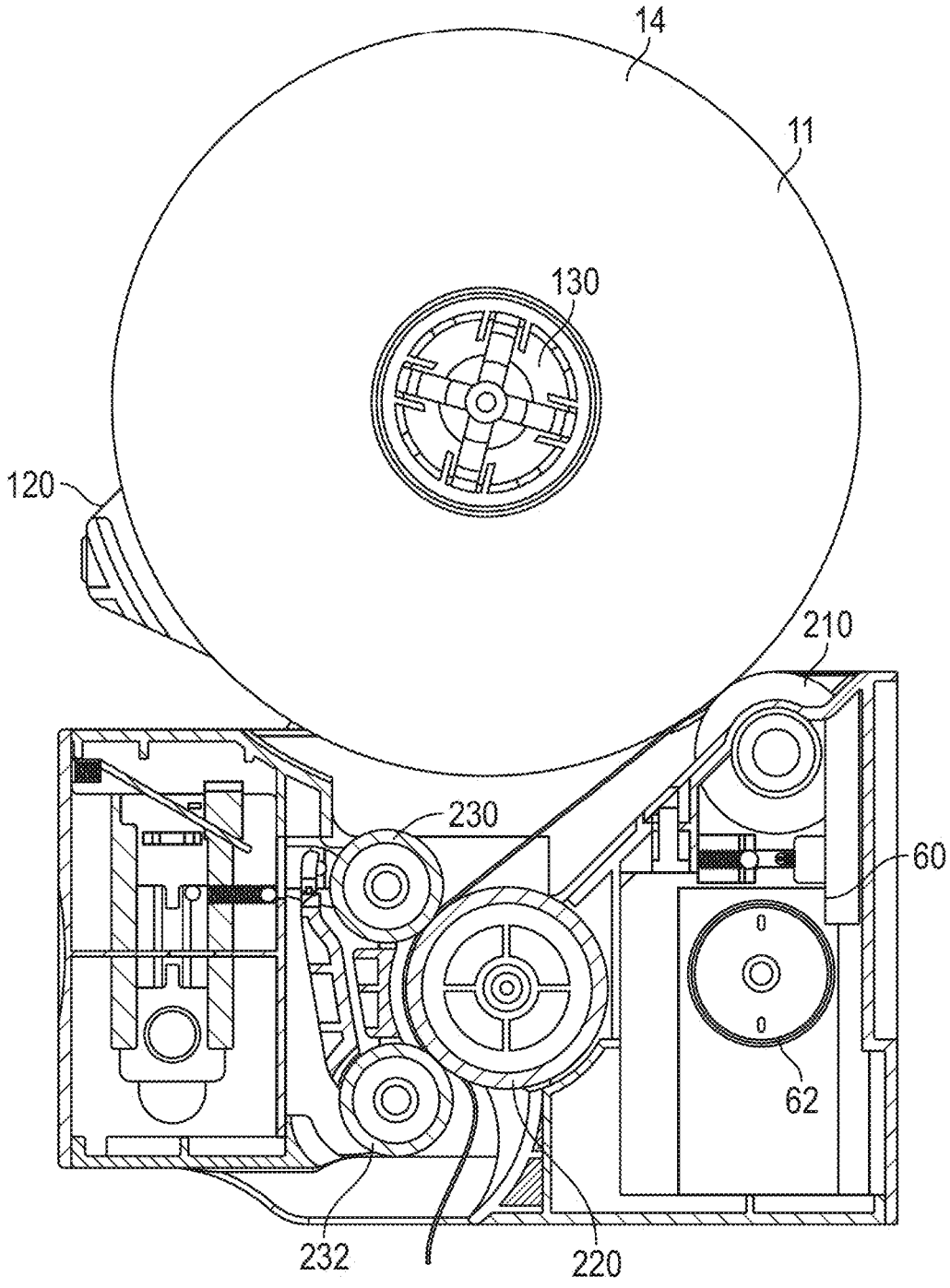

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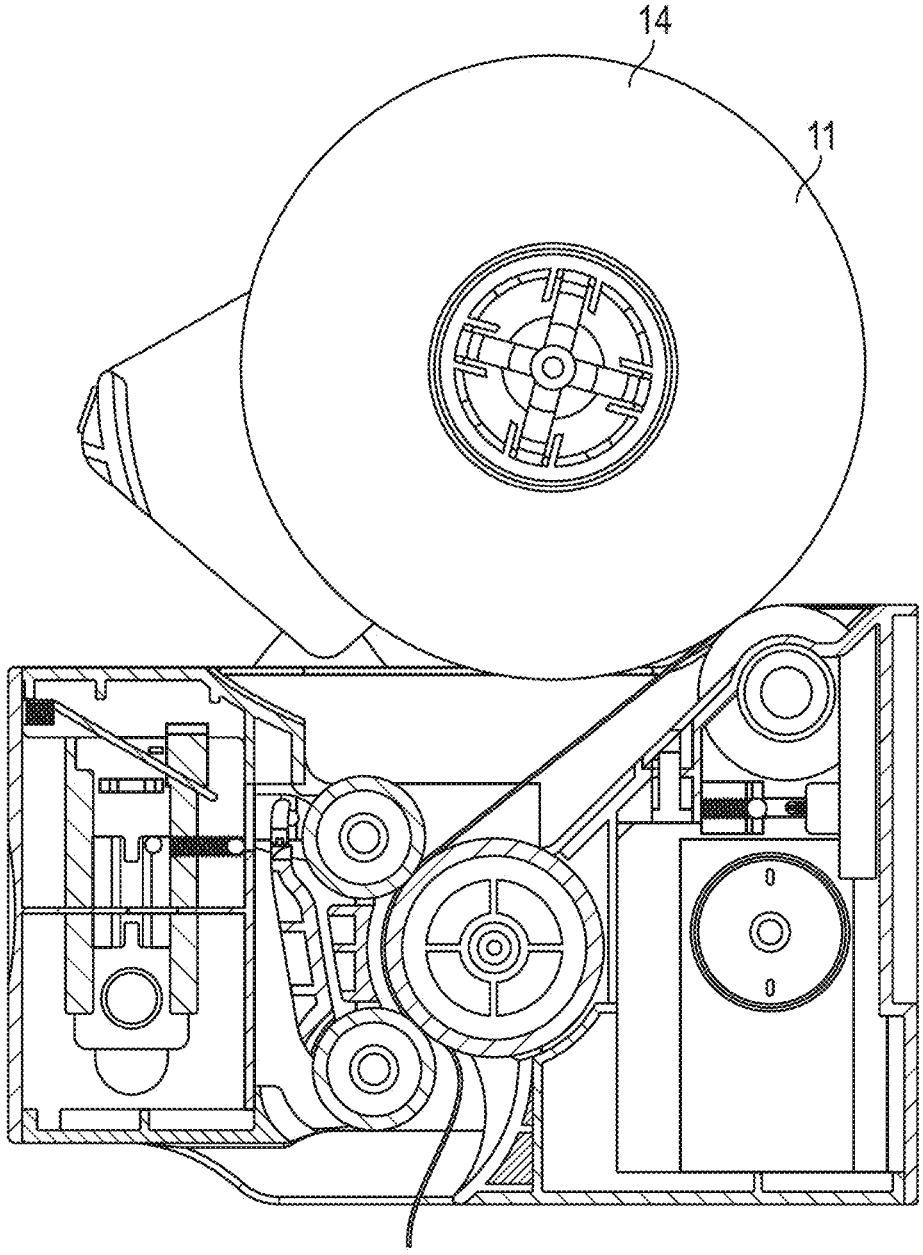


FIG. 8

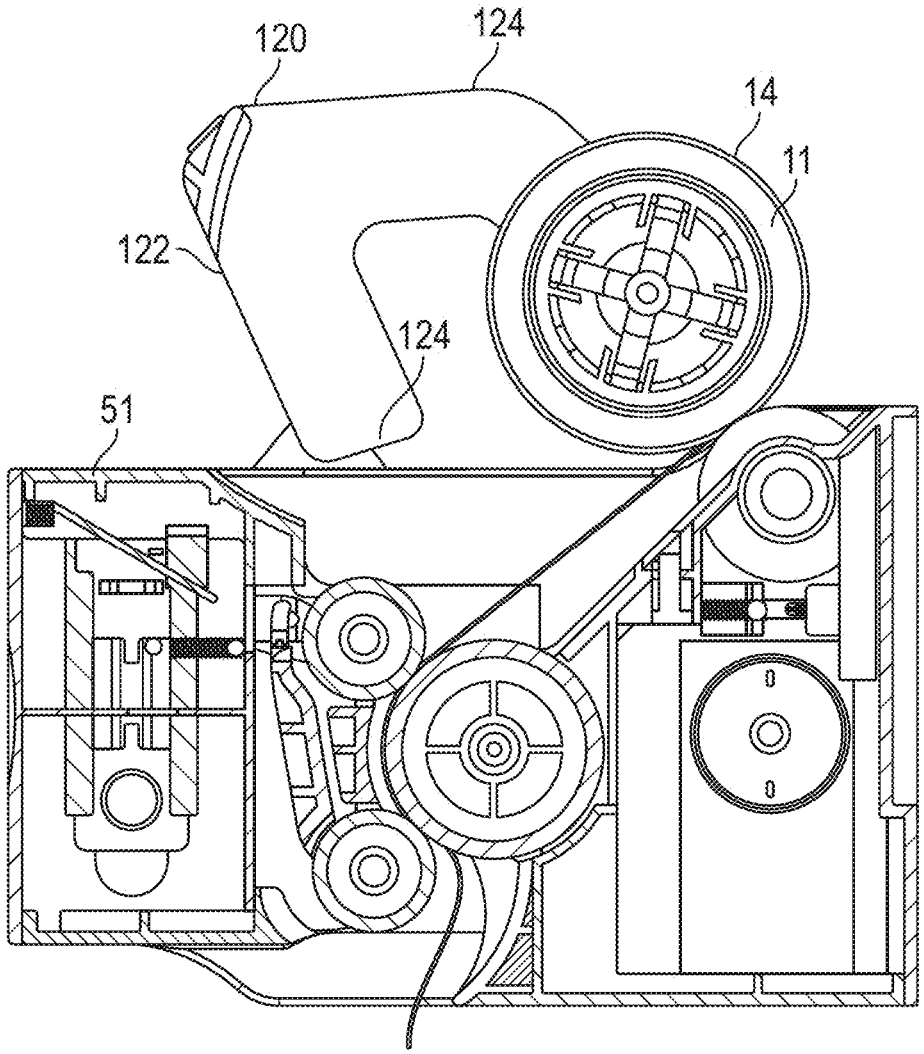
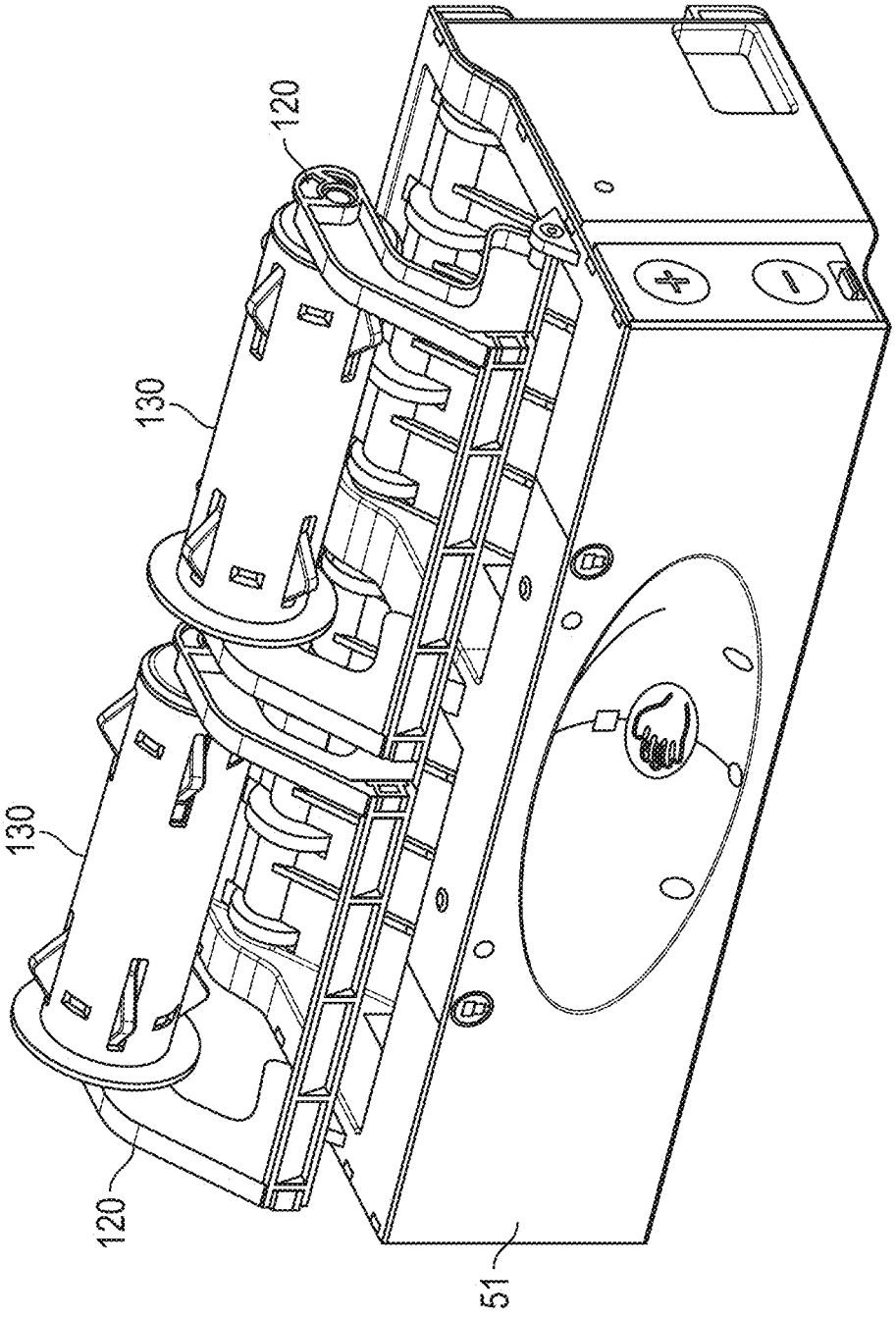


FIG. 9



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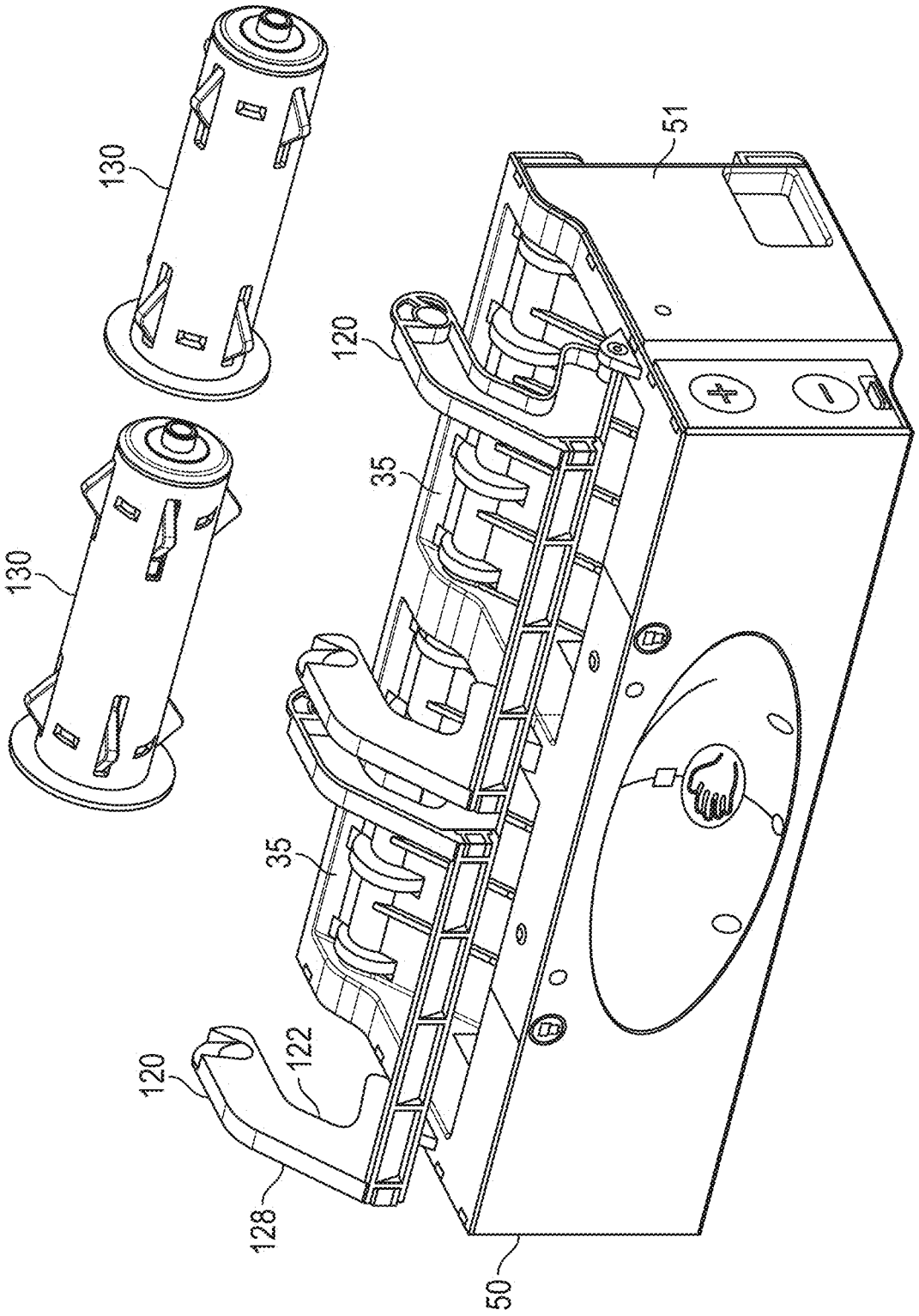

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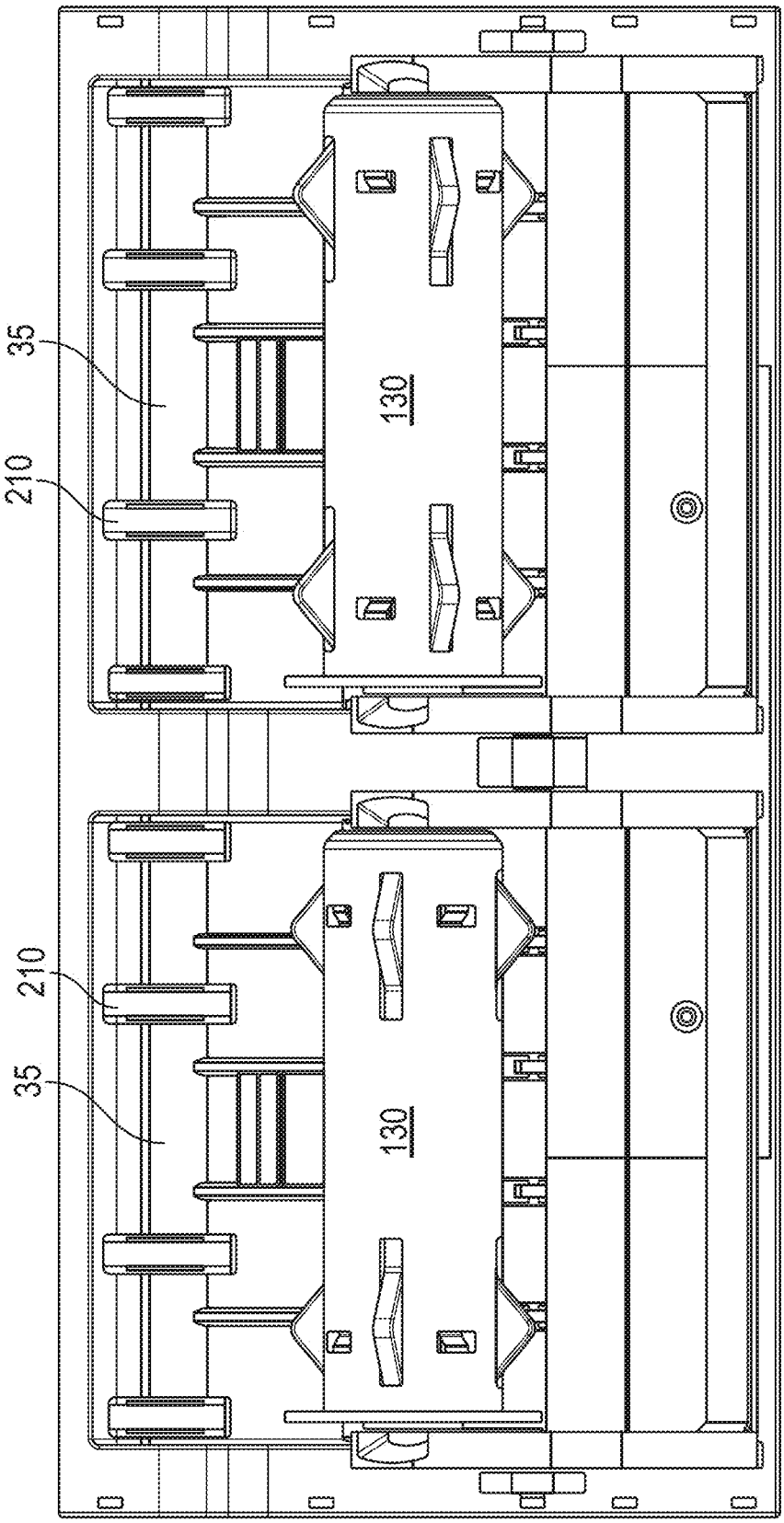

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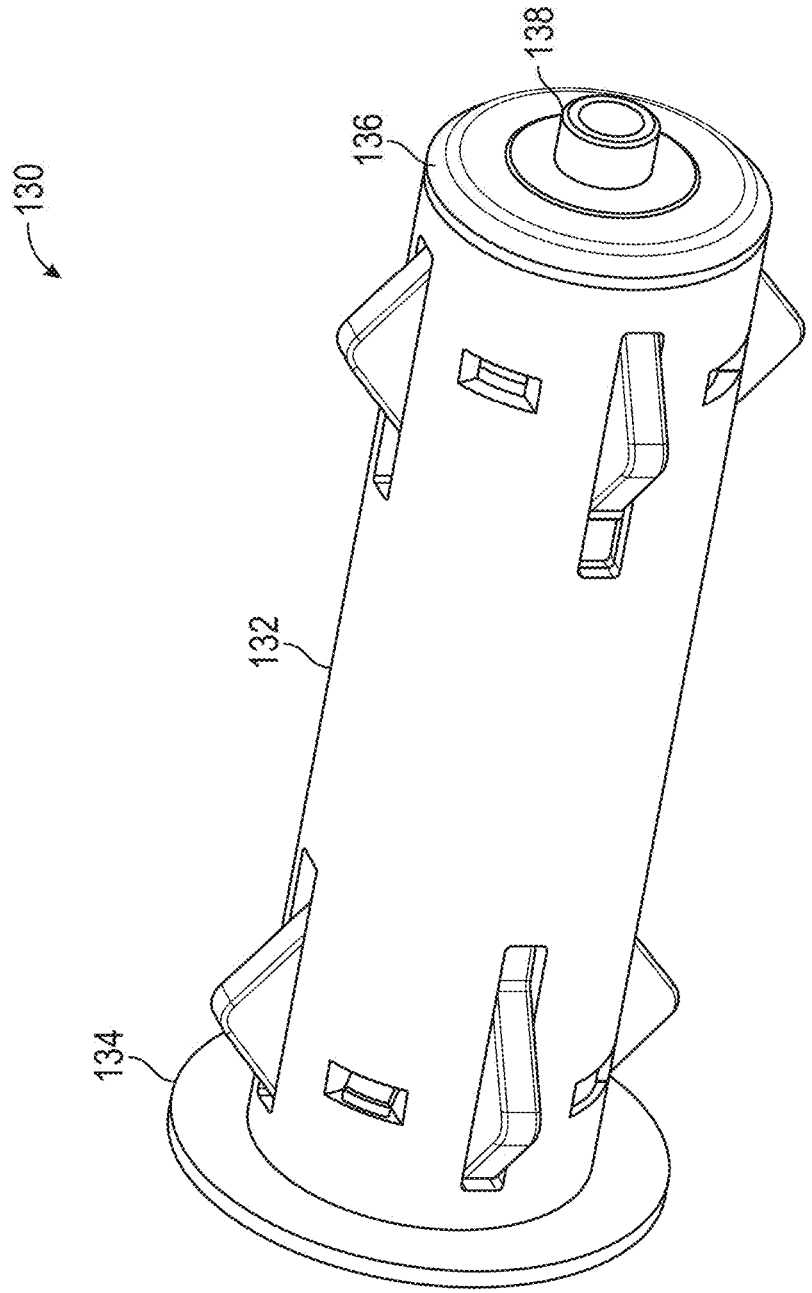

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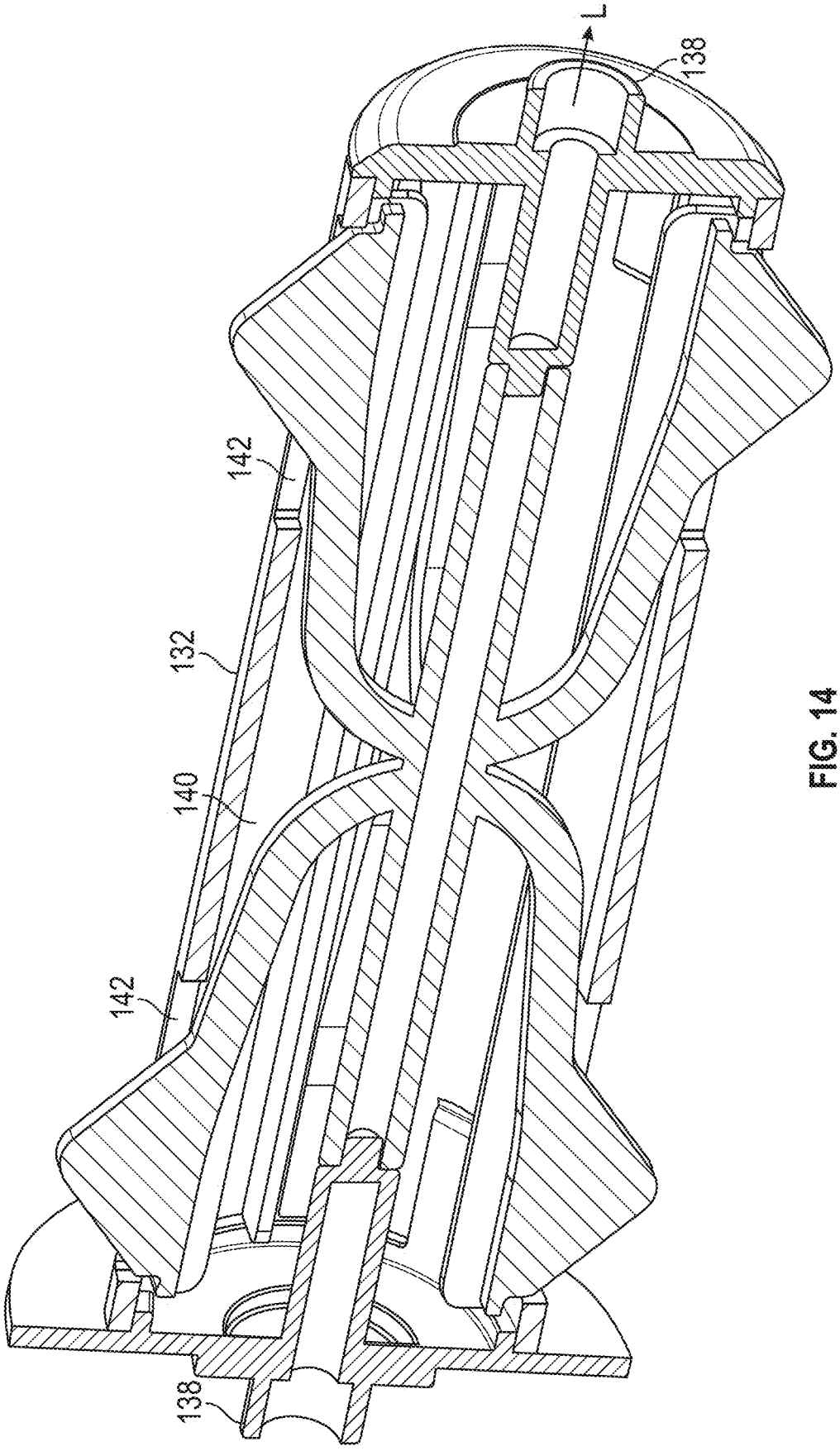

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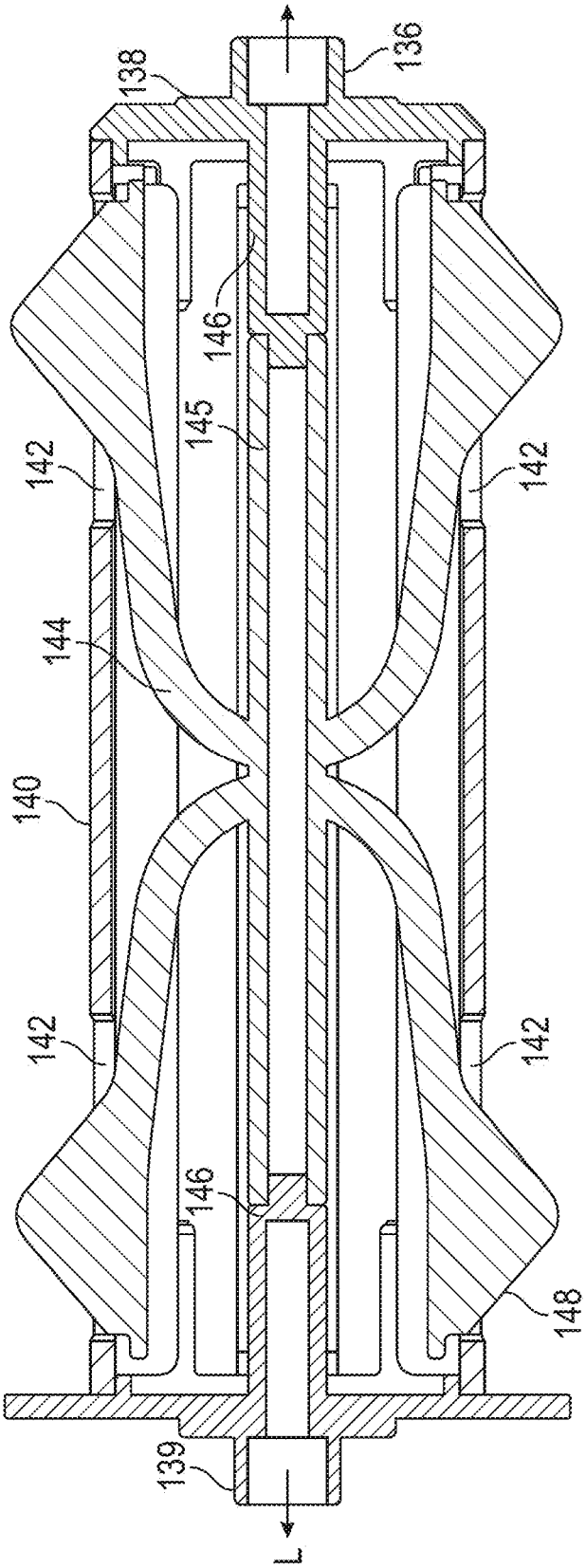

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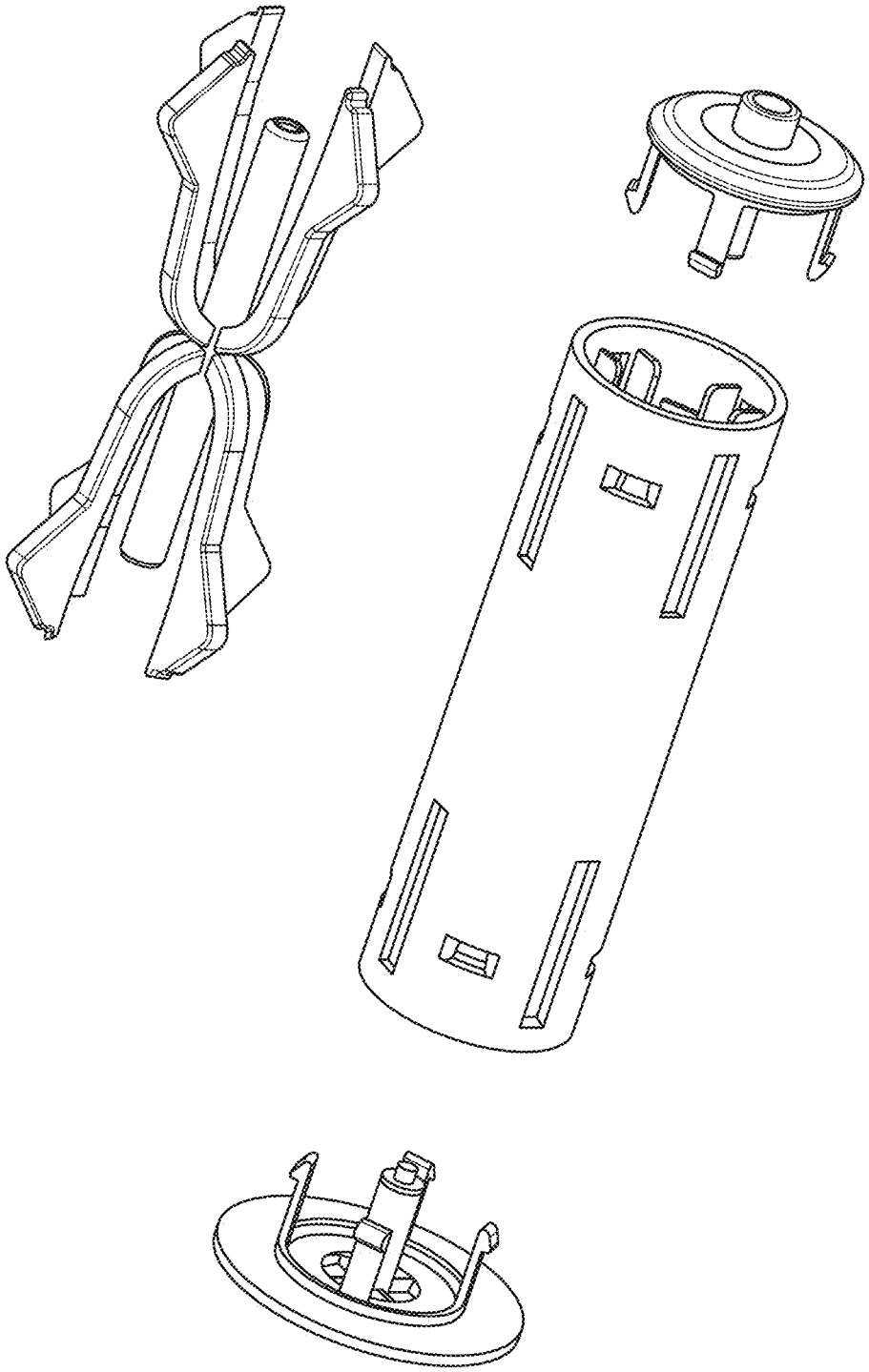


FIG. 16

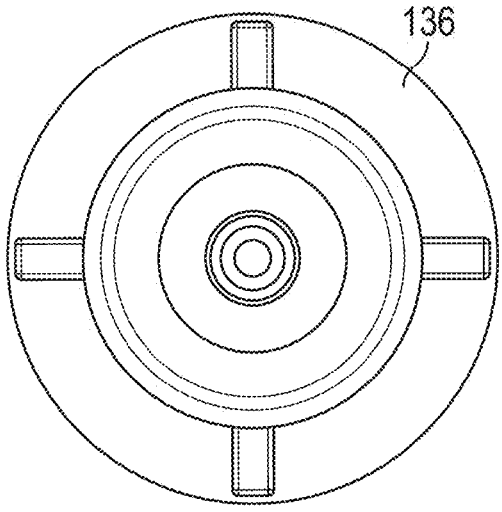
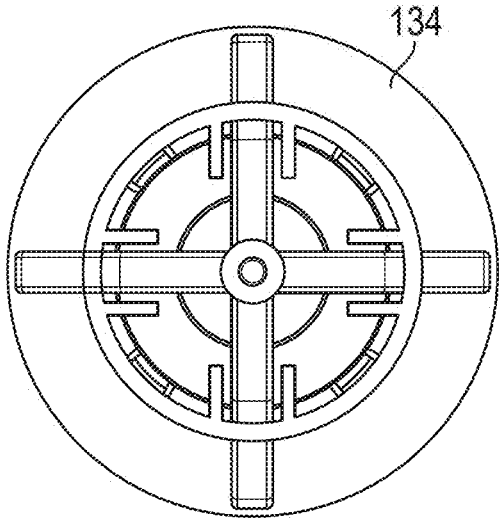


FIG. 17



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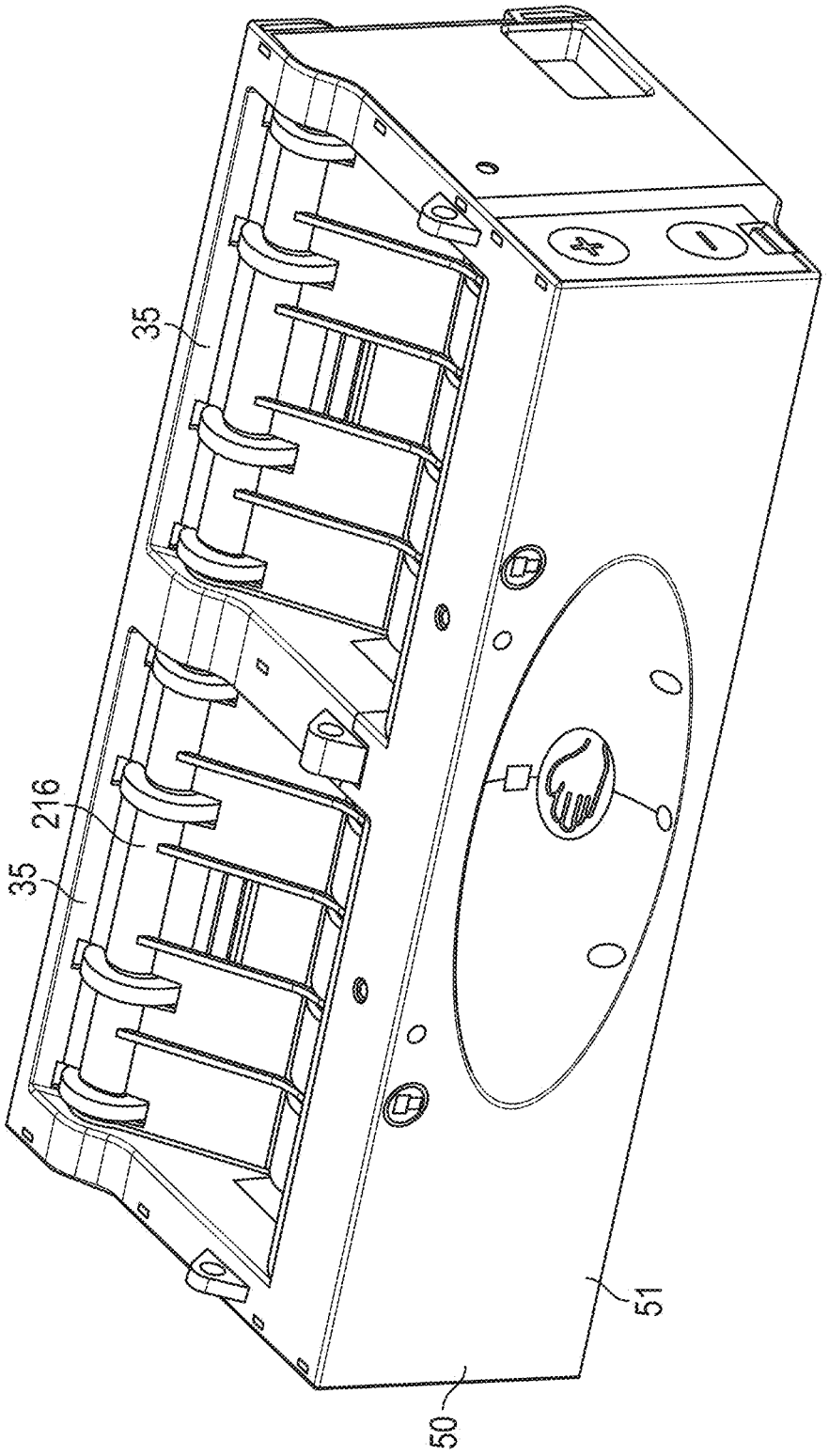

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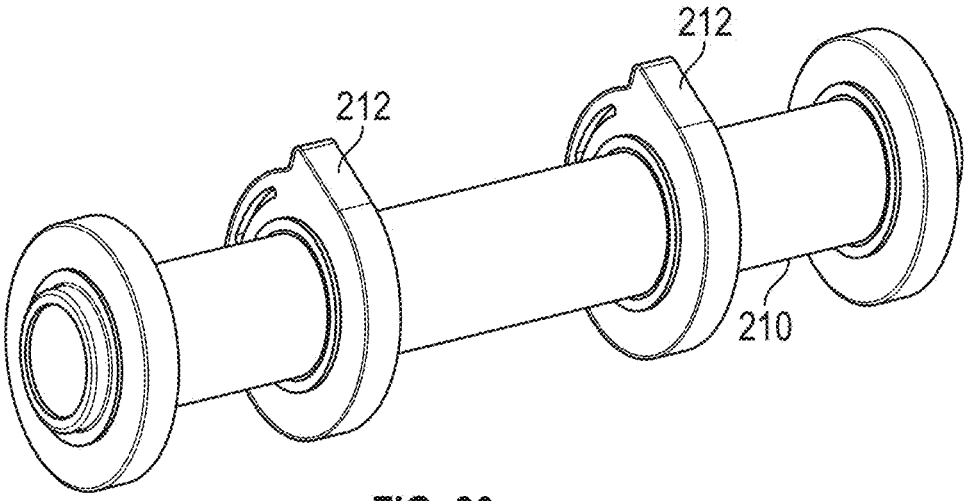
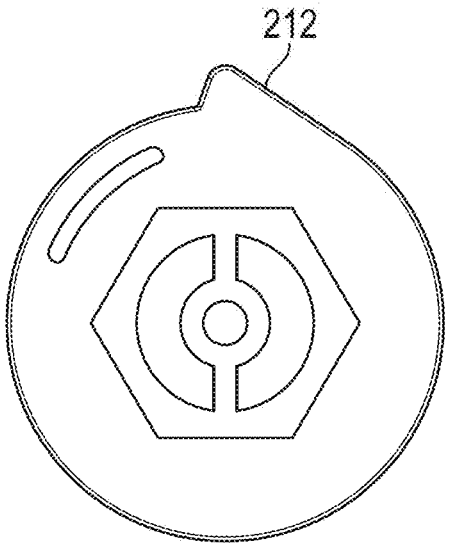


FIG. 20



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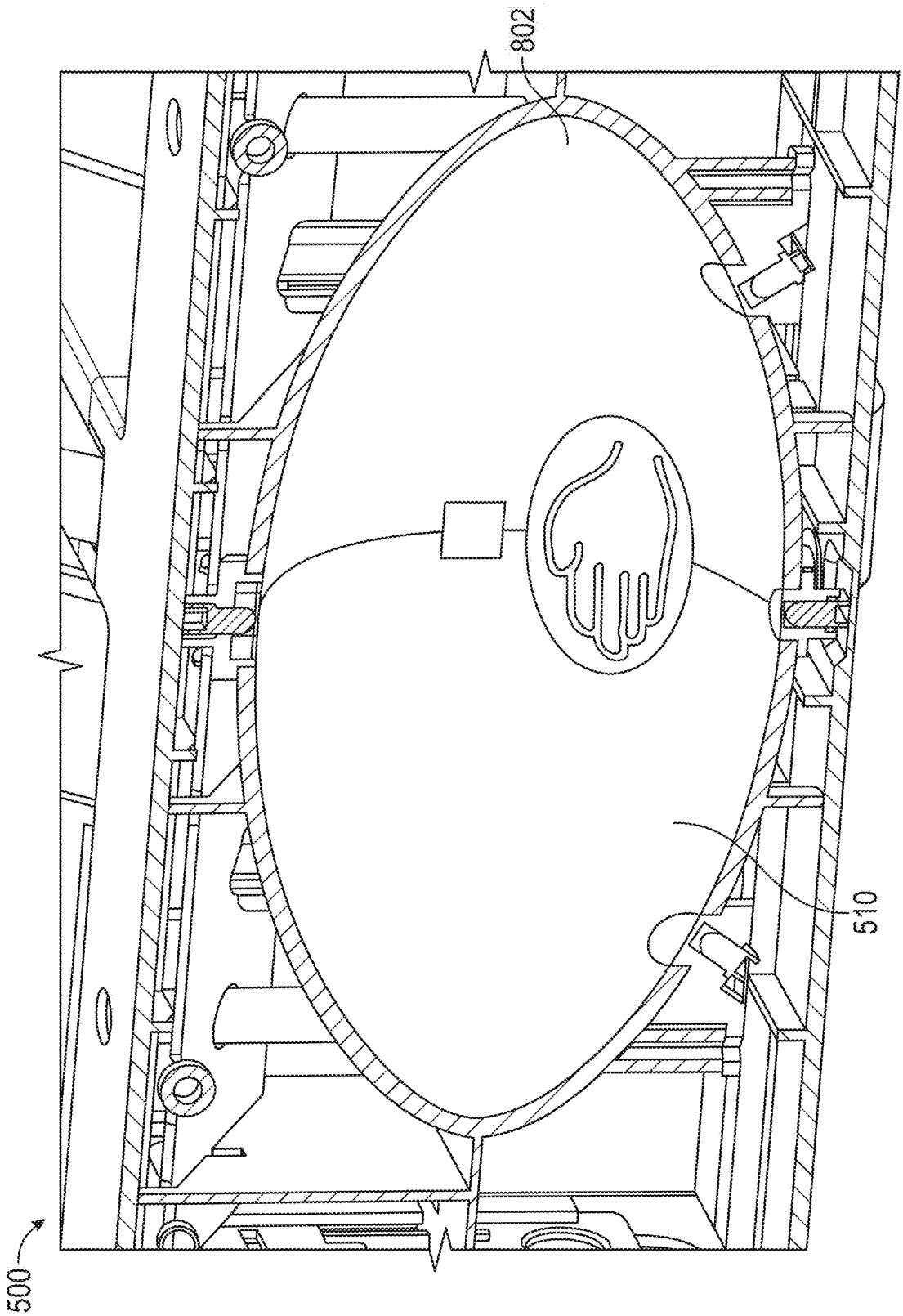

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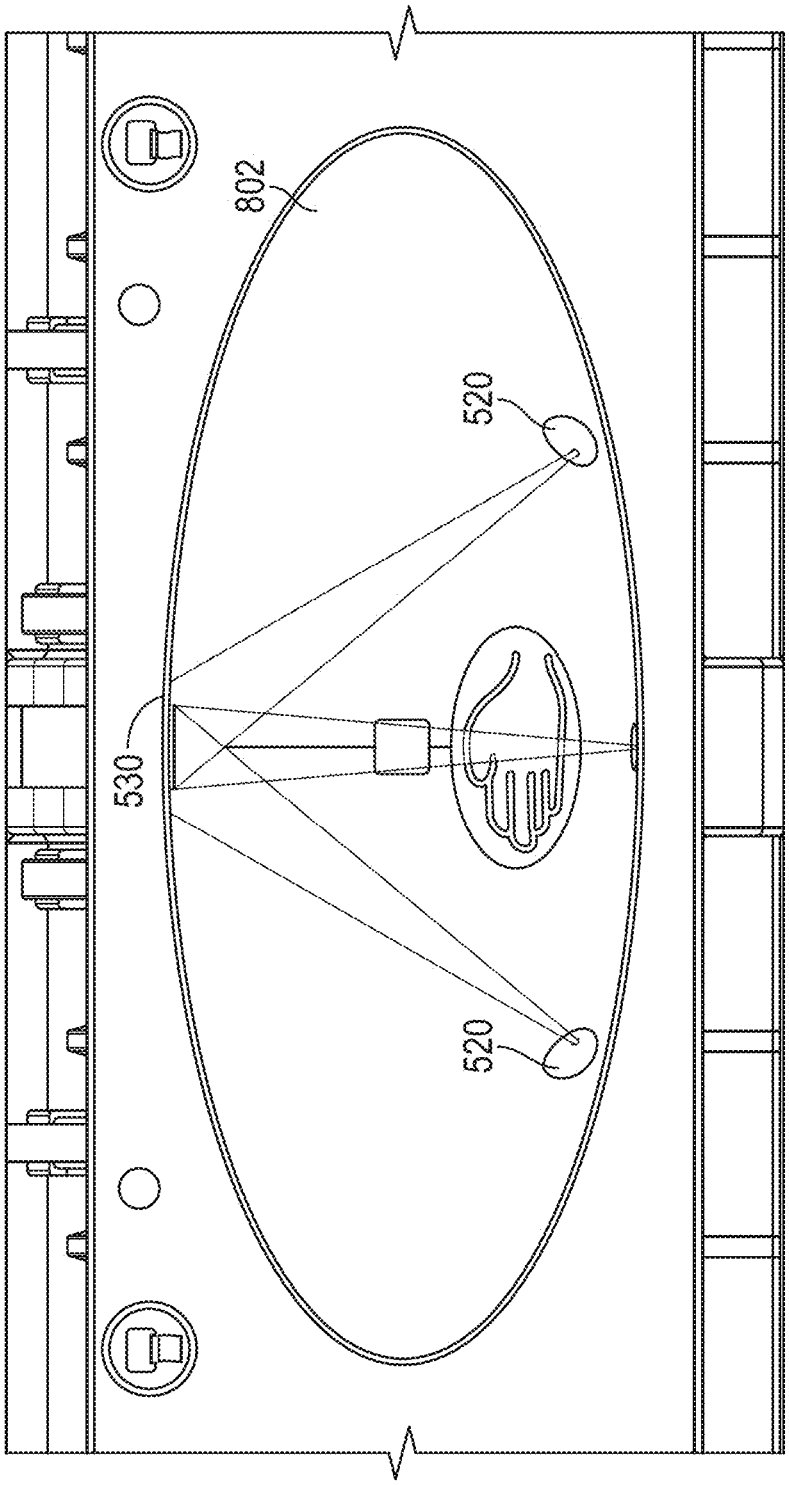

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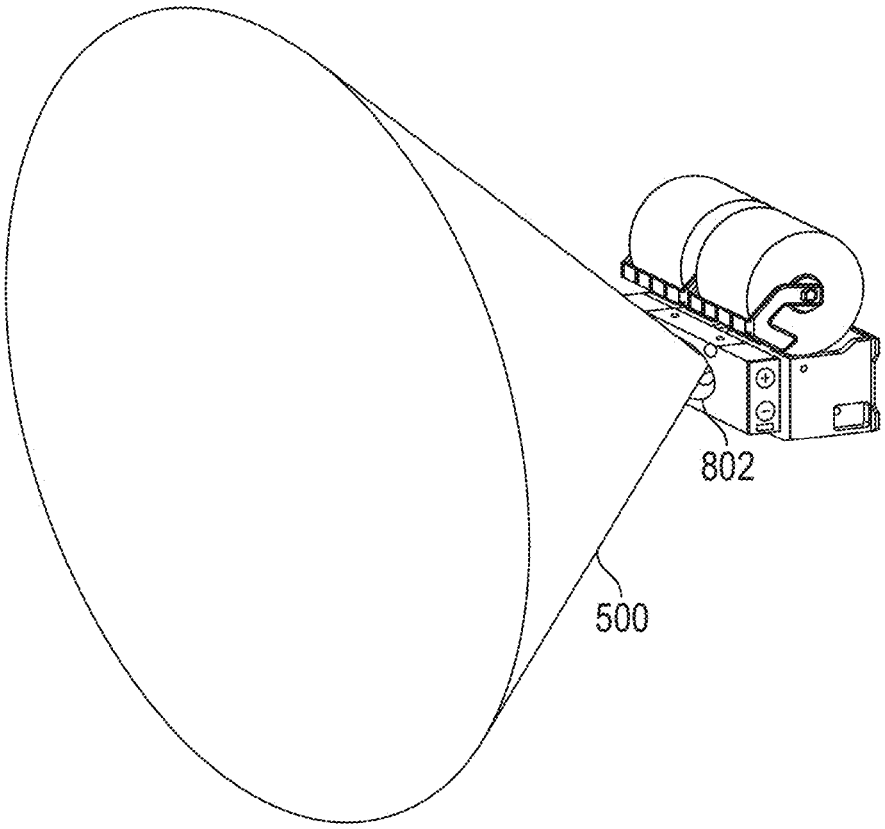

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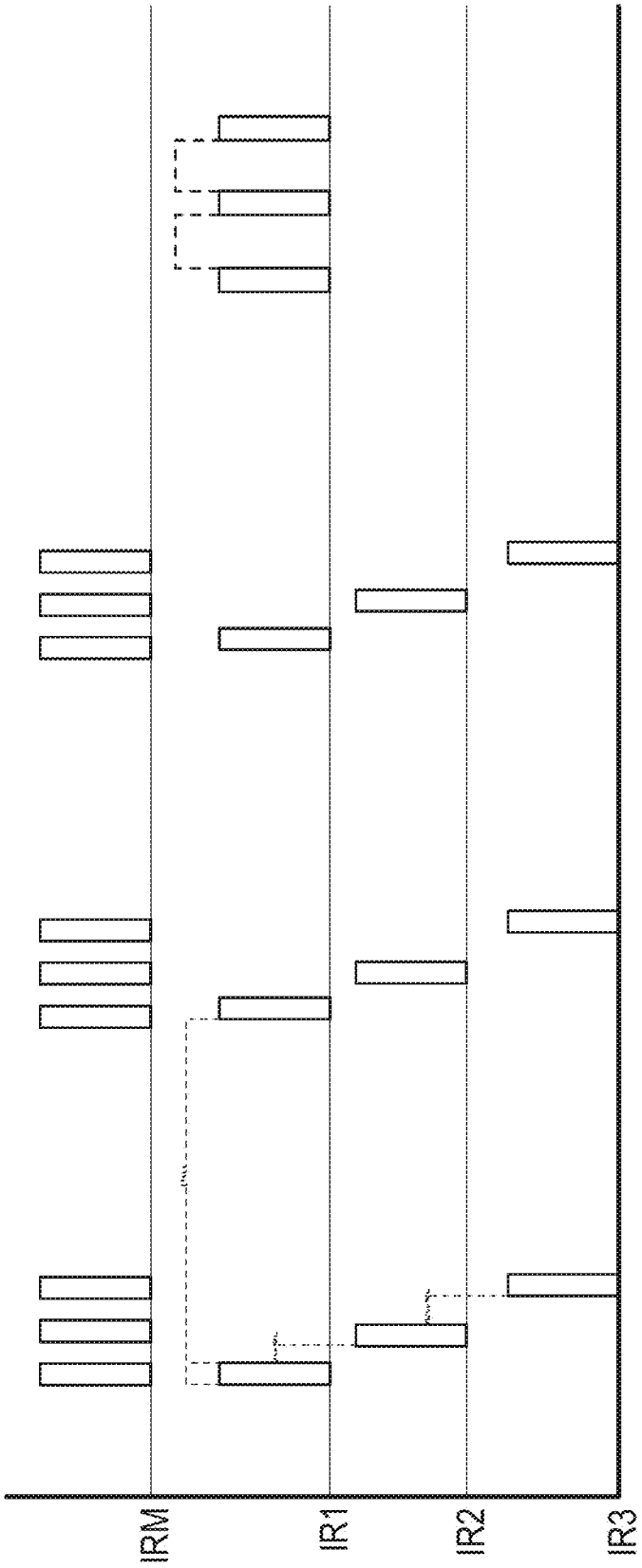

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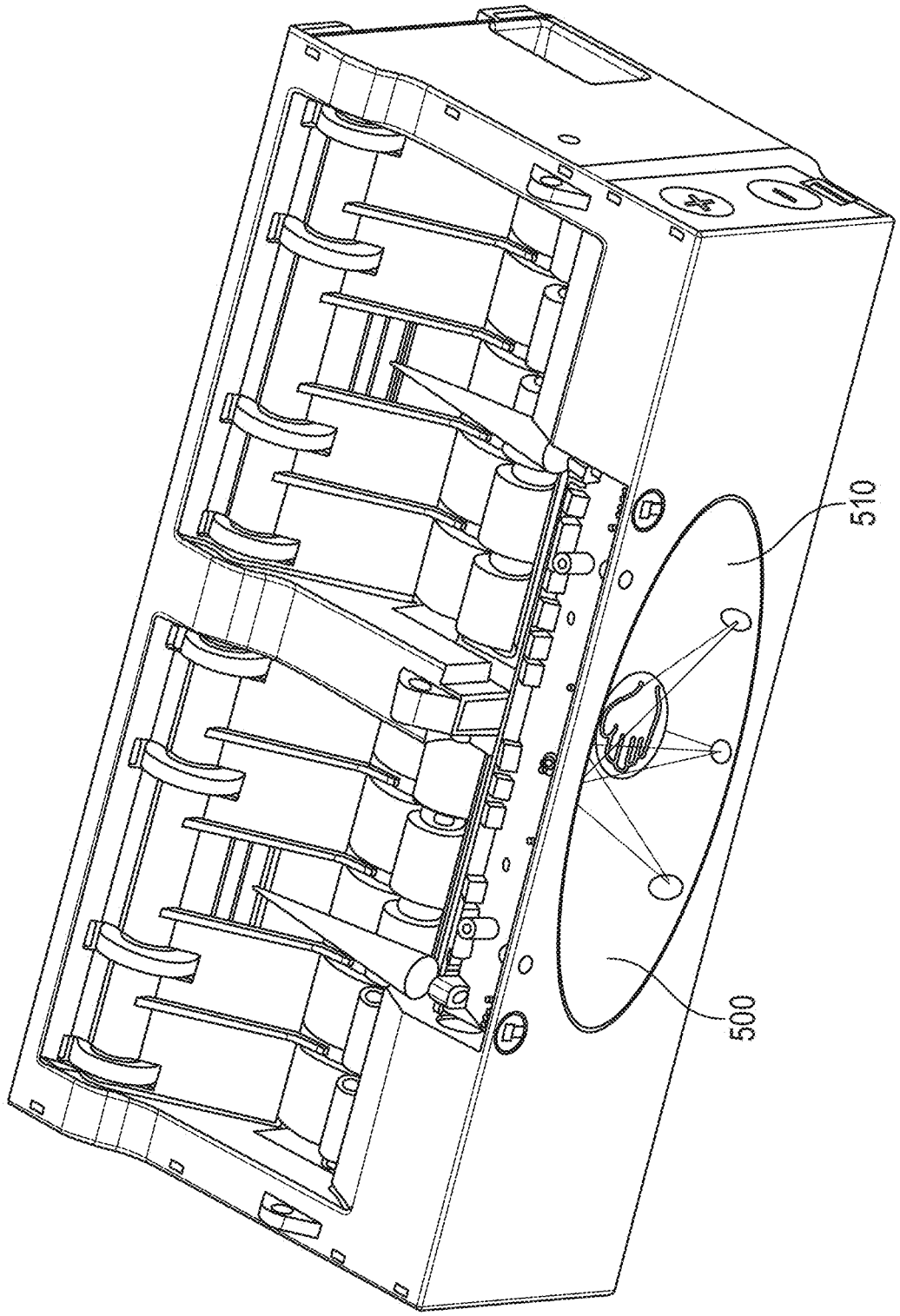

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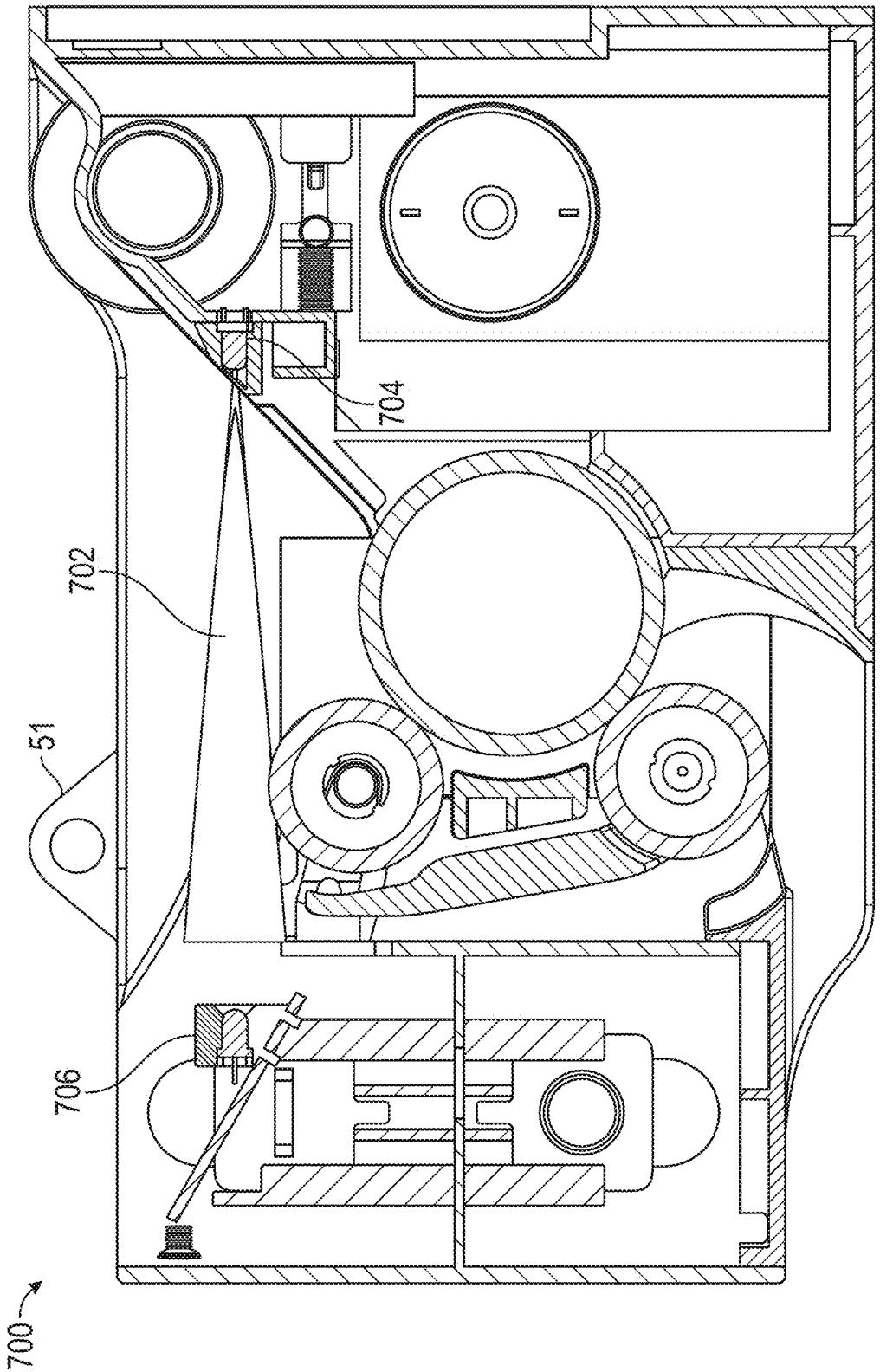

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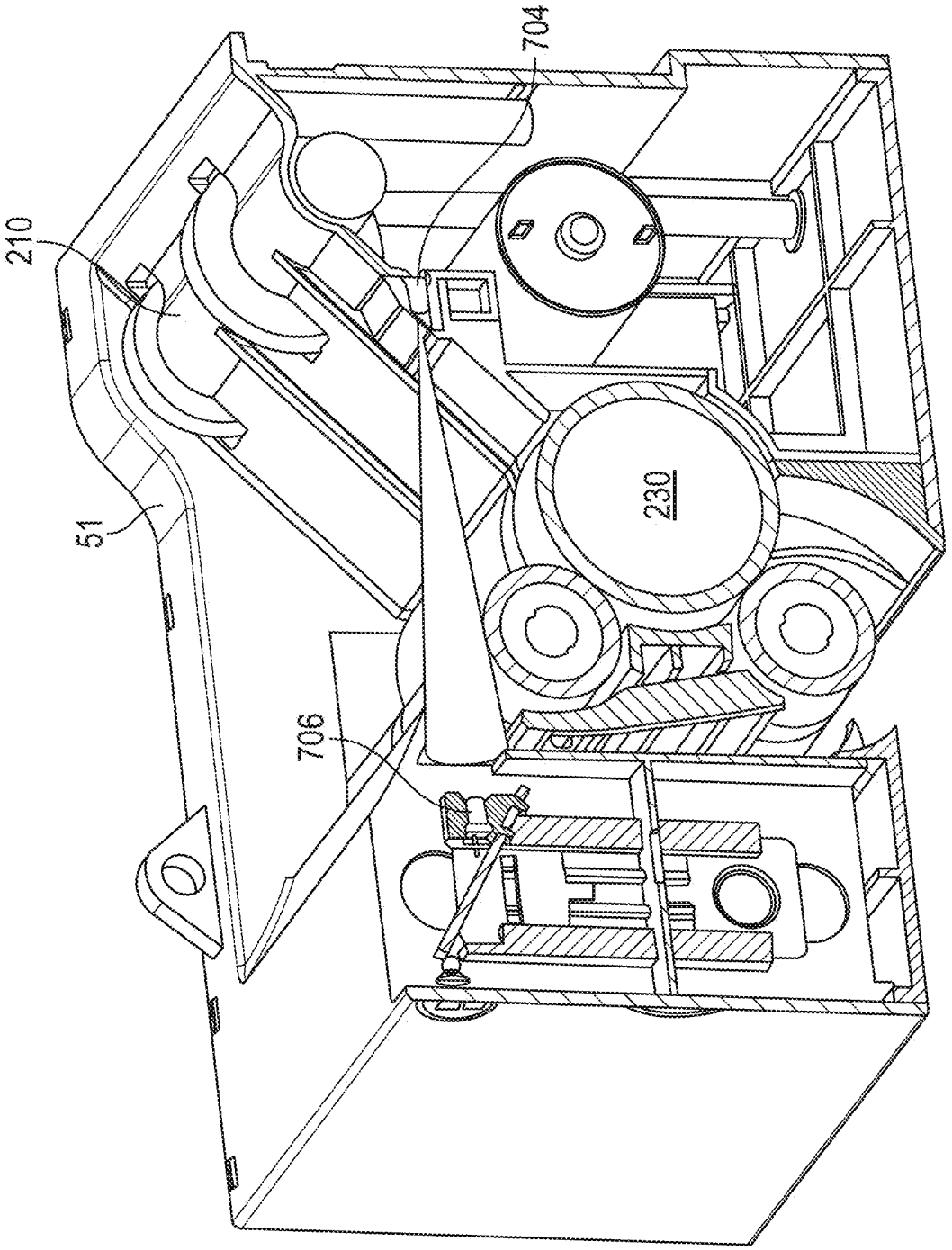

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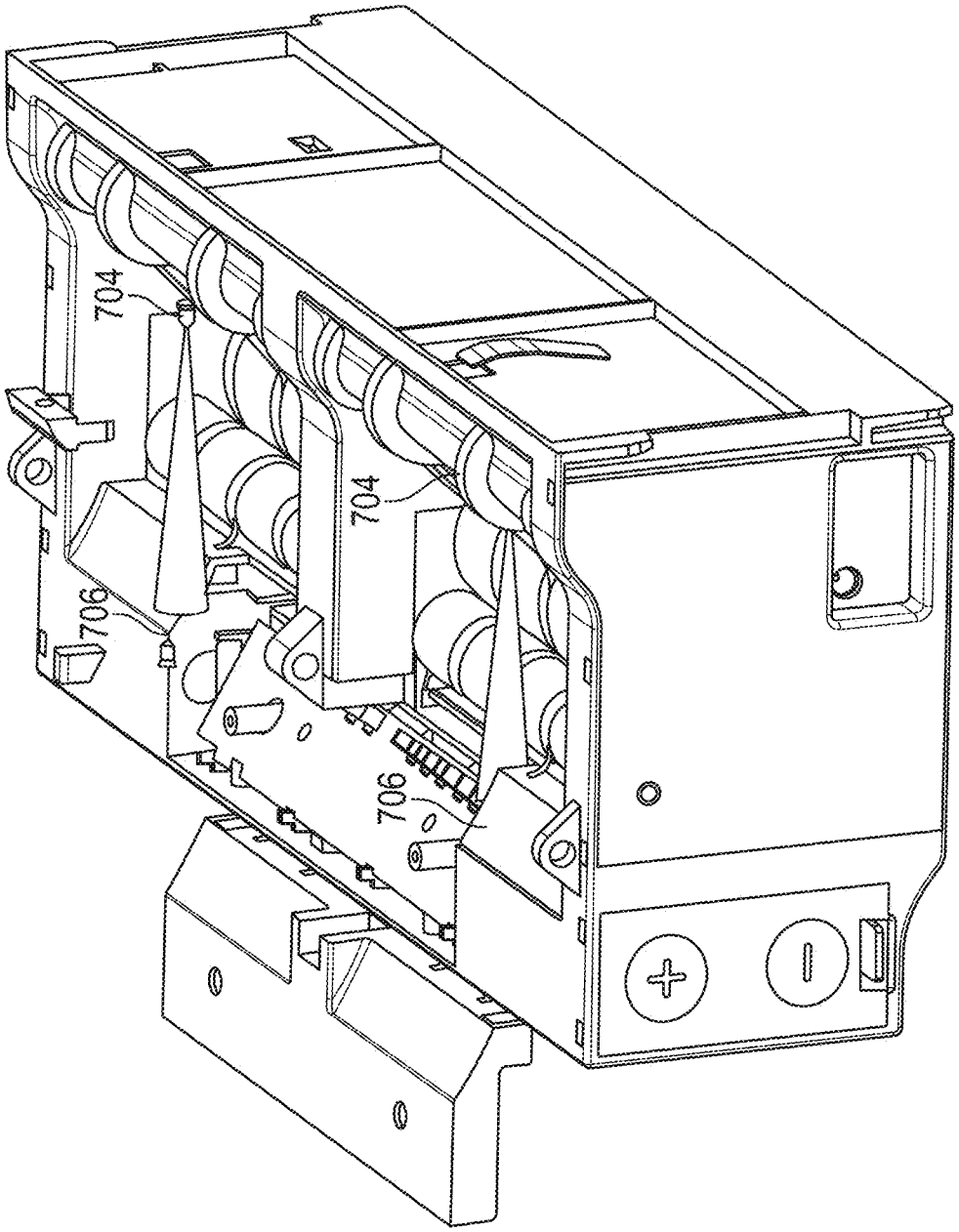

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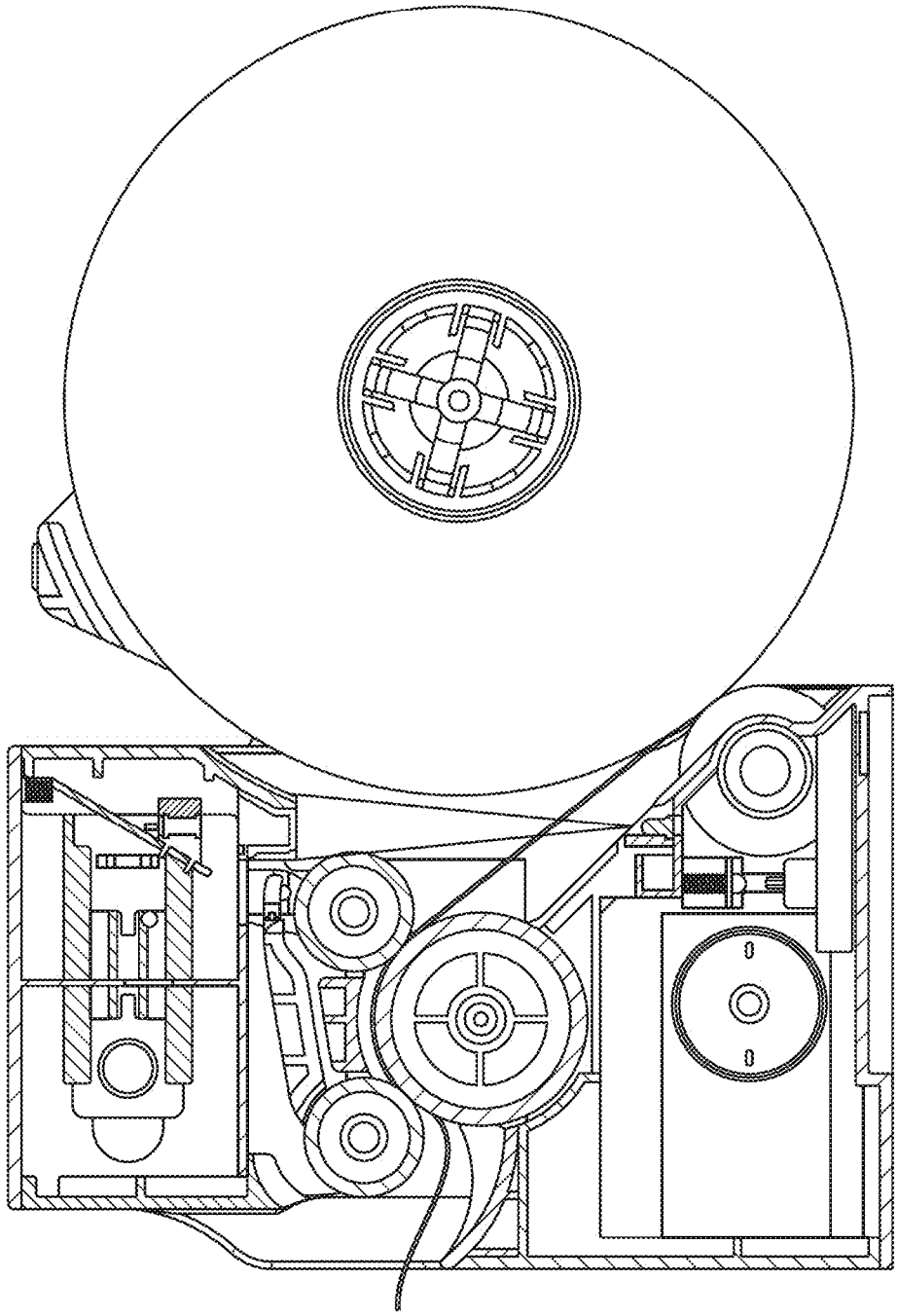

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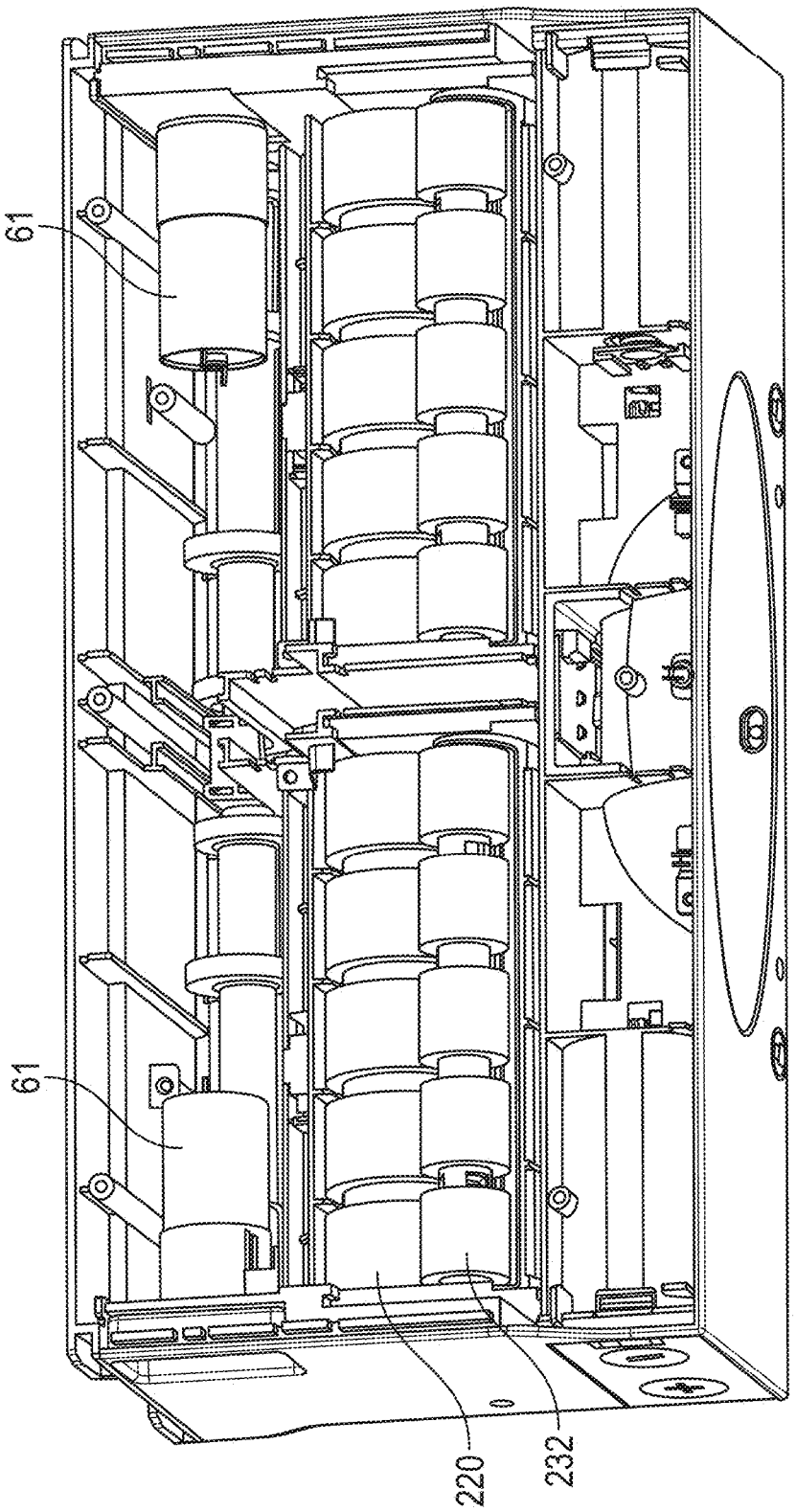

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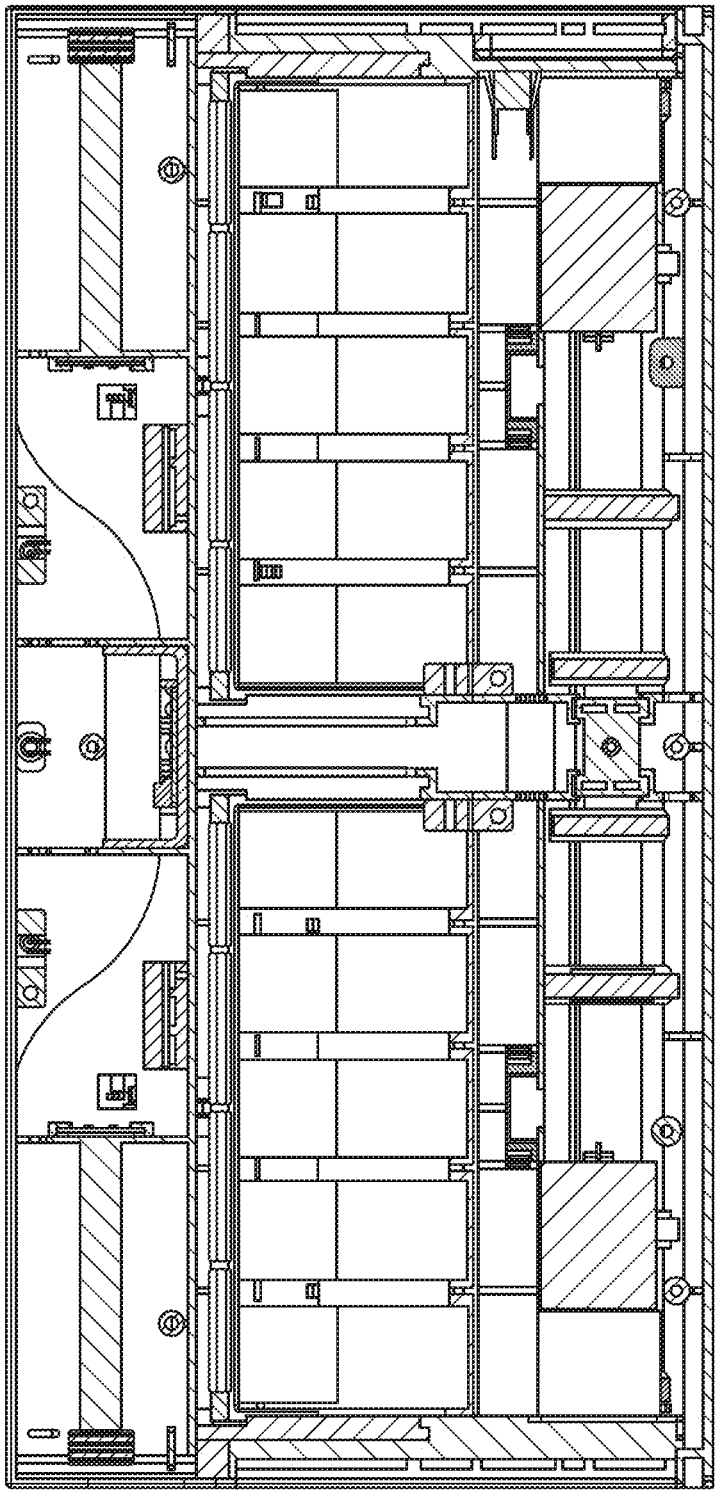

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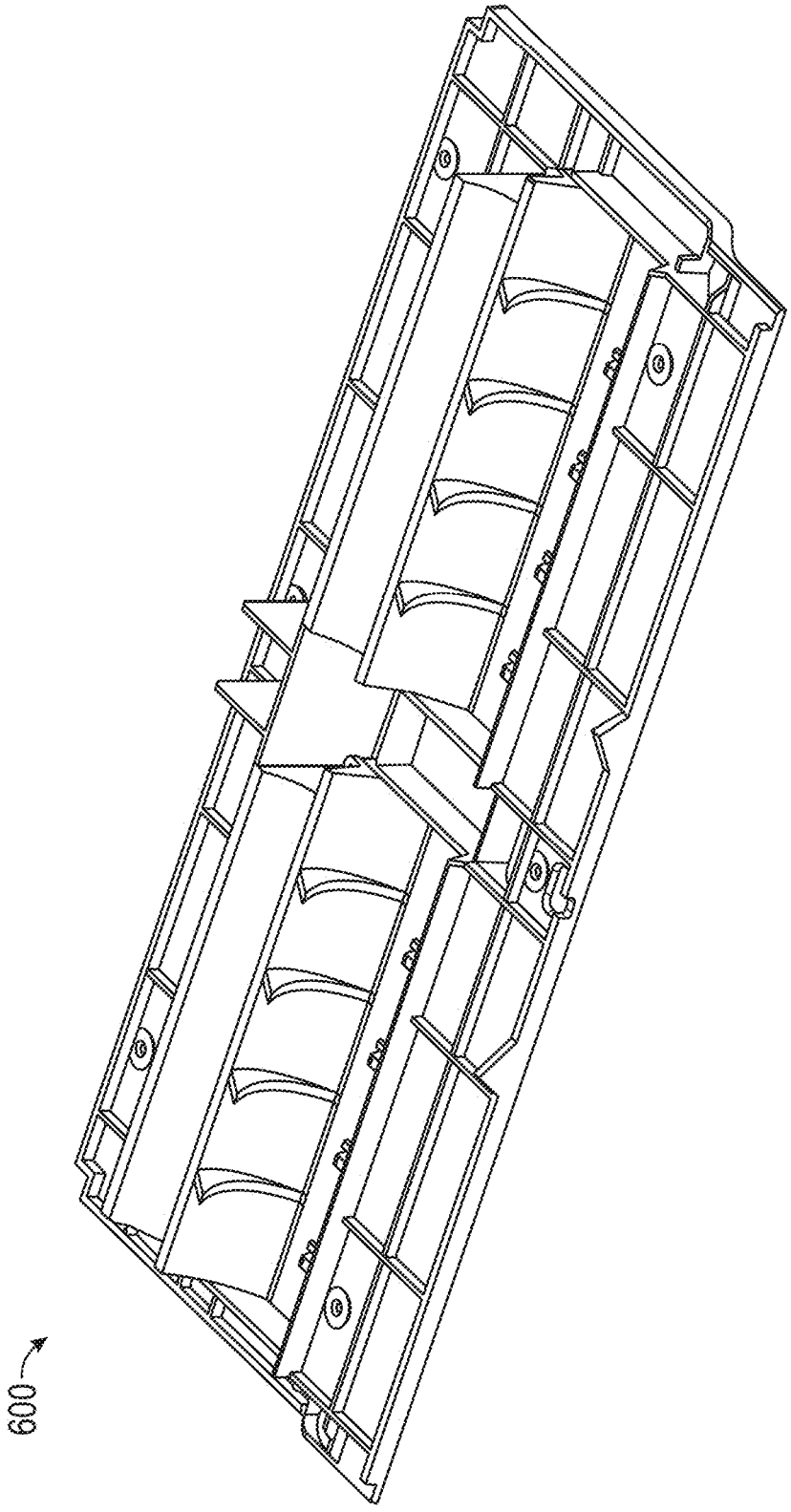
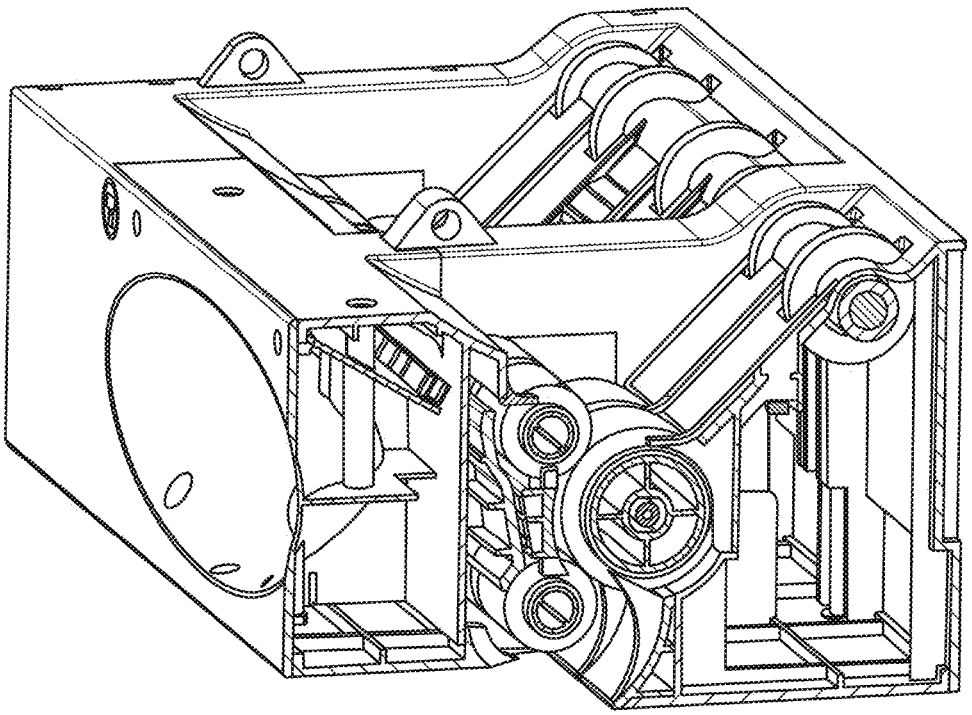


FIG. 33



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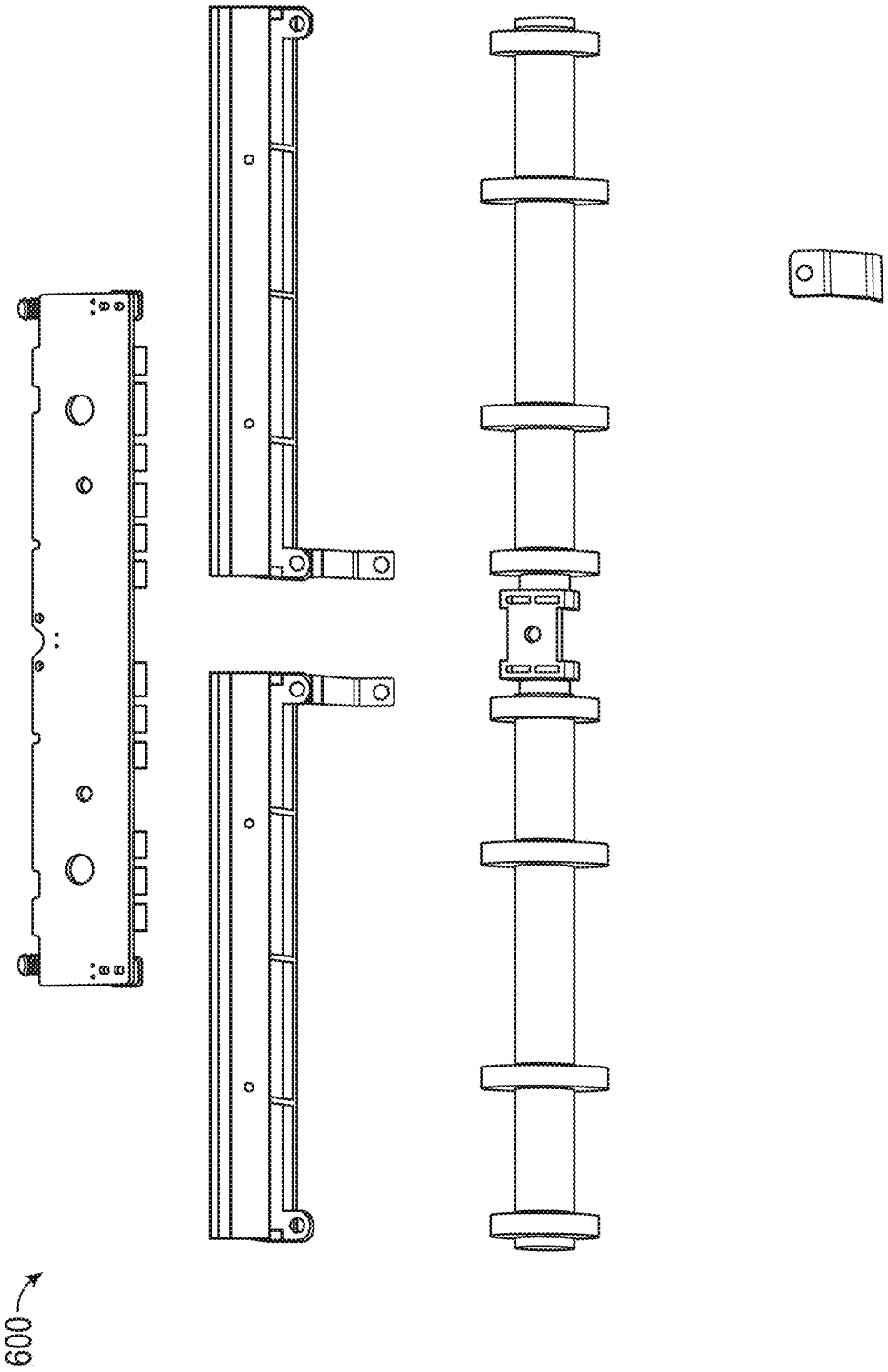

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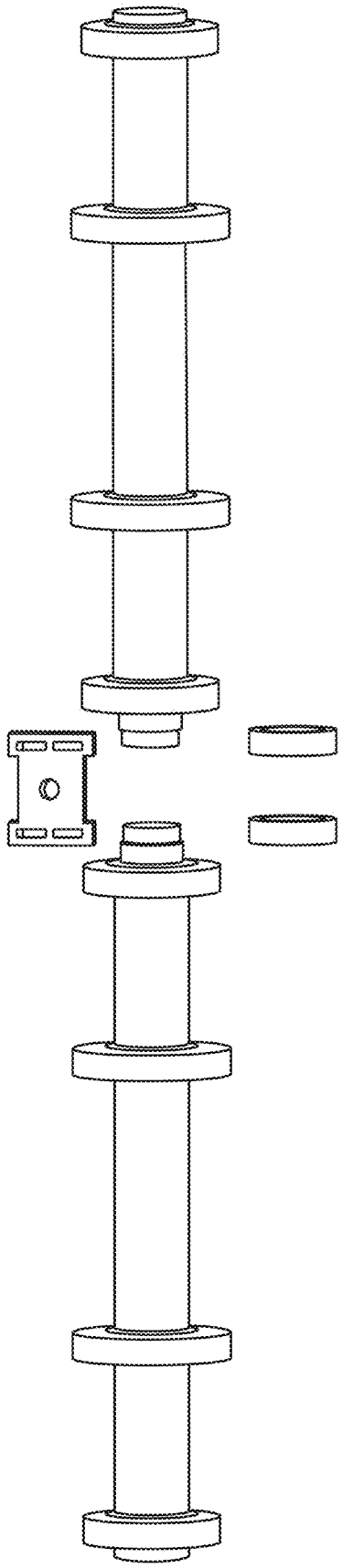

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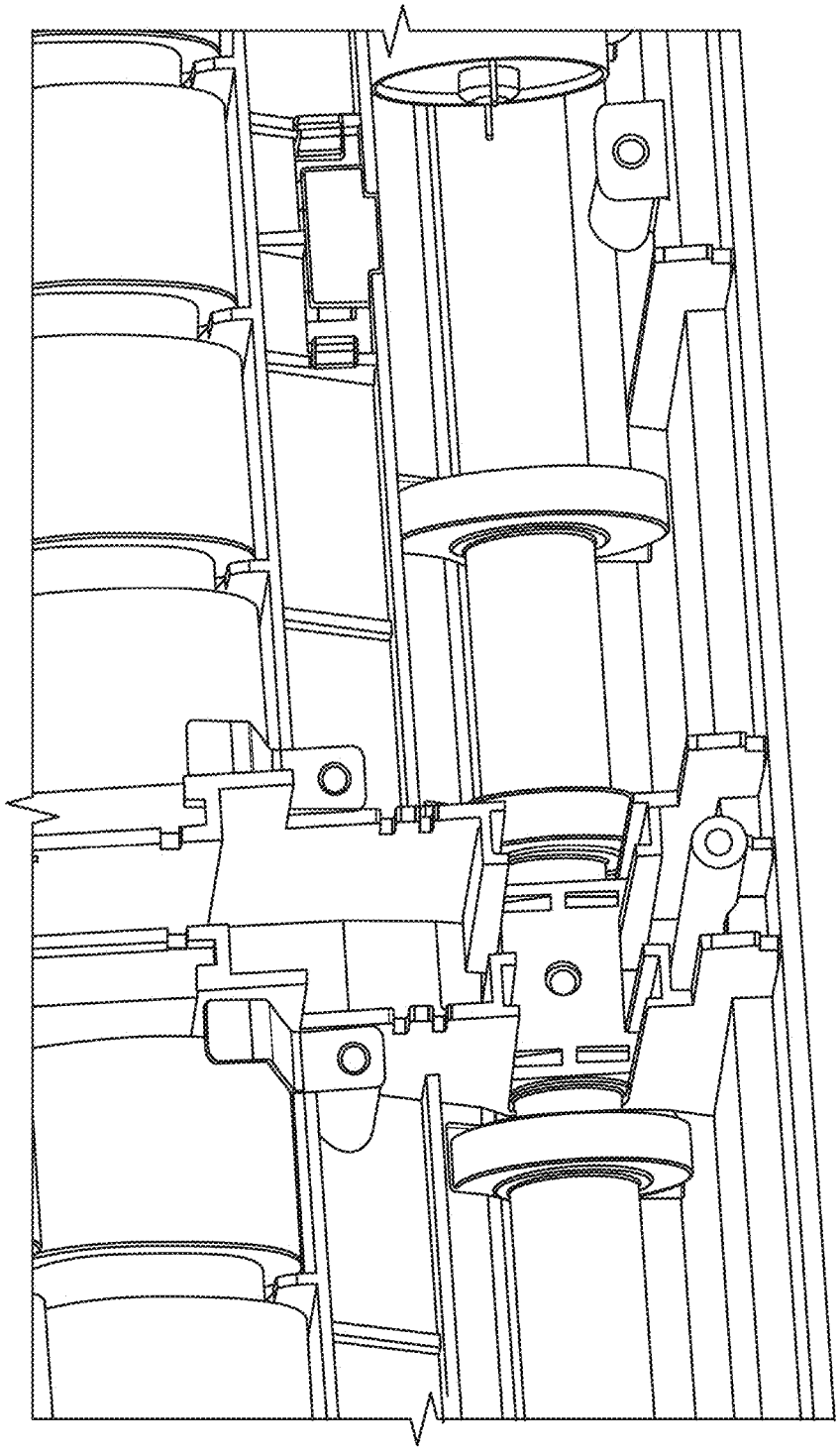

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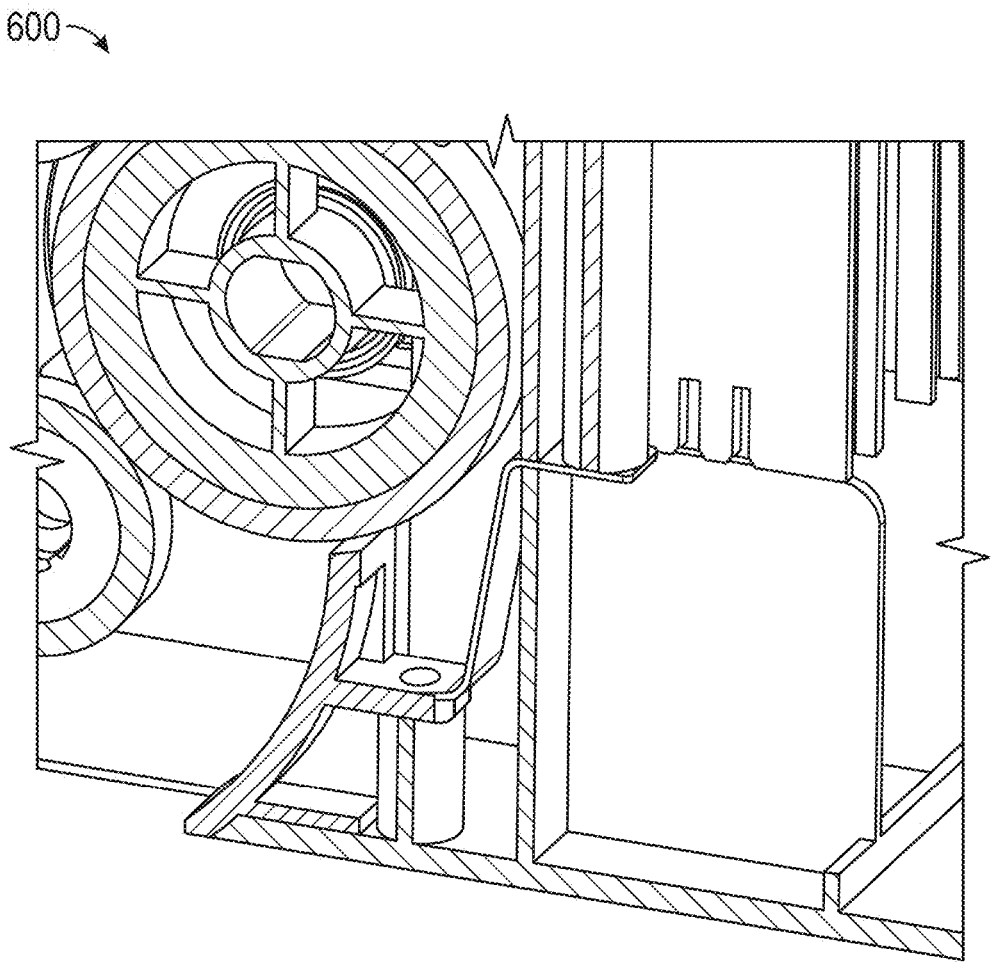

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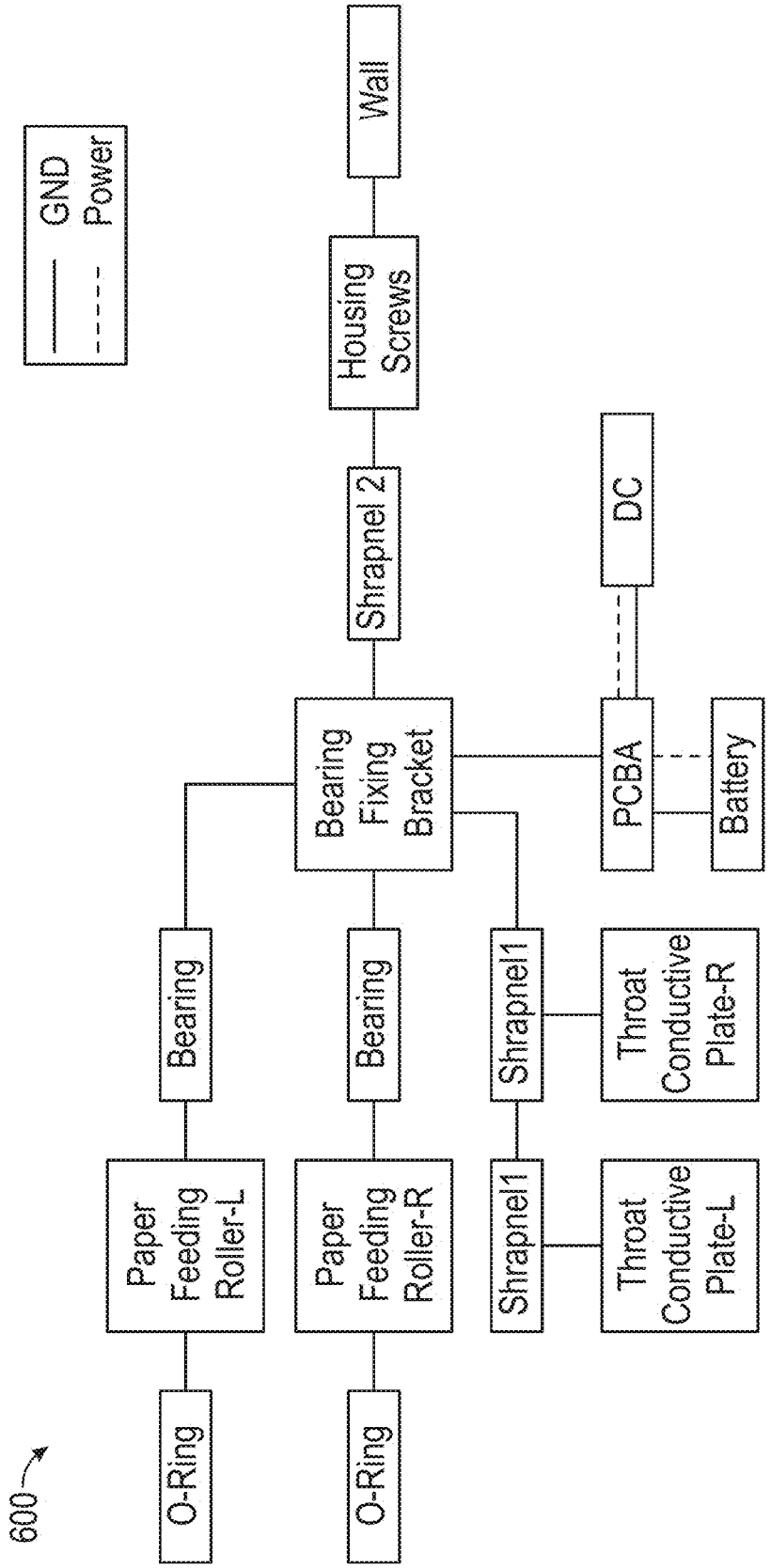
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Housing Screws
Shrapnel 2
DC
Bearing Fixing Bracket
PCBA
Battery
Bearing
Bearing
Shrapnel1
Throat Conductive Plate-R
Paper Feeding Roller-L
Paper Feeding Roller-R
Shrapnel1
Throat Conductive Plate-L
O-Ring
O-Ring
600

FIG. 39

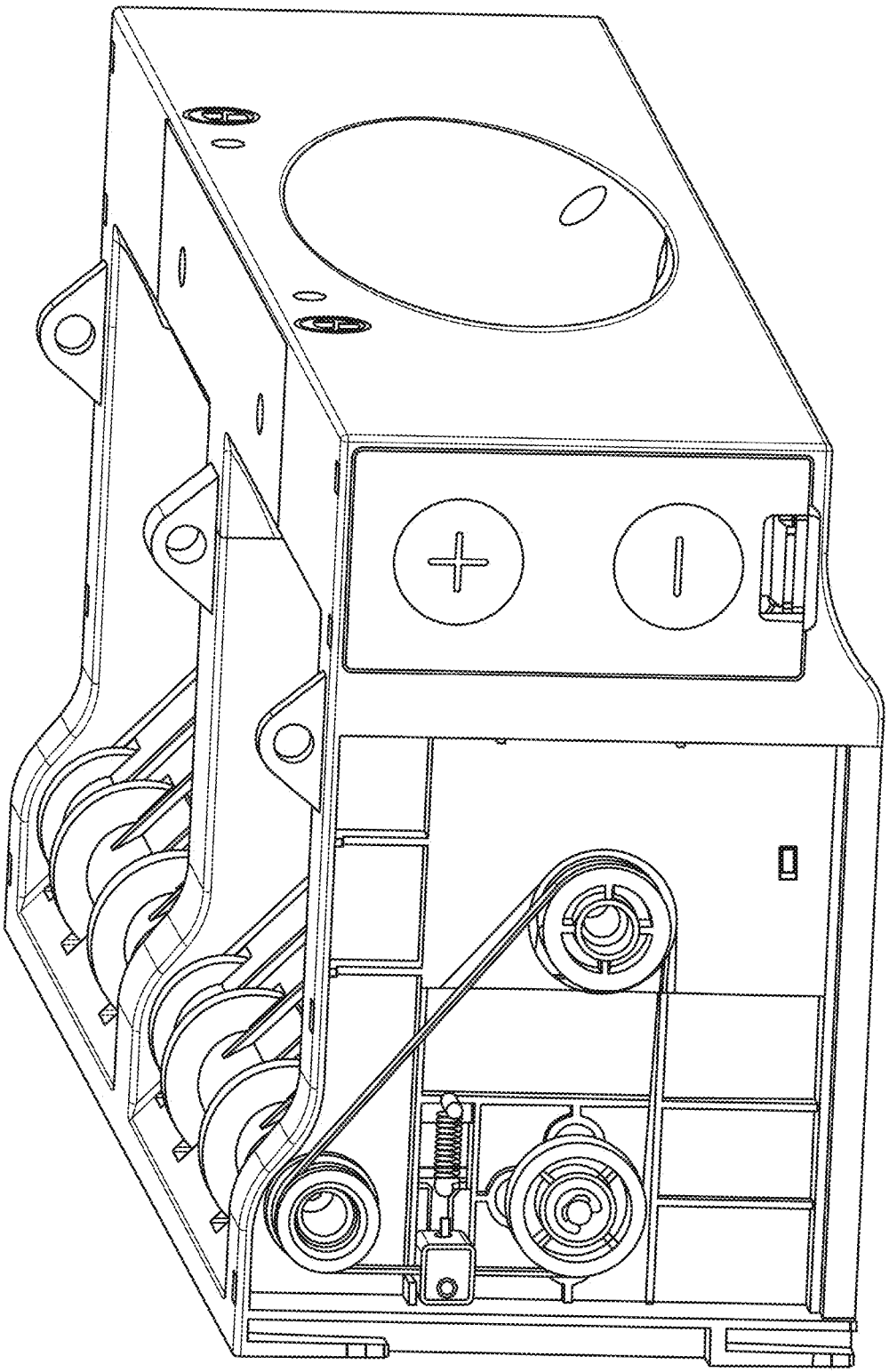


FIG. 40

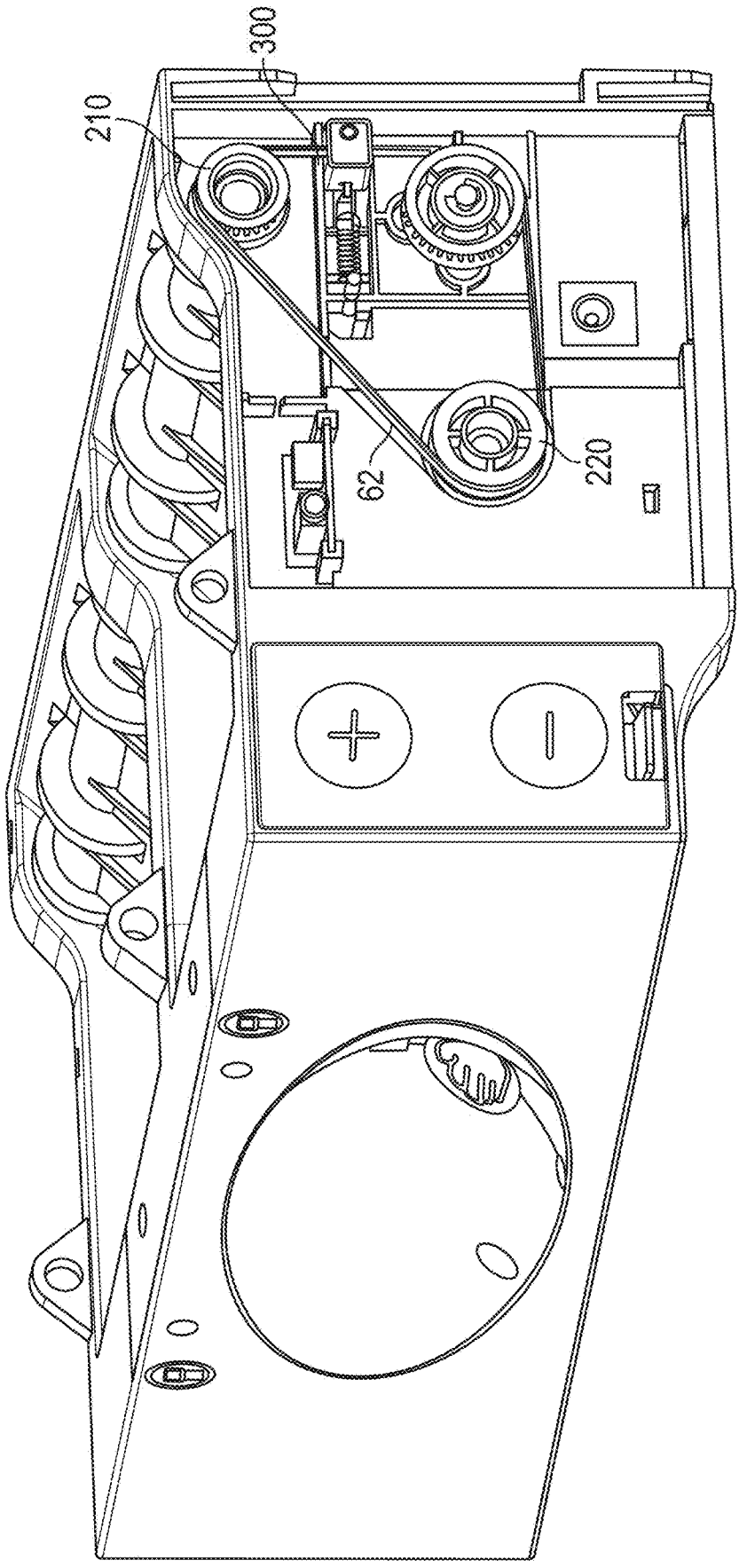


FIG. 41

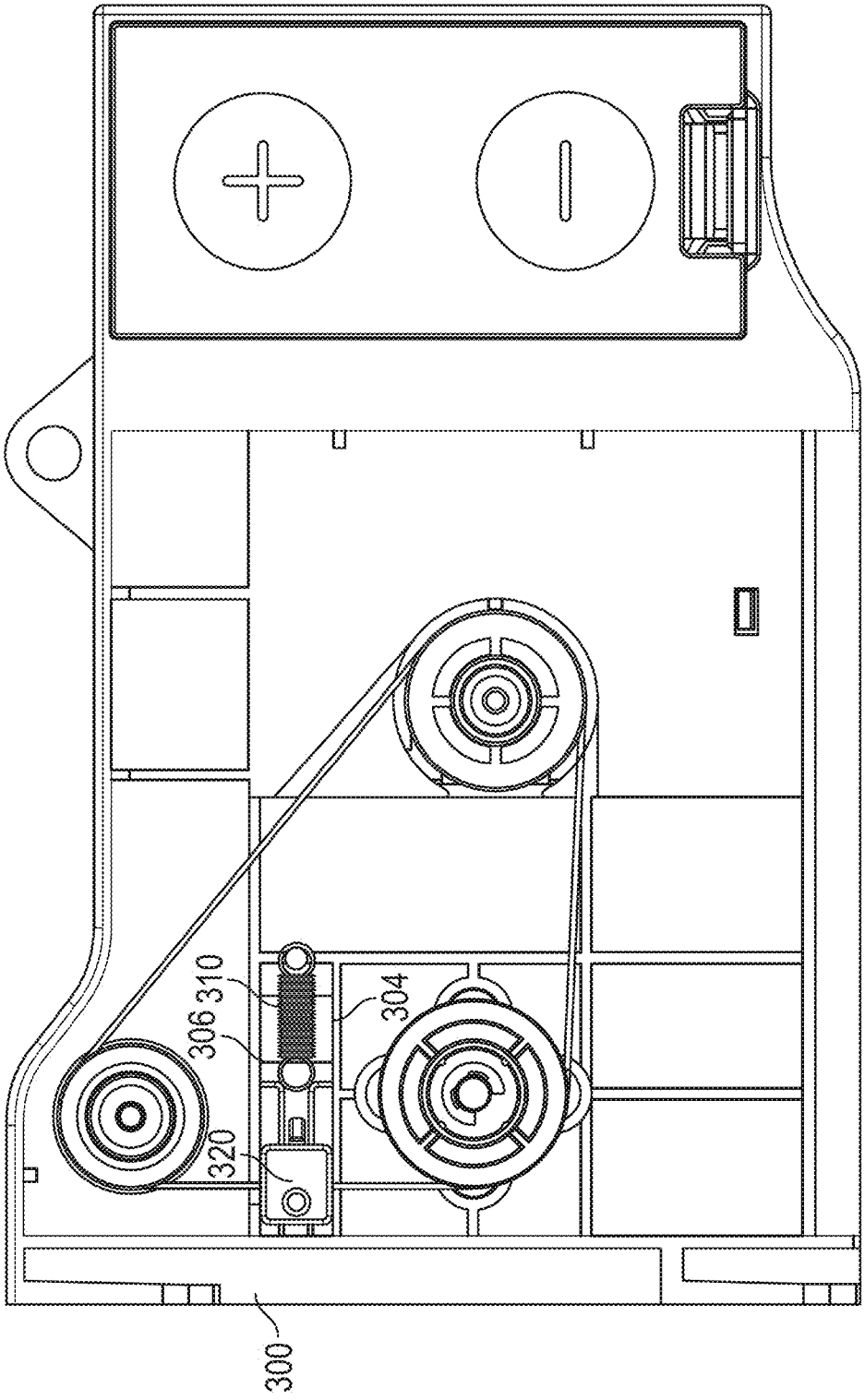
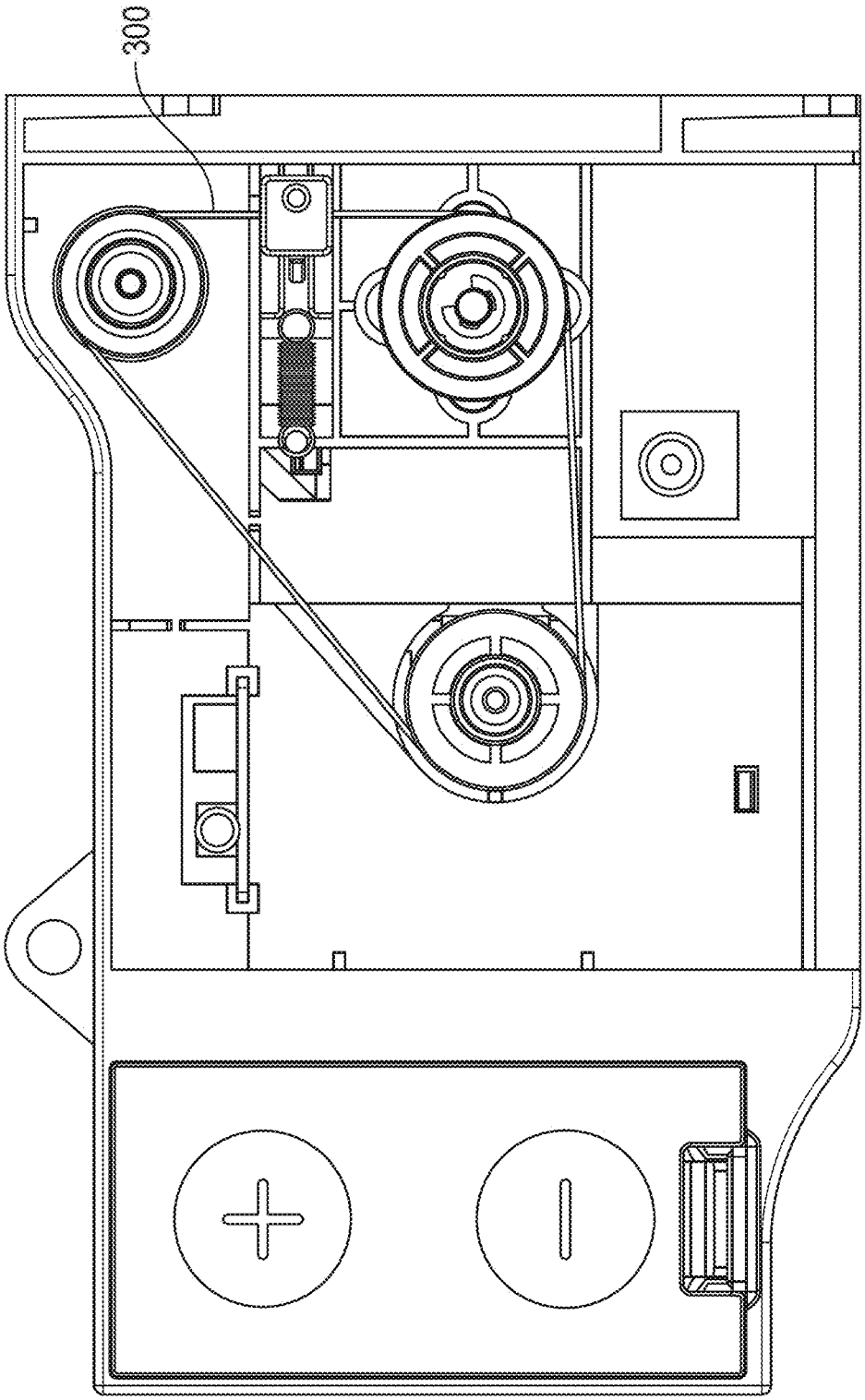


FIG. 42



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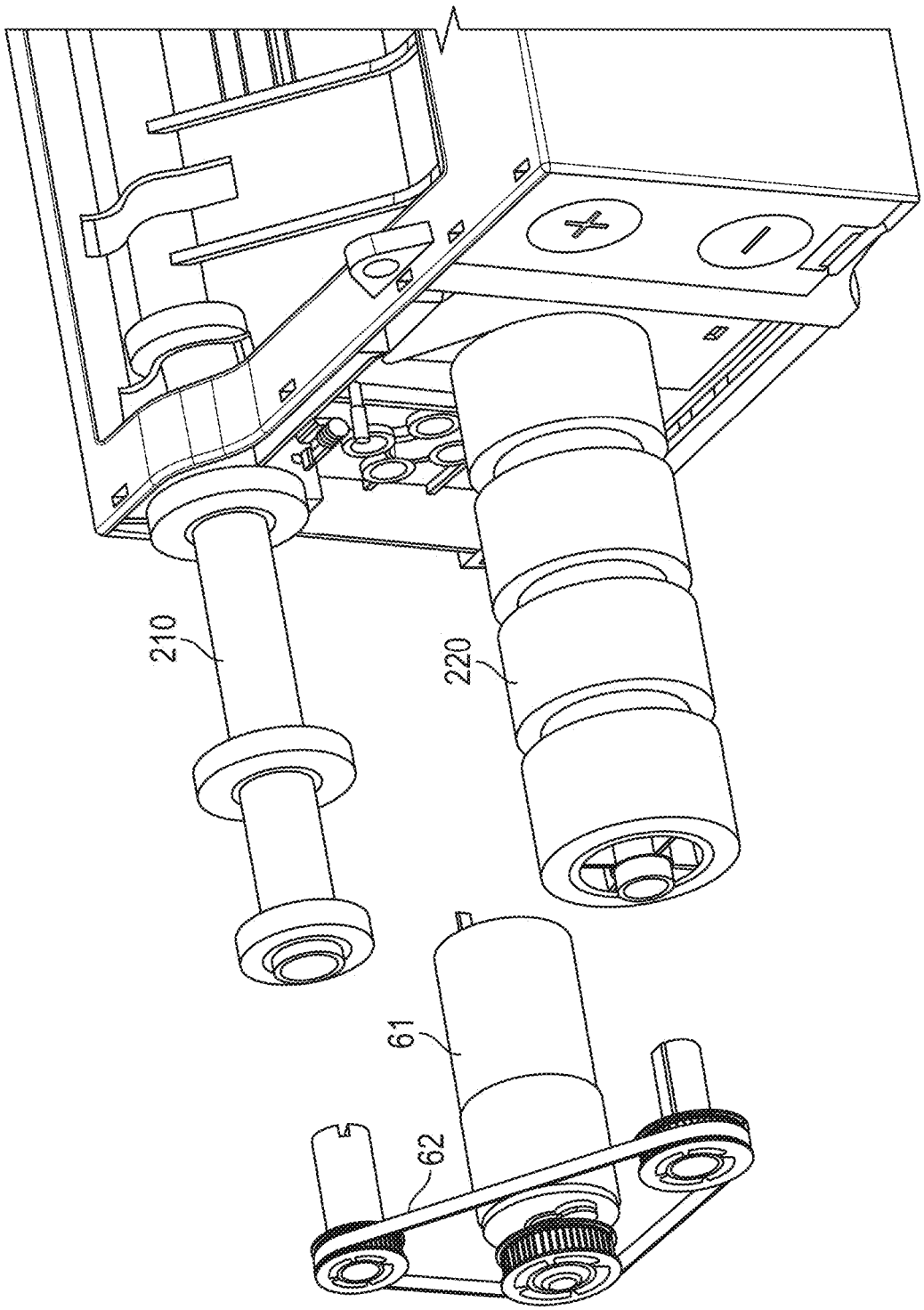

FIG. 44

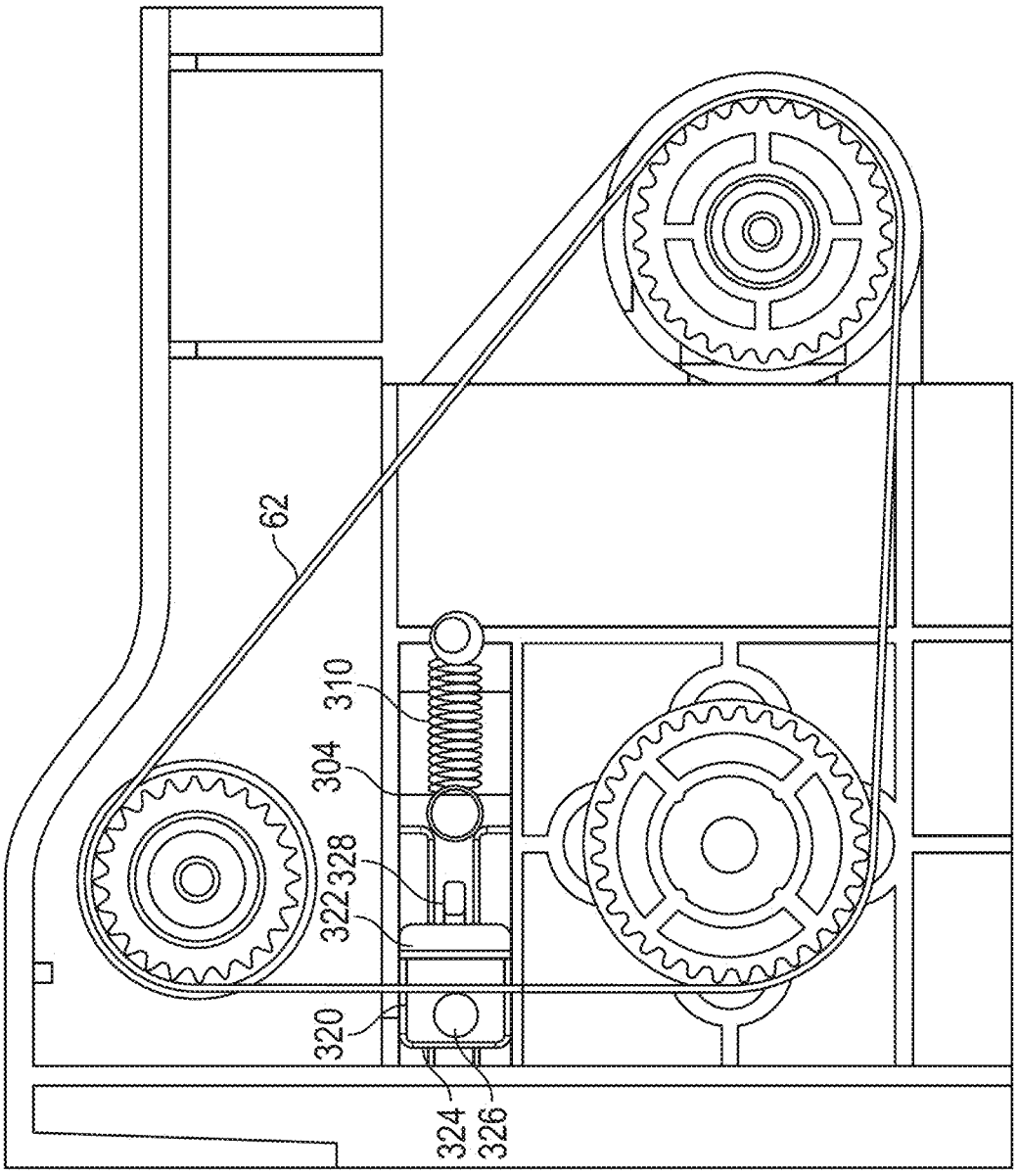

FIG. 45

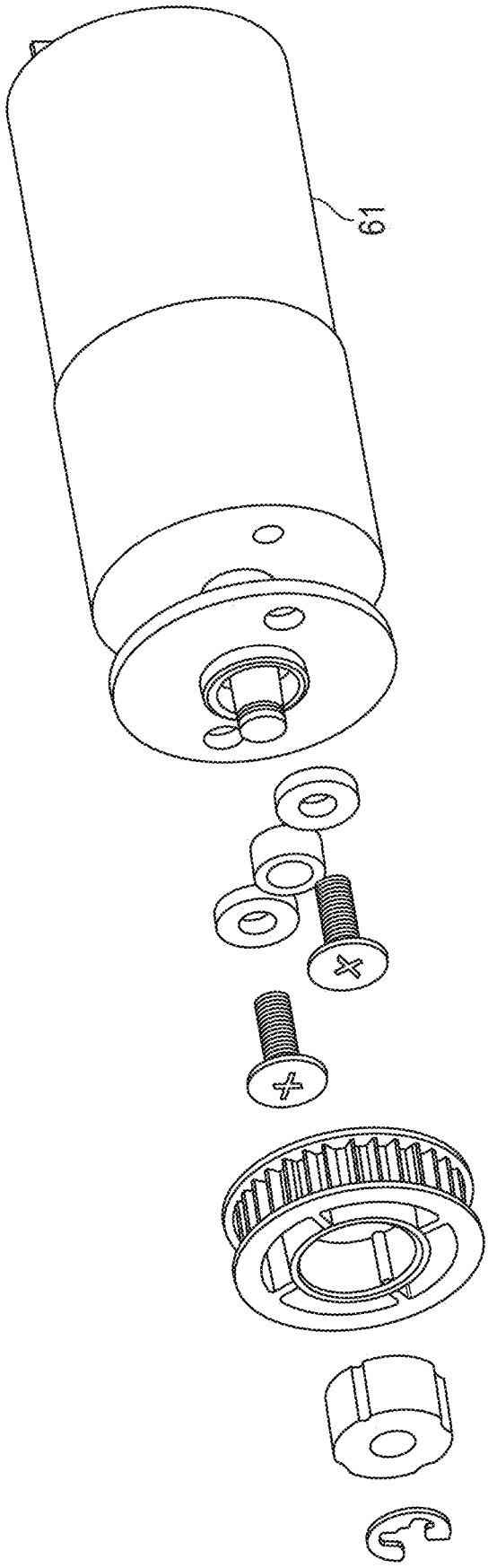

FIG. 46

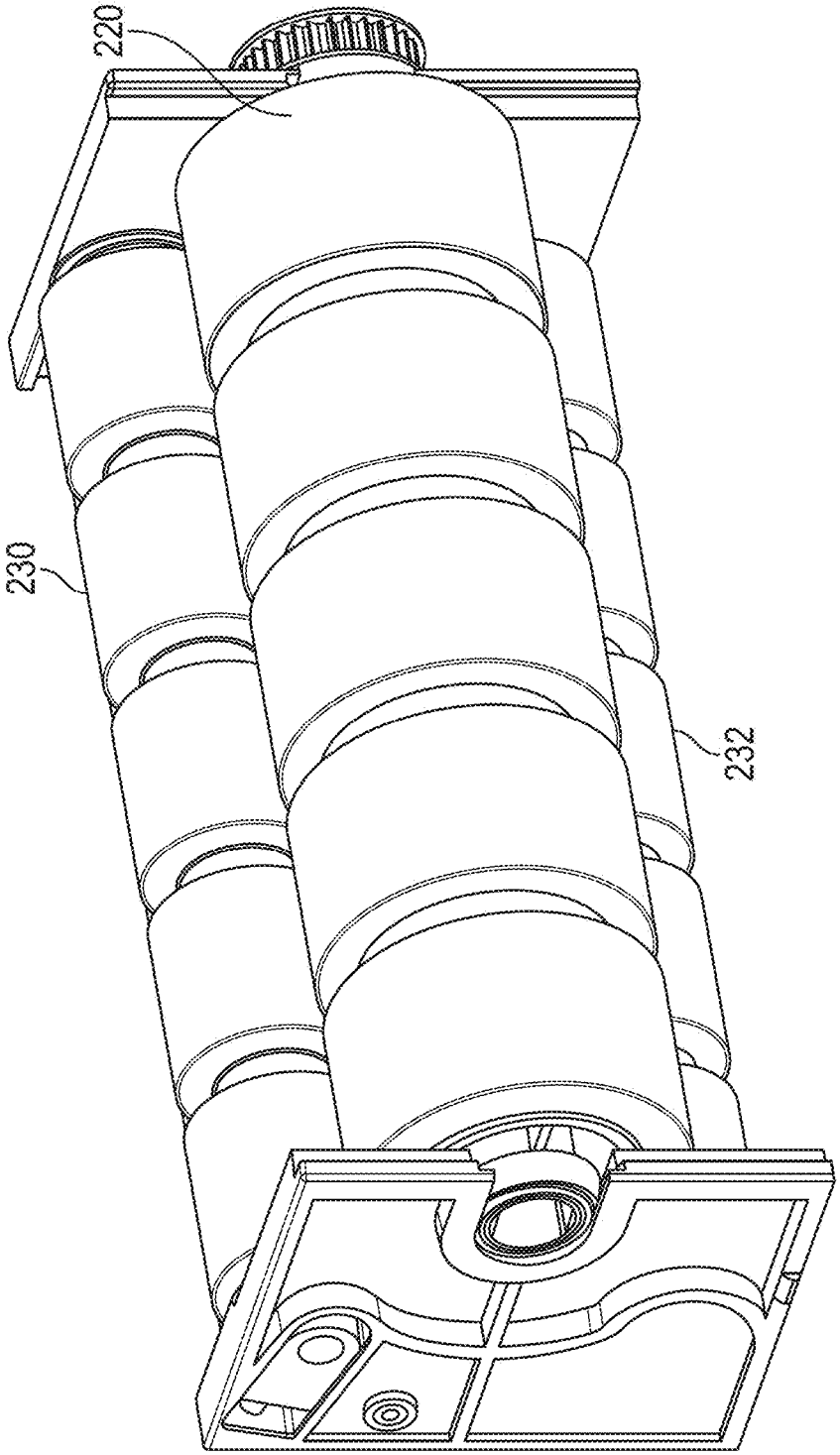

FIG. 47

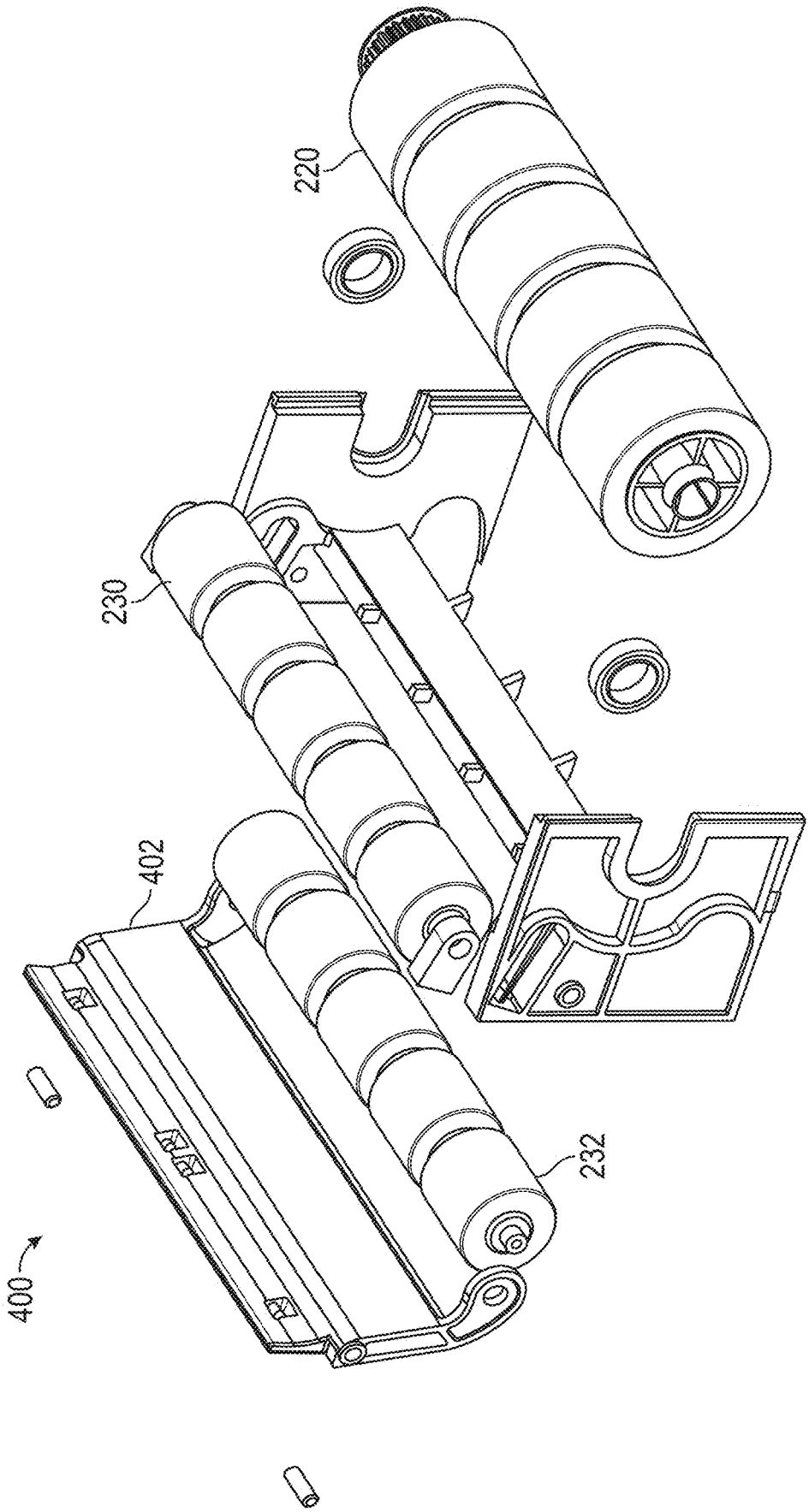

FIG. 48

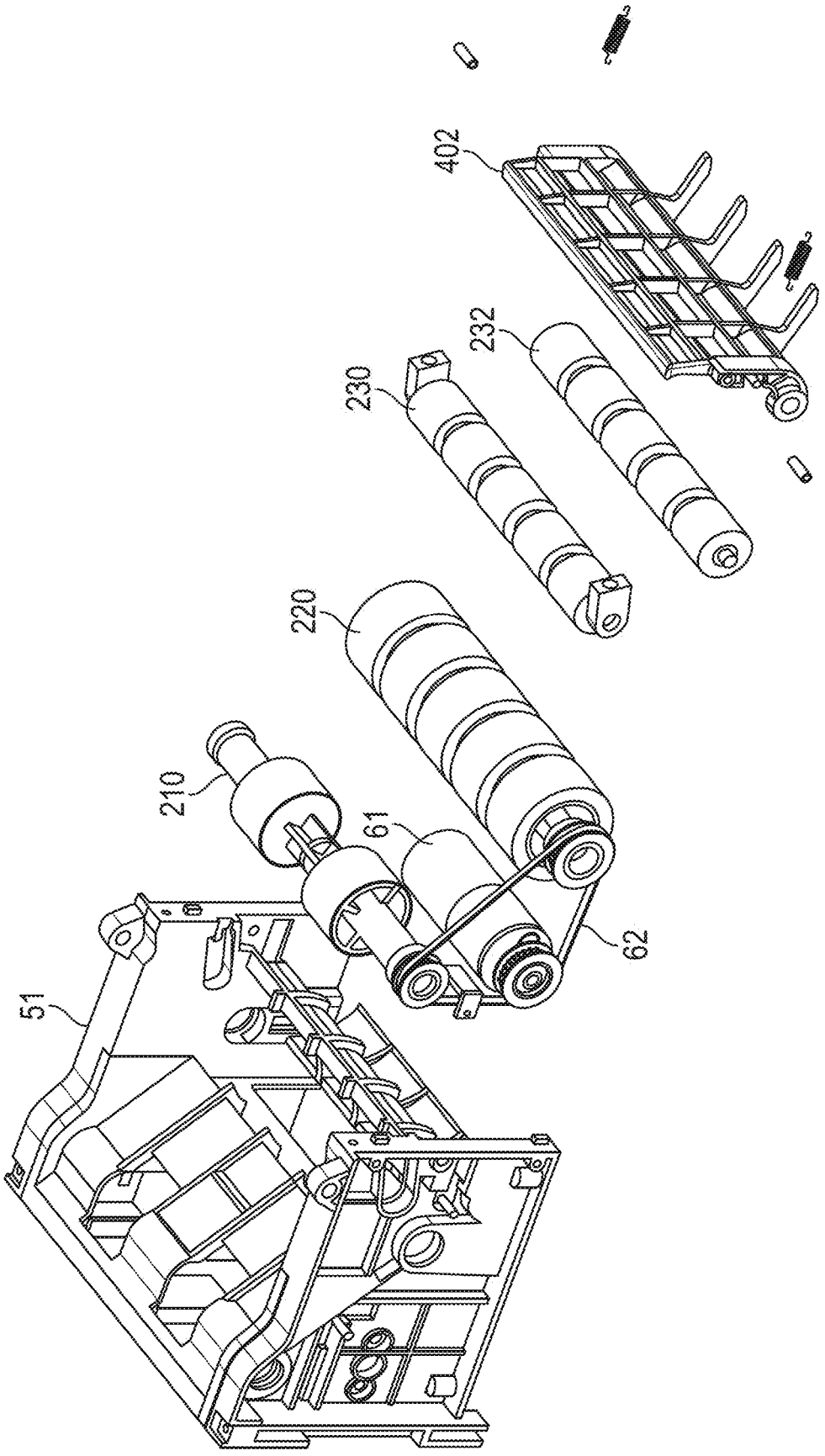

FIG. 49

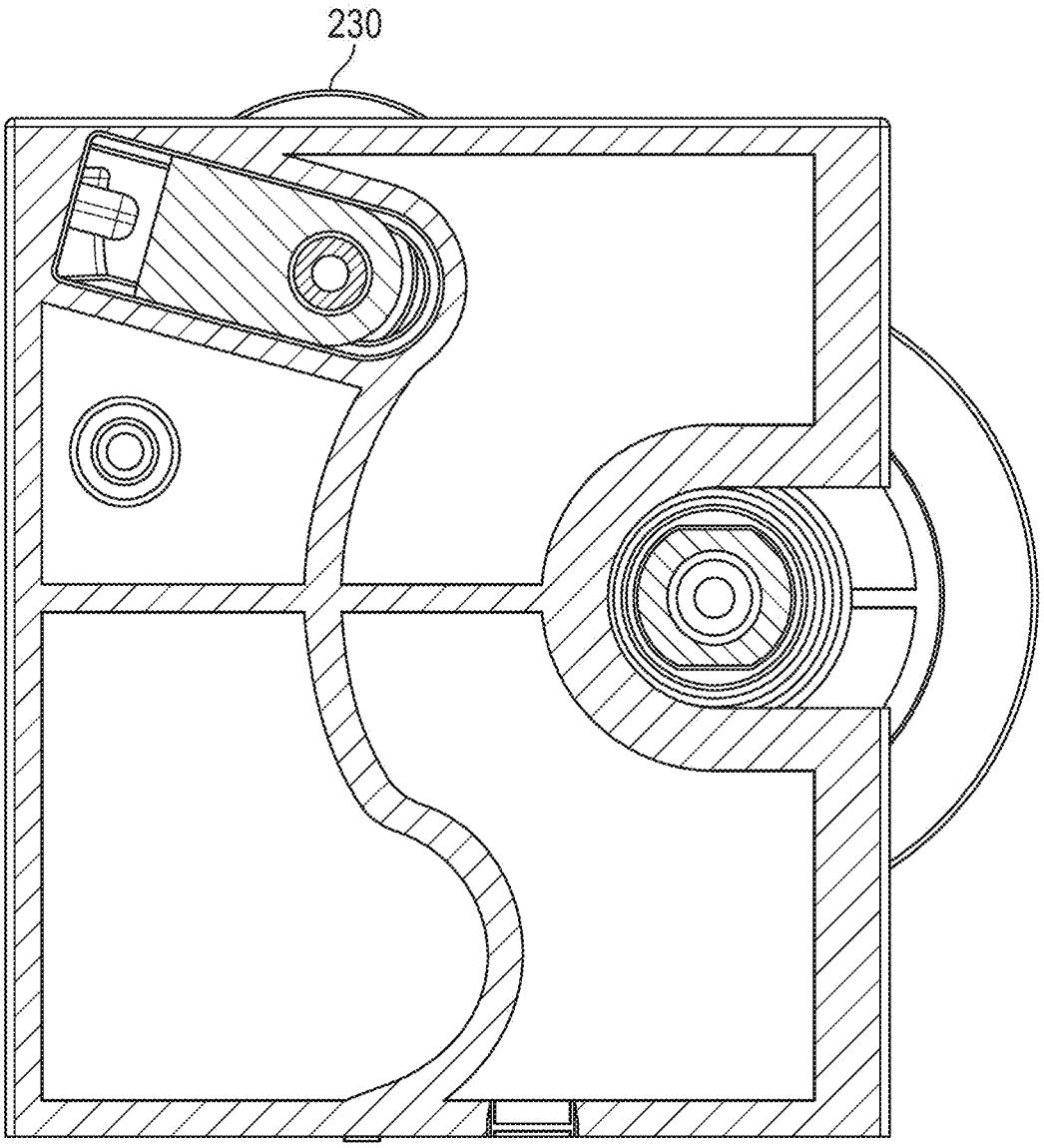

FIG. 50

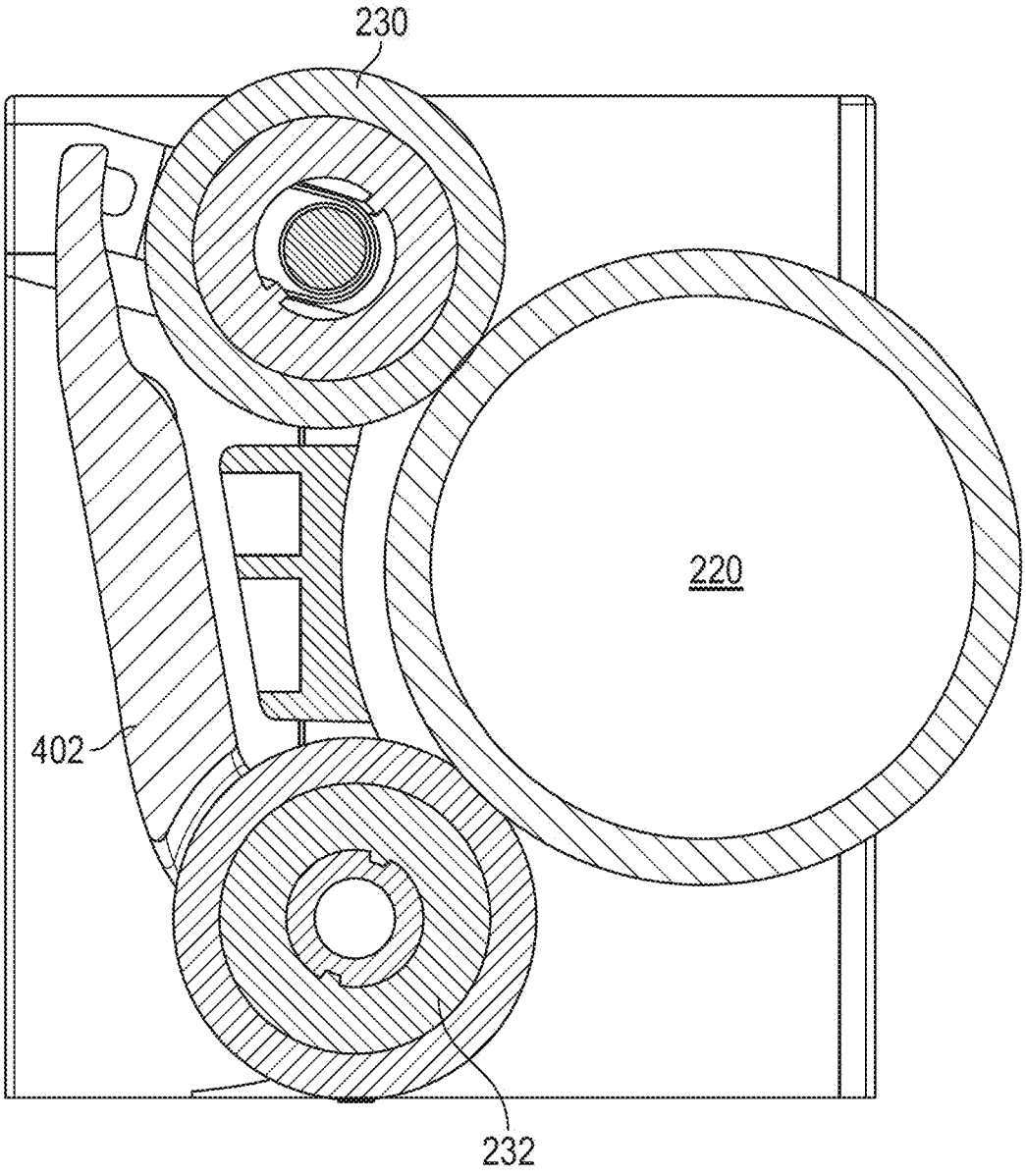

FIG. 51

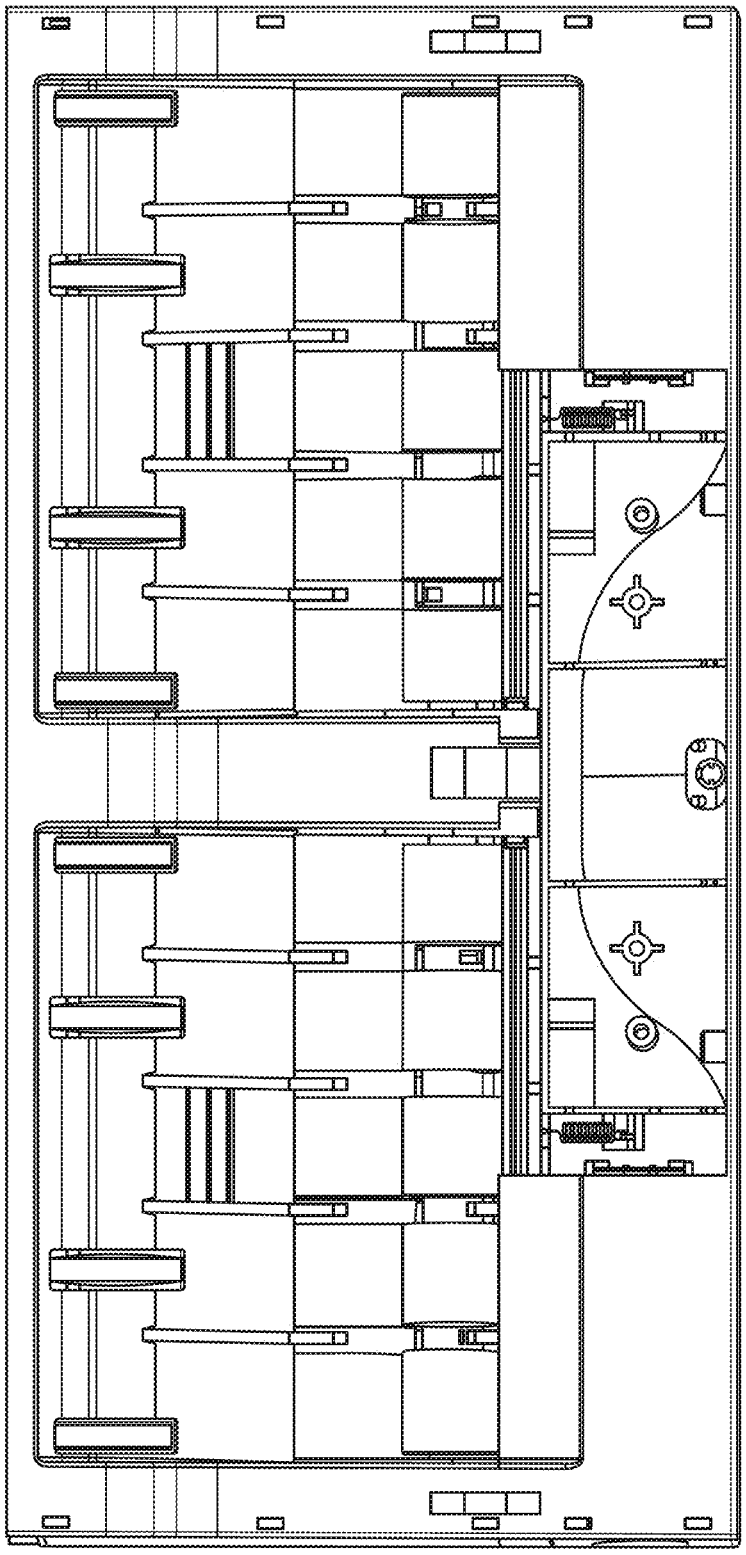

FIG. 52

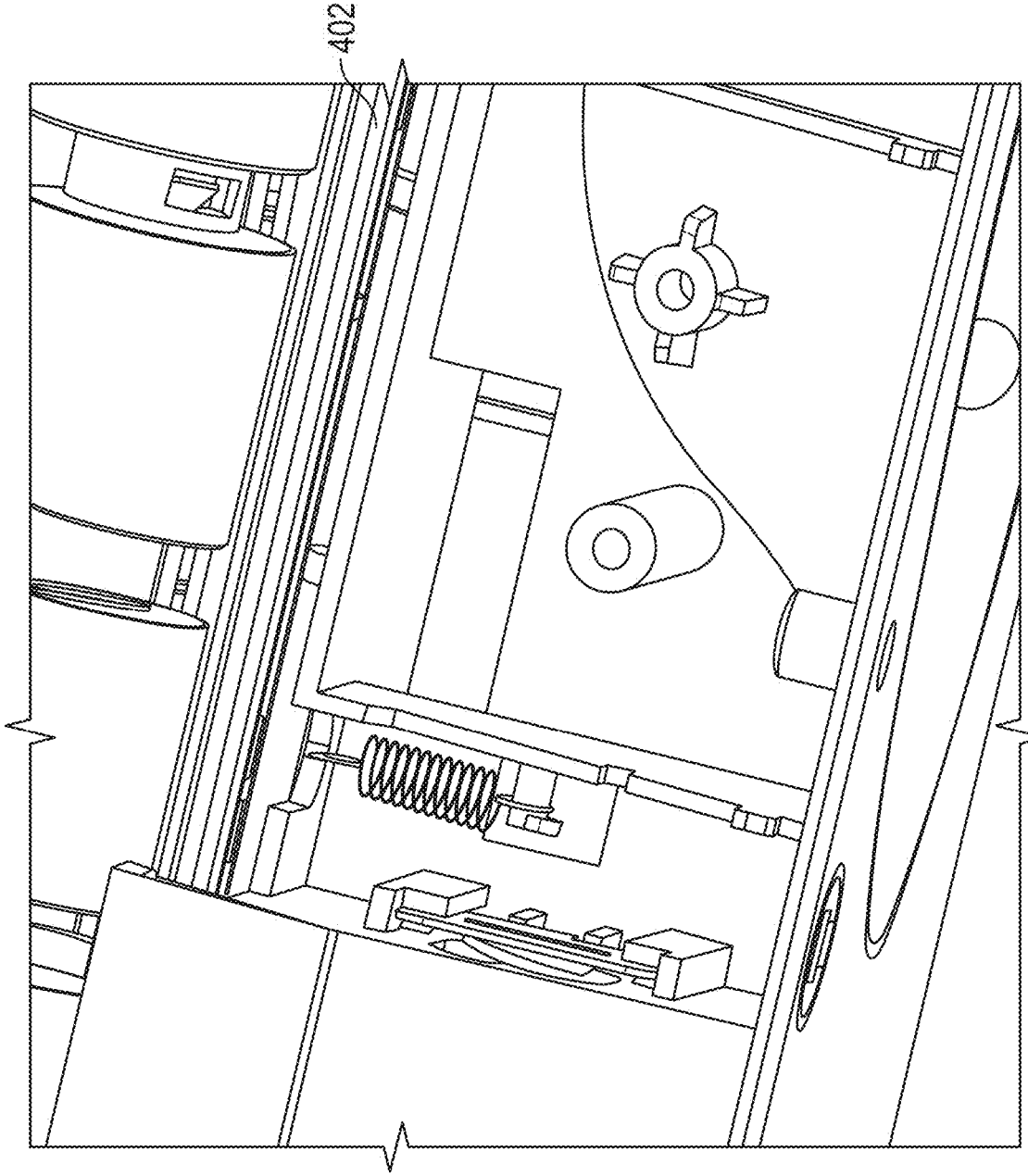

FIG. 53

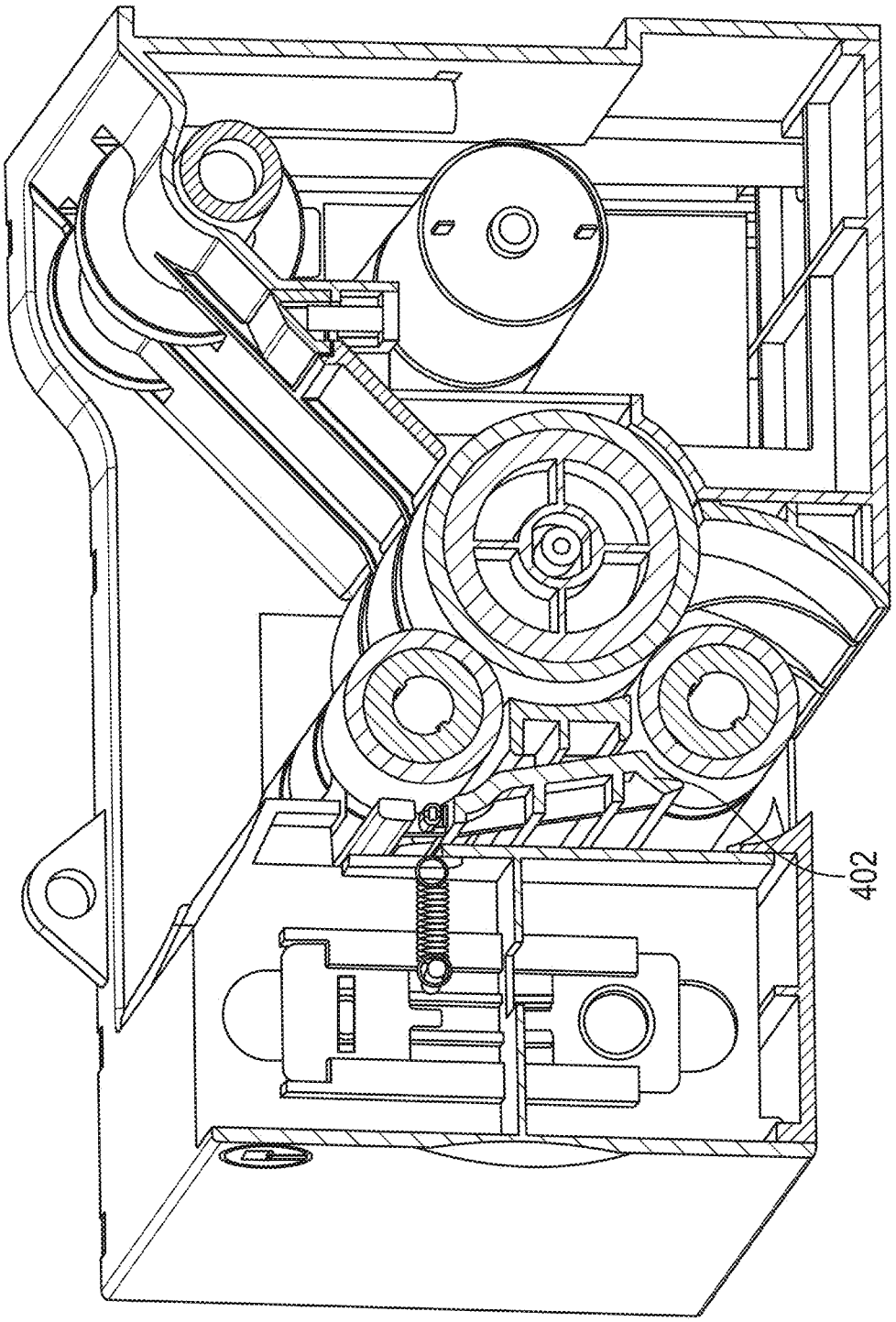

FIG. 54

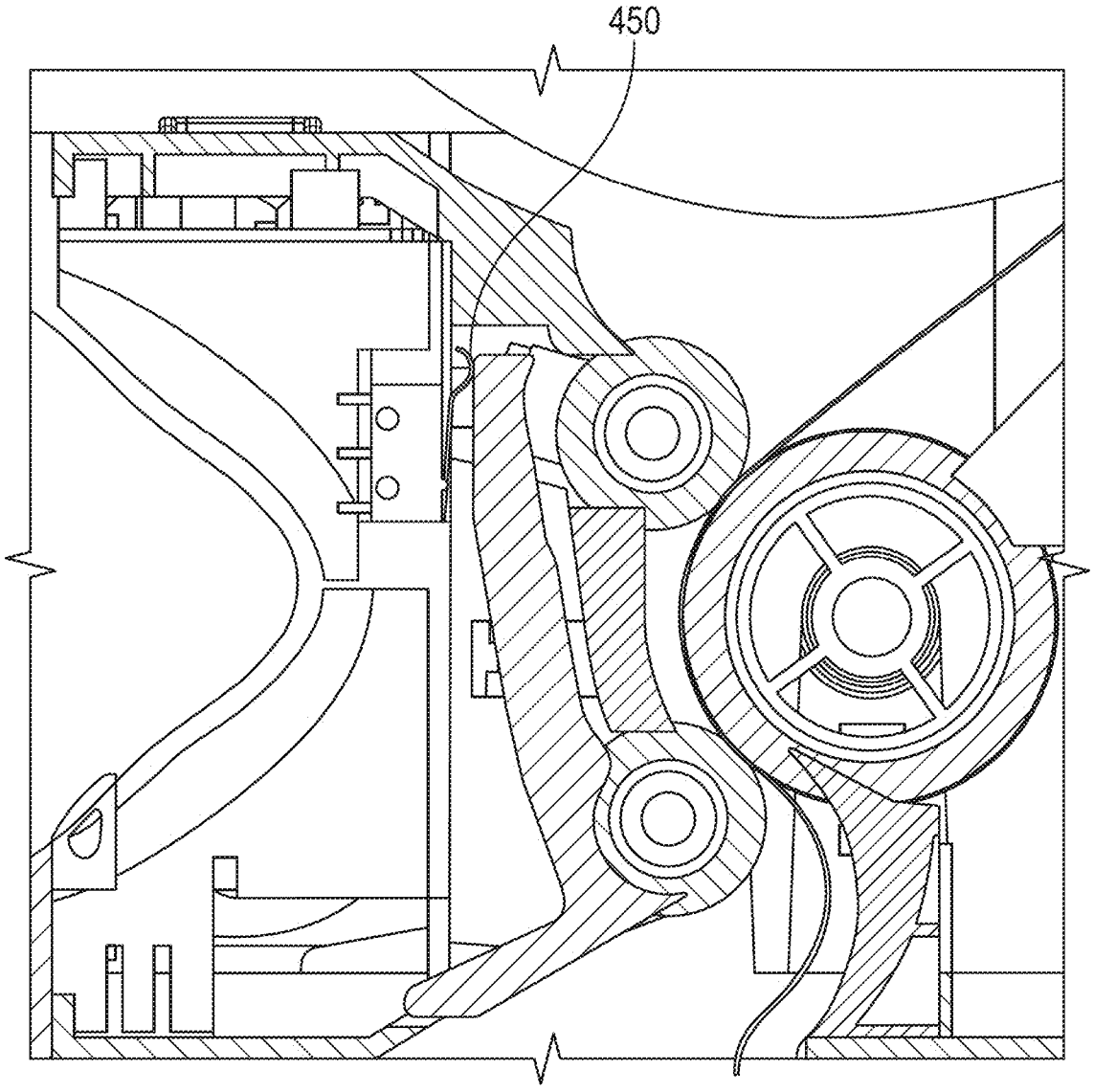

FIG. 55

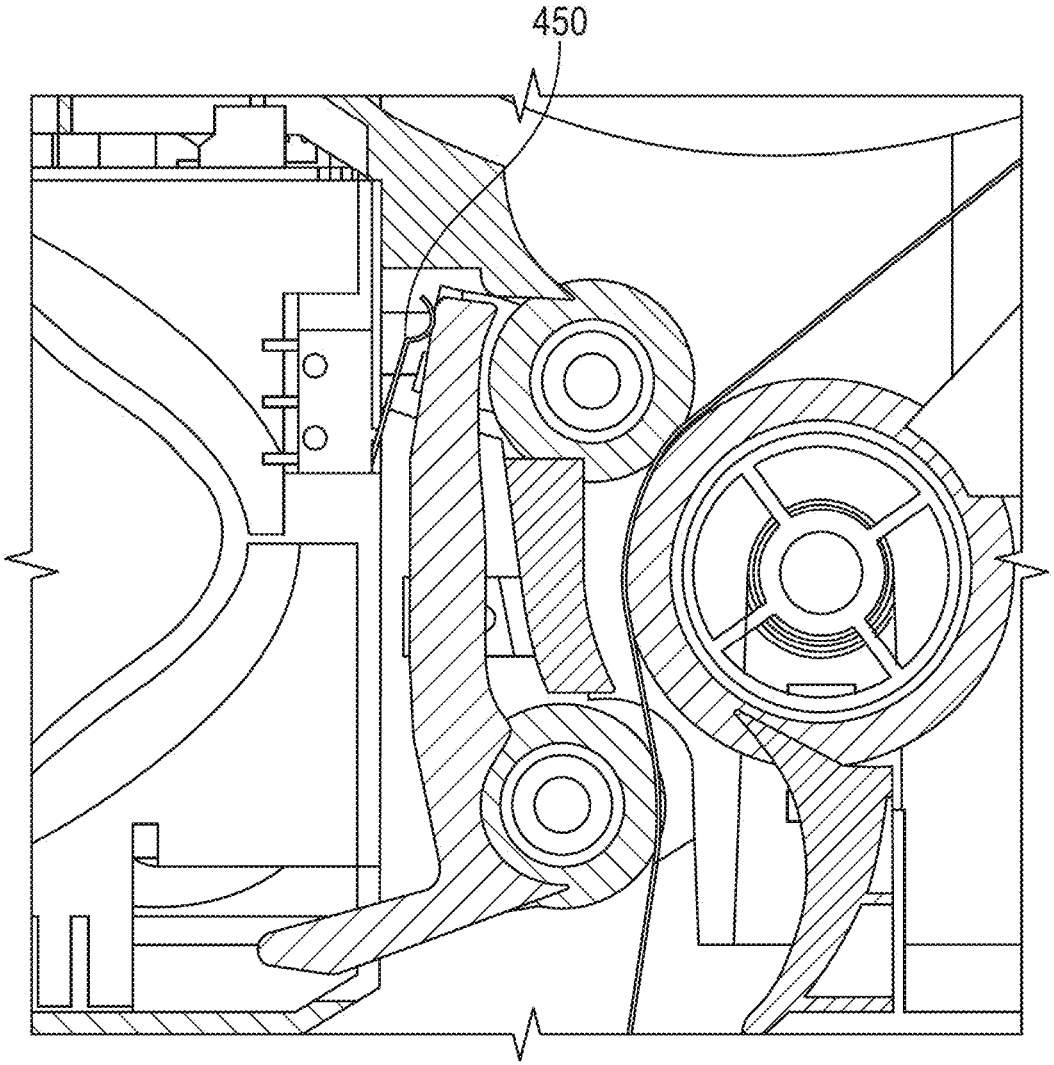

FIG. 56

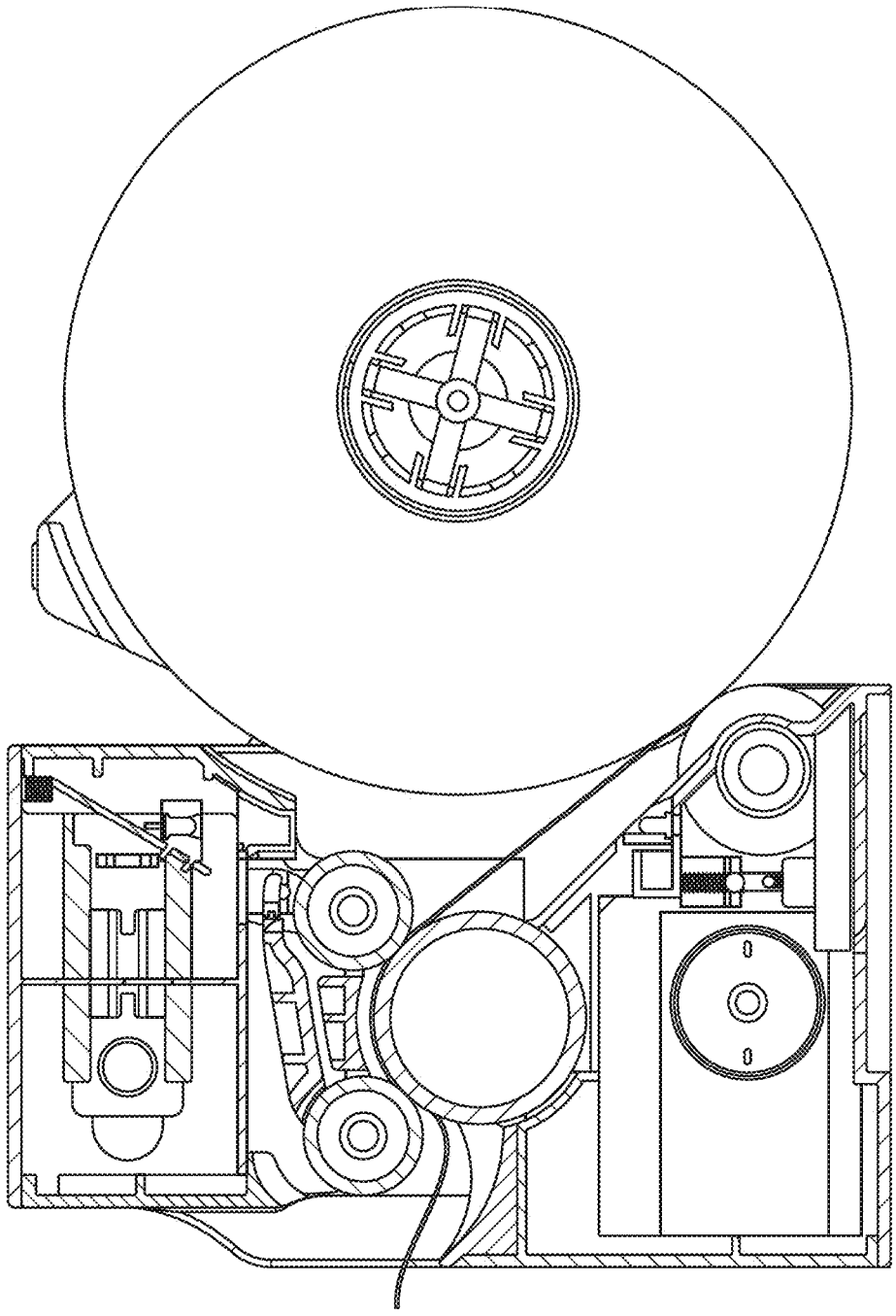

FIG. 57

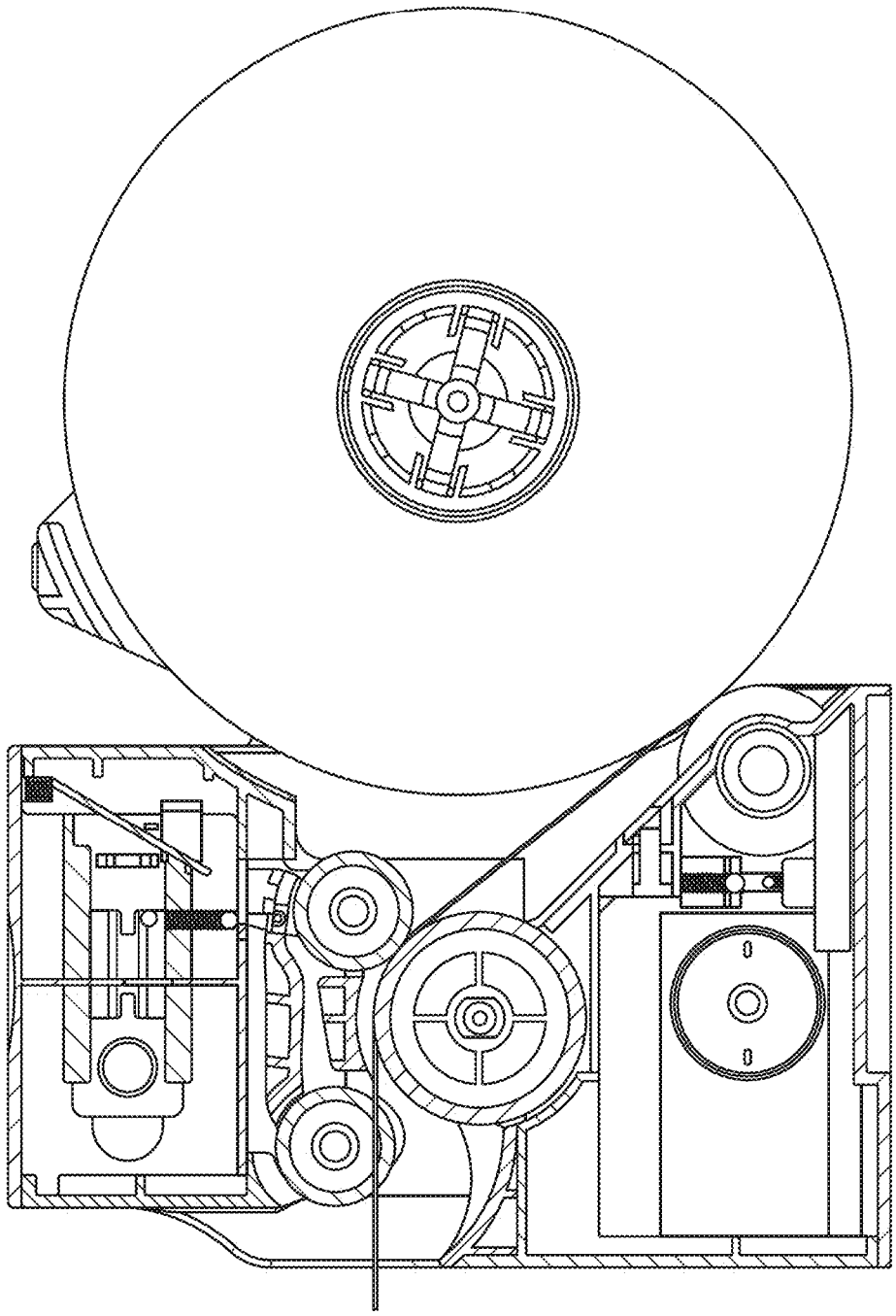

FIG. 58

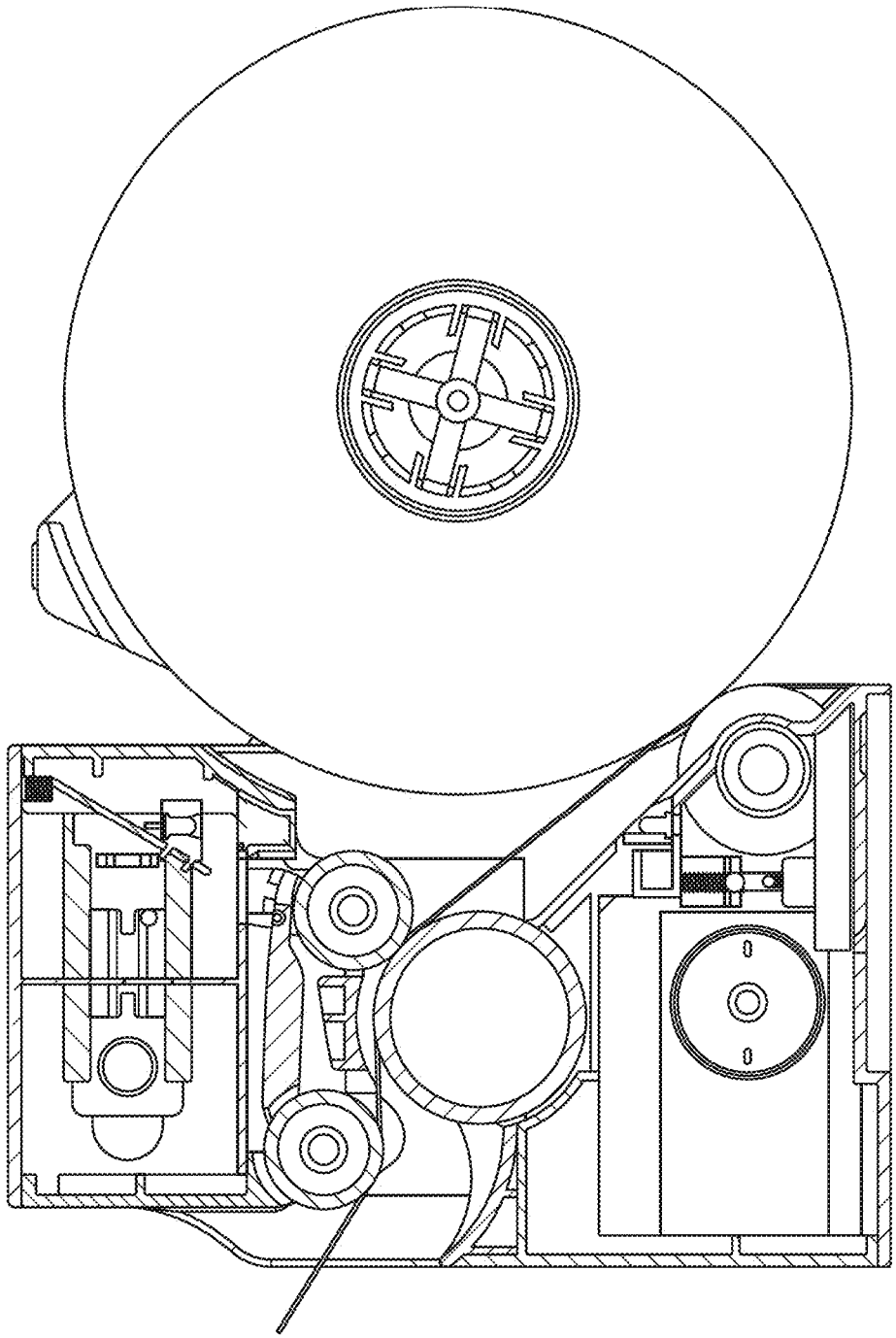

FIG. 59

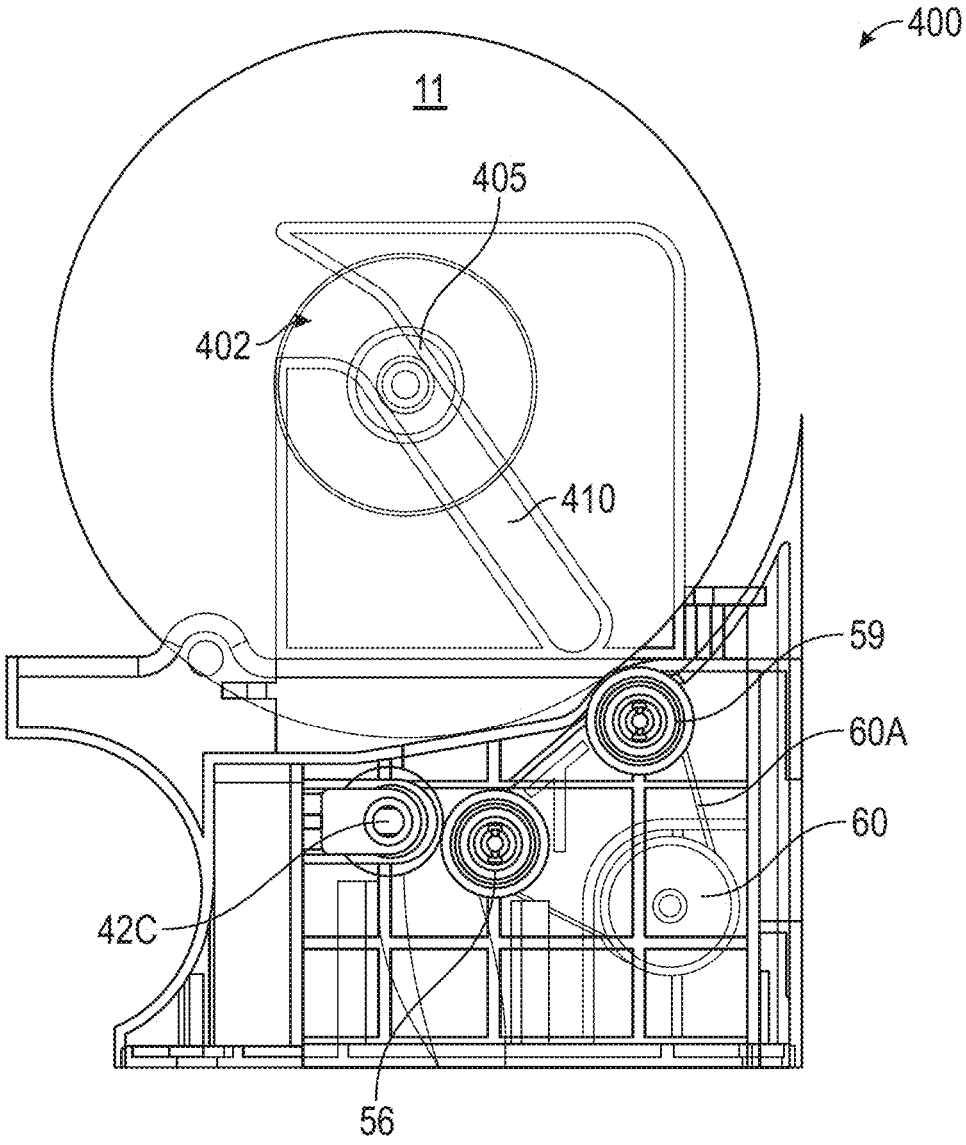

FIG. 60

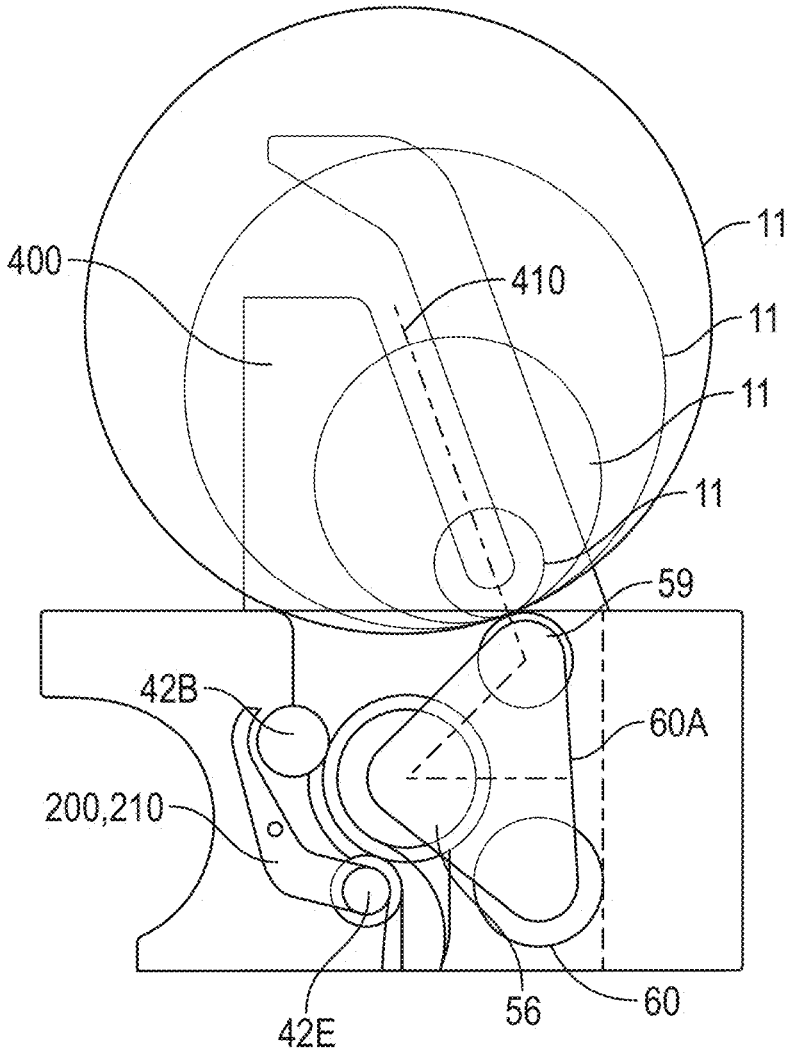

FIG. 61

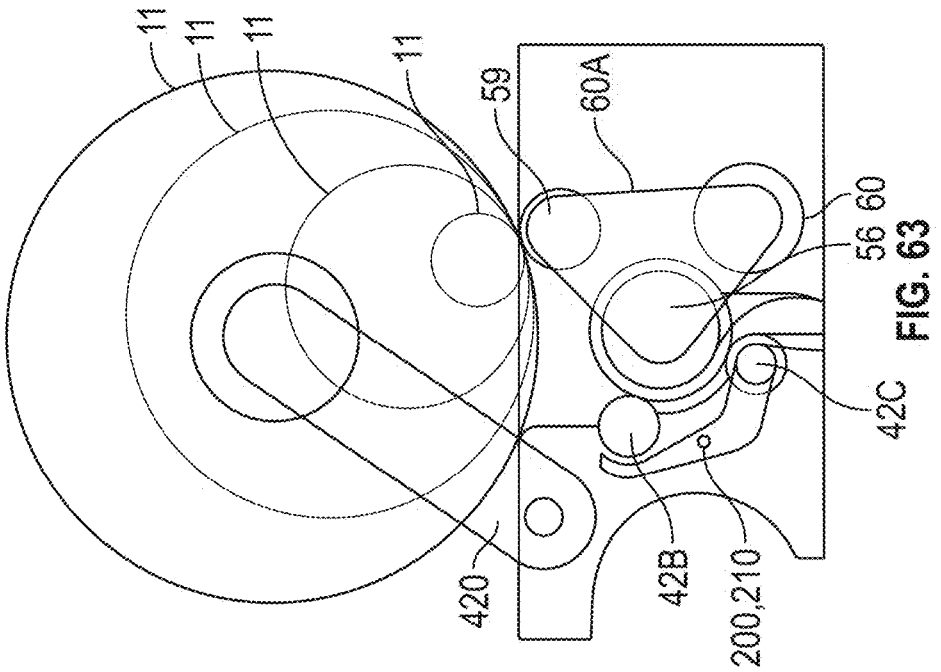
11
11
11
11
59
60A
60
56
42C
42B
200,210
420

FIG. 63

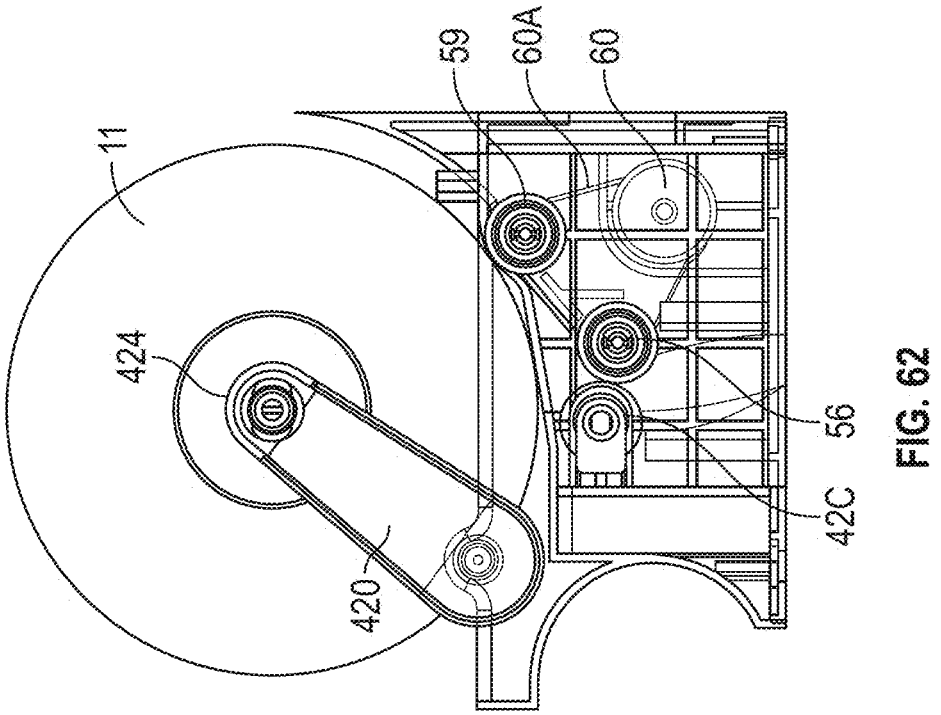
59
60A
60
11
424
56
42C
420

FIG. 62

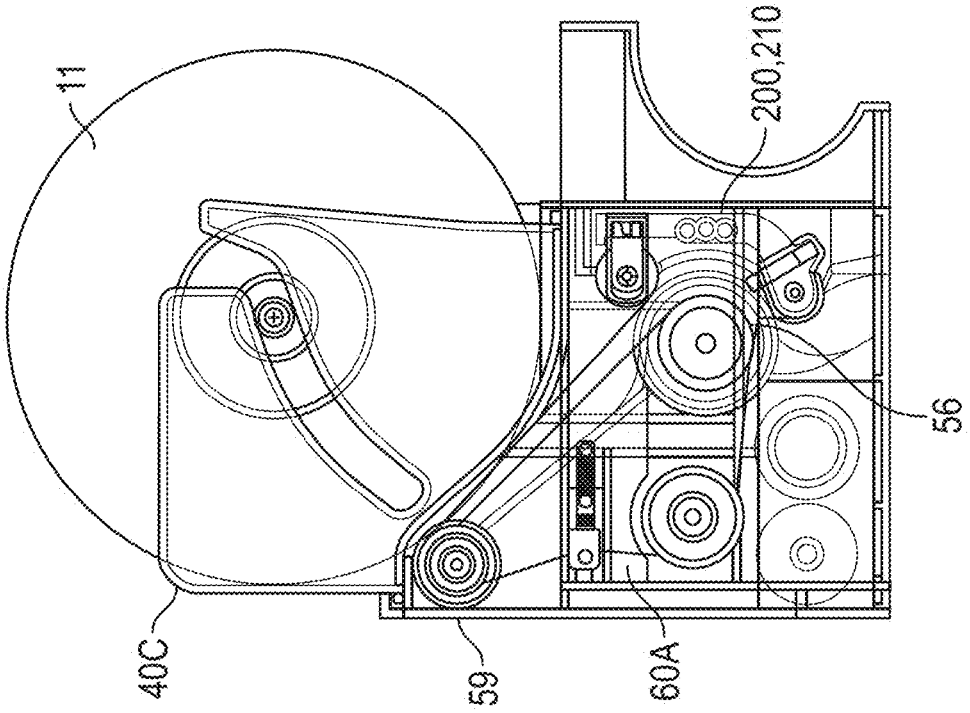

FIG. 65

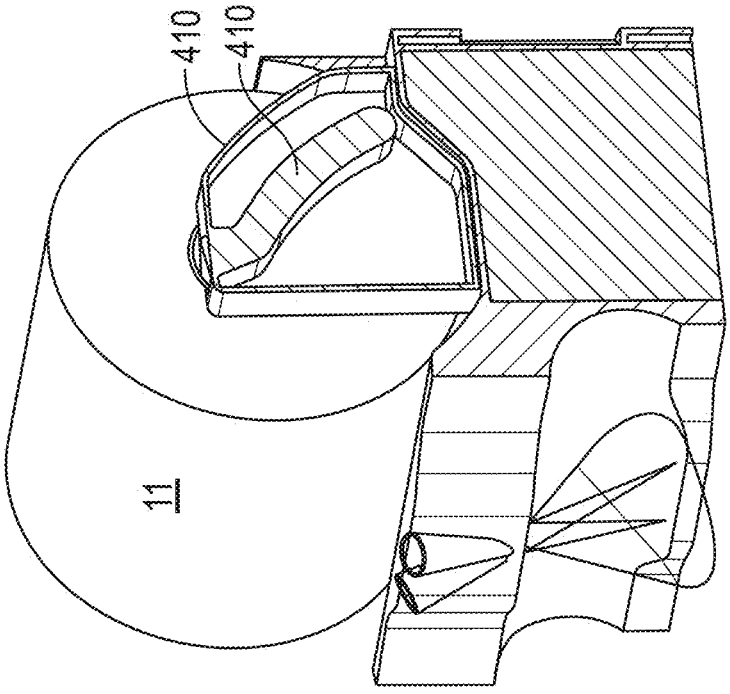

FIG. 64

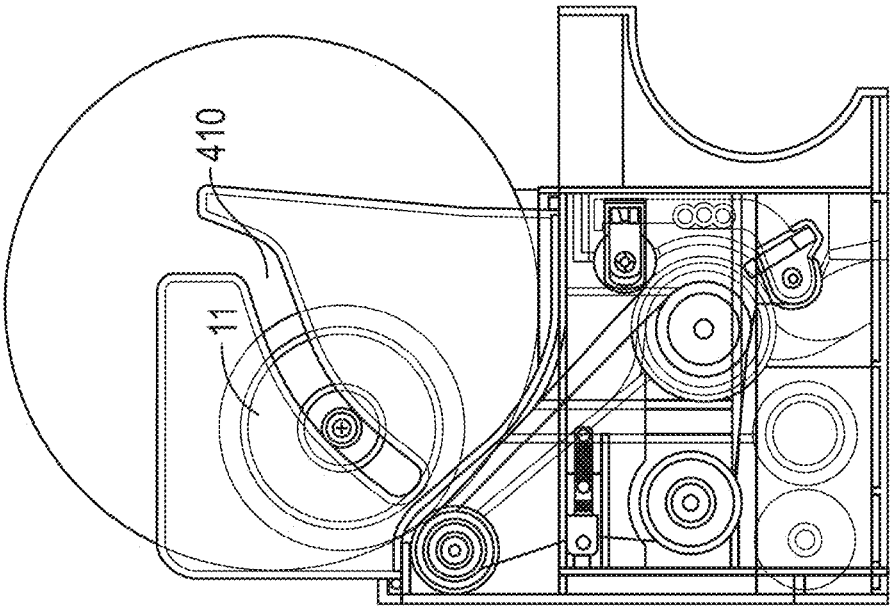

FIG. 67

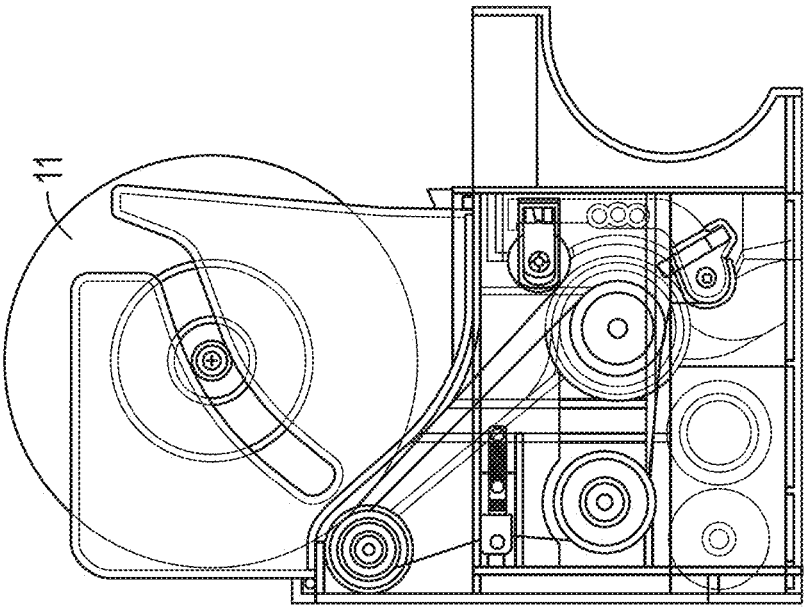

FIG. 66

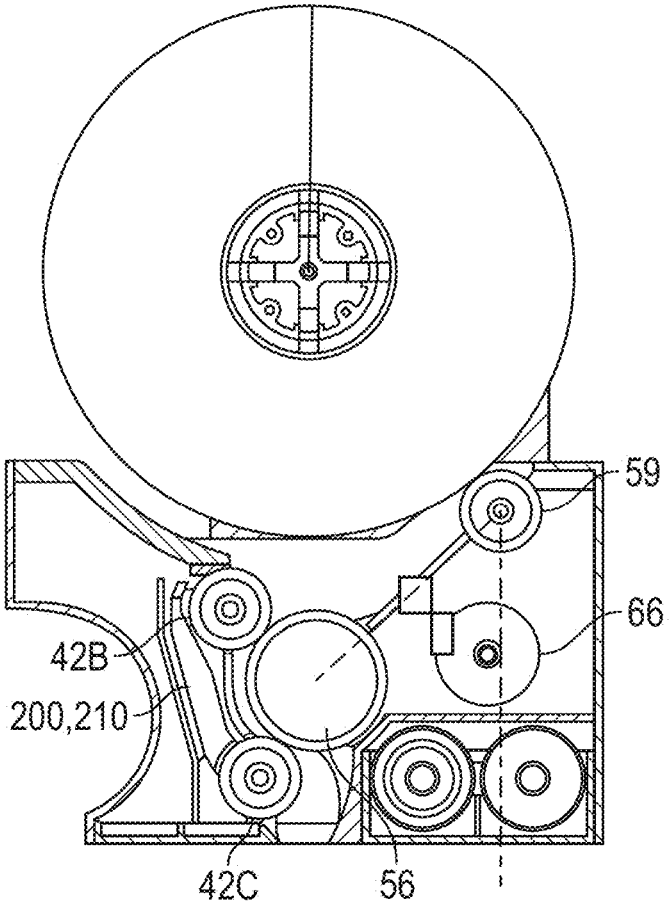

FIG. 68

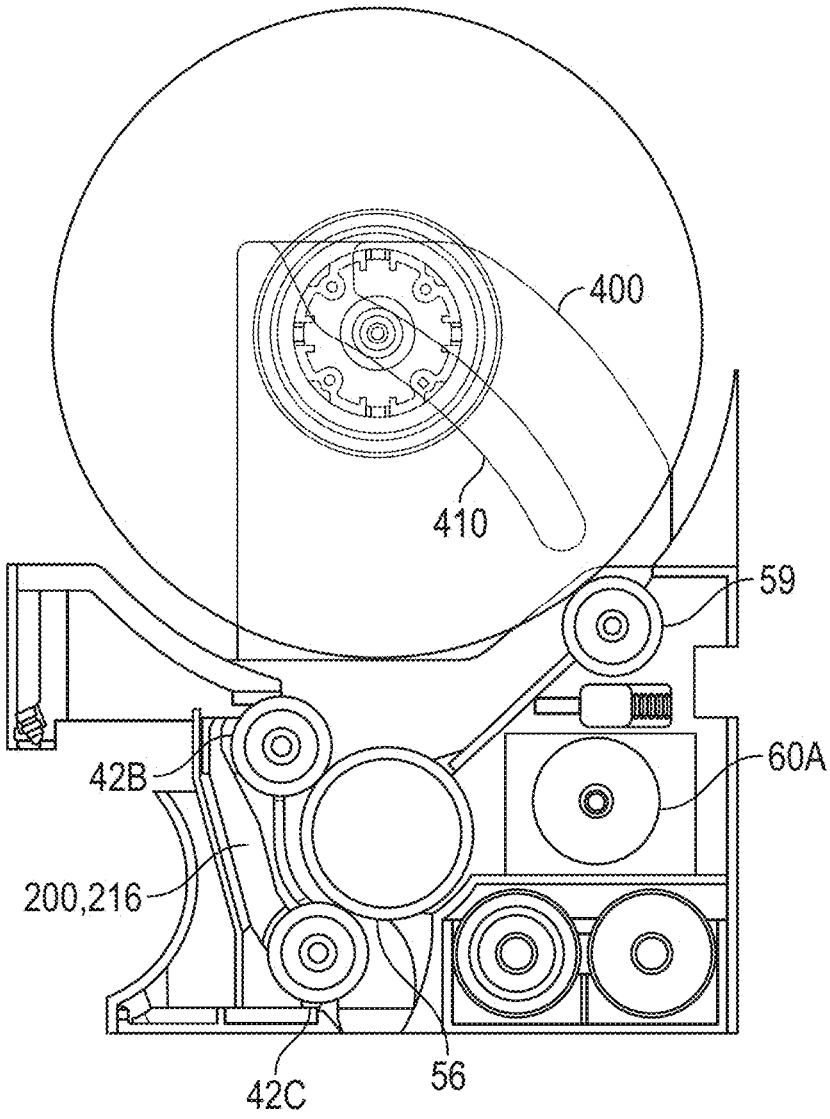

FIG. 69

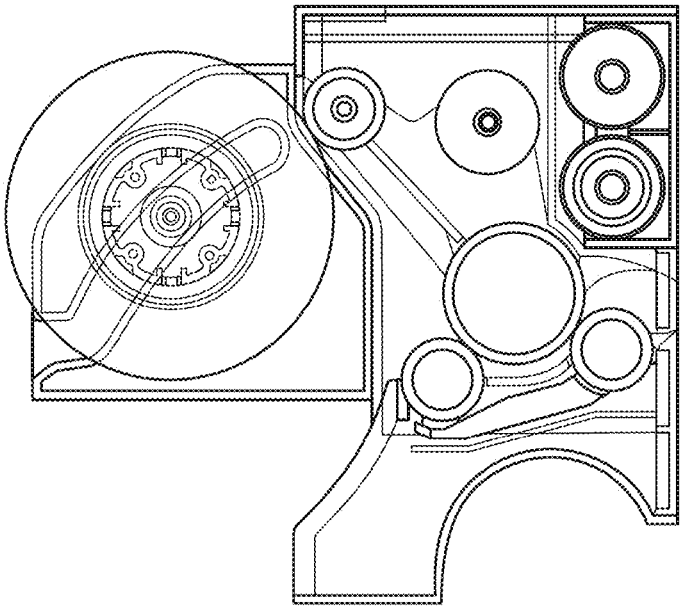

FIG. 71

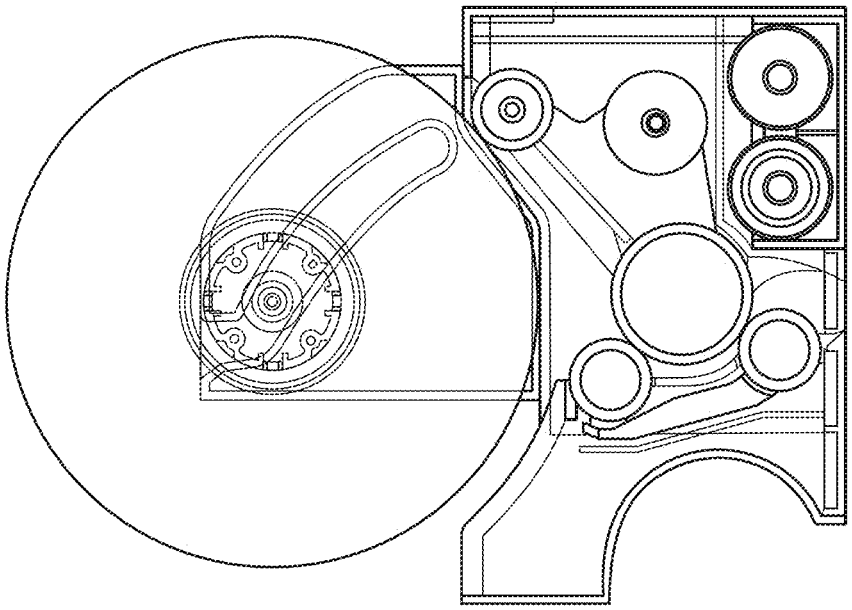

FIG. 70

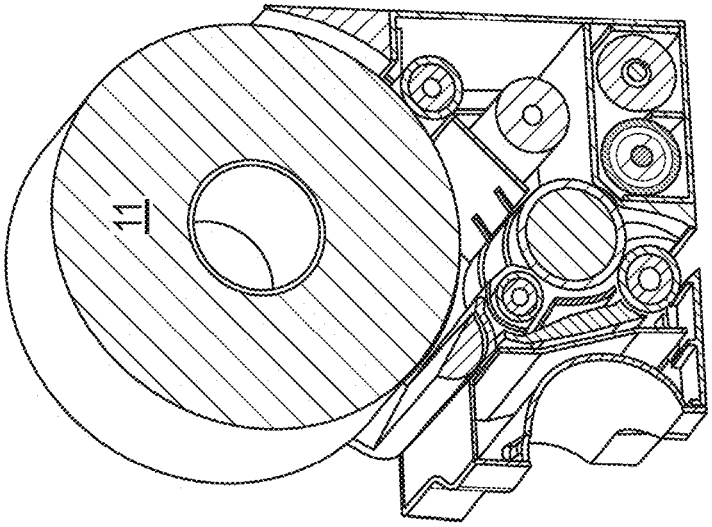

FIG. 73

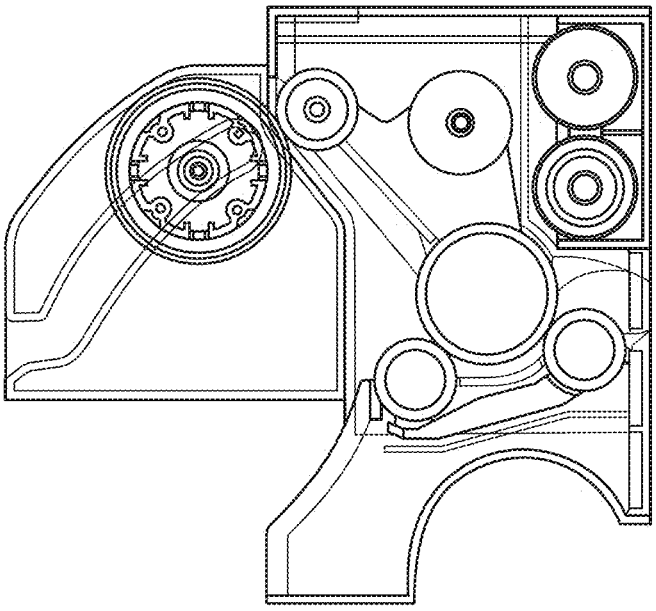

FIG. 72

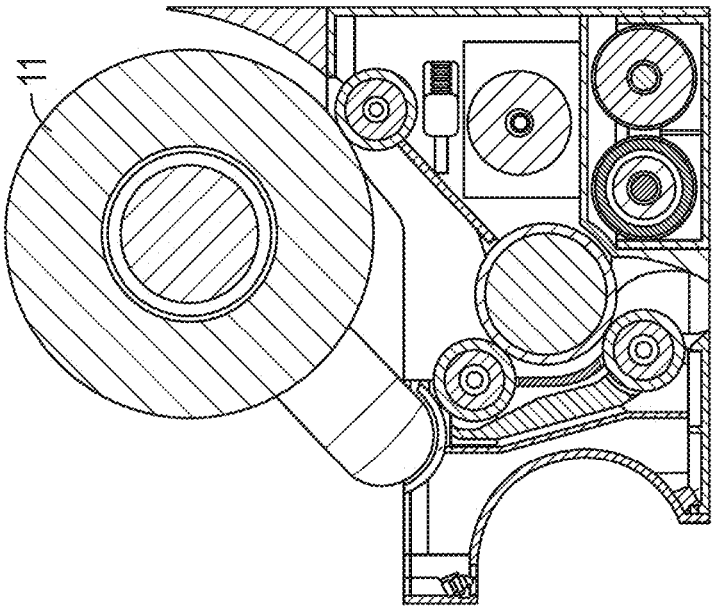

FIG. 75

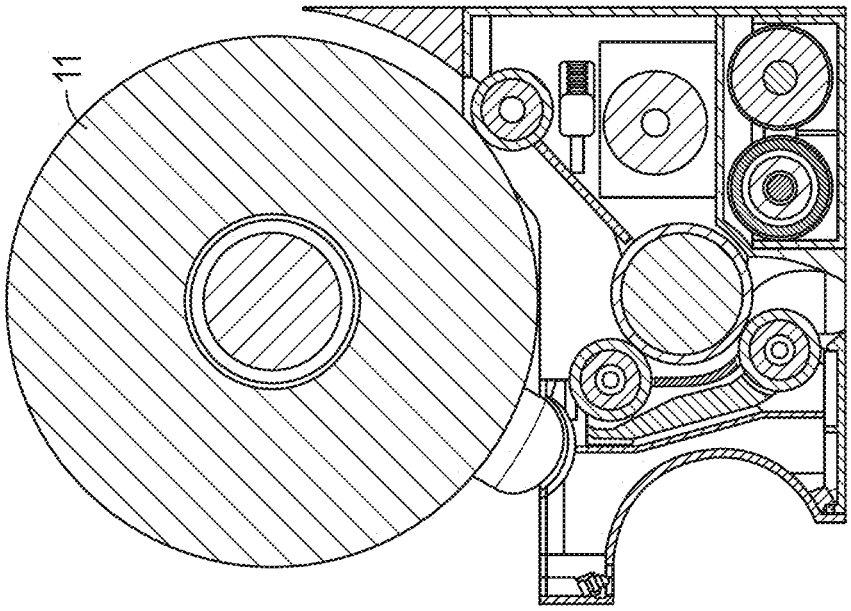

FIG. 74

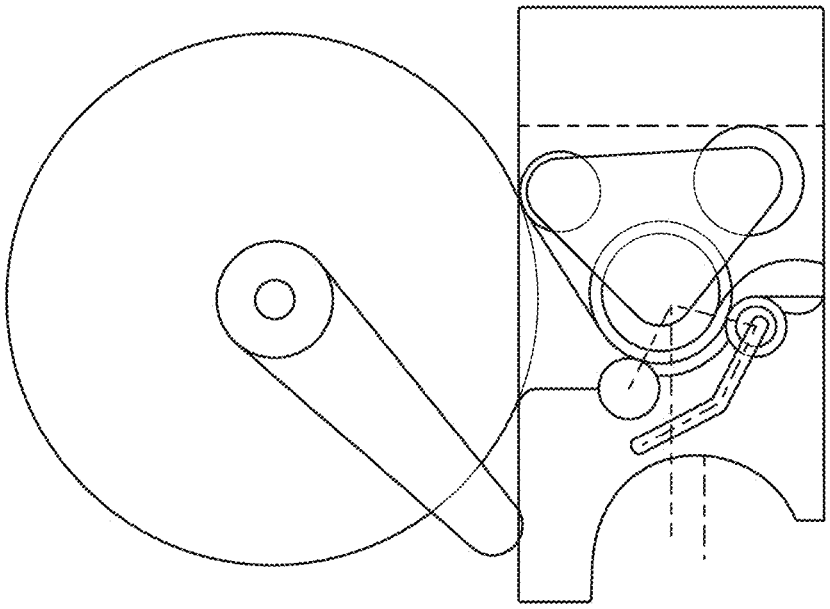

FIG. 77

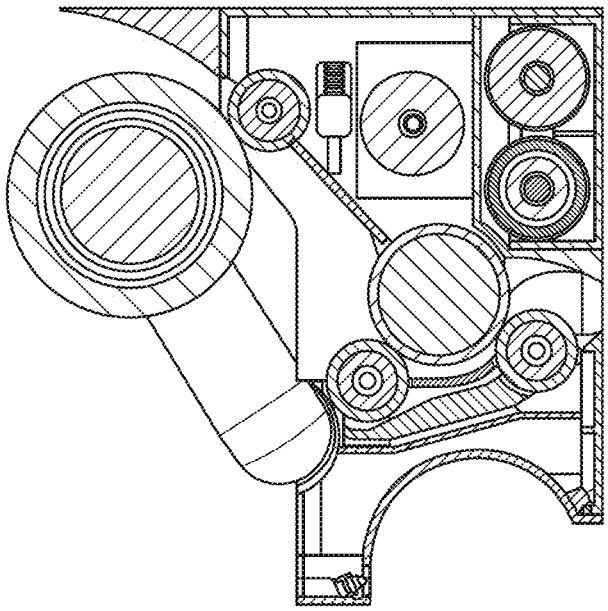

FIG. 76

DISPENSER ASSEMBLY FOR SELECTIVELY DISPENSING SHEET MATERIAL

CROSS-REFERENCE

[0001] The present application claims benefit of U.S. Provisional Patent Application No. 63/524,084, filed on Jun. 29, 2023; U.S. Provisional Patent Application No. 63/524,310, filed on Jun. 30, 2023 and U.S. Provisional Patent Application No. 63/529,740, filed Jul. 30, 2023.

INCORPORATION BY REFERENCE

[0002] The disclosures of U.S. patent application Ser. No. 16/692,105, filed Nov. 22, 2019, U.S. patent application Ser. No. 16/732,005, filed Dec. 31, 2019, U.S. Provisional Patent Application No. 62/772,199, filed on Nov. 28, 2018, U.S. Provisional Patent Application No. 63/307,699, filed on Feb. 8, 2022, U.S. Provisional Patent Application No. 63/337,371, filed on May 2, 2022, U.S. Provisional Patent Application No. 63/389,467, filed on Jul. 15, 2022, U.S. Provisional Patent Application No. 63/412,090, filed on Sep. 30, 2022, U.S. Provisional Patent Application No. 63/524,084, filed on Jun. 29, 2023, U.S. Provisional Patent Application No. 63/524,310, filed on Jun. 30, 2023 and U.S. Provisional Patent Application No. 63/529,740, filed Jul. 30, 2023 are specifically incorporated by reference herein as if set forth in their entireties.

TECHNICAL FIELD

[0003] In one aspect, the present disclosure is directed to dispenser assemblies for rolled sheet materials or other suitable materials, and more particularly, is directed to dispenser assemblies for selectively dispensing from a plurality of supplies of rolled sheet material. Other aspects are also described.

BACKGROUND

[0004] Dispensers for sheet materials, such as for dispensing tissue paper, paper towels, or other paper products, or other suitable materials are commonly used in hospitals, restrooms, and other facilities. Some dispensers have more than one supply of sheet material, e.g., multiple rolls of sheet material, for dispensing/feeding. When a supply of sheet material in such dispensers is running low or has been fully dispensed, a transfer of the feeding of sheet material to a new supply generally must be performed, which often must be done manually. Accordingly, it can be seen that a need exists for a dispenser assembly that can selectively switch/transfer the feeding/dispensing of sheet material between a plurality of supplies of sheet material between a plurality of supplies of sheet material, e.g., when a supply of sheet material is running low or has been fully dispensed. In addition, dispensers for sheet materials, such as those that hold multiple supplies of sheet material, can be difficult to reload with sheet material when supplies run out. Further, unwanted dispensing of material by dispensers for sheet materials, liquids, and/or other materials can waste energy and materials. Accordingly, it can be seen that a need exists for a dispenser assembly that is easier to load with supply and/or that avoids unwanted dispensing of materials. The present disclosure addresses these and other related and unrelated problems/issues in the relevant art.

SUMMARY

[0005] In one aspect, the present disclosure is directed to a dispenser assembly for dispensing sheet materials such as rolls of tissue, paper towels, and/or other rolled sheet material products. The dispenser assembly generally includes a dispenser housing having a plurality of supplies of rolled sheet material supported therein.

[0006] Each supply of rolled sheet material is supported by a corresponding support assembly within the dispenser housing. In one construction, the plurality of supplies of sheet material can include a first supply of sheet material supported by a corresponding first support assembly, and a second supply of sheet material supported by a corresponding second support assembly. The first and second support assemblies can be arranged to hold the supplies of sheet material in a side-by-side configuration (e.g., with ends of the rolls of sheet material facing one another). In embodiments, the axes of the supplies of sheet material can be collinear (e.g., substantially, generally, approximately collinear).

[0007] The dispenser assembly further can include a dispensing system for controlling the dispensing of selected, predetermined amounts of sheet material from at least one of the plurality of supplies of "sheet material. The dispensing system can include a plurality of driven roller assemblies for engaging and driving the sheet material from the supplies of rolled sheet material. Each driven roller assembly generally will be associated with at least one supply of the plurality of supplies of sheet material for dispensing sheet material therefrom. For example, the first supply of rolled sheet material can be dispensed by a first driven roller assembly and the second supply of rolled sheet material can be dispensed by a second driven roller assembly.

[0008] Each driven roller assembly can have at least one driven roller driven by a drive mechanism (e.g., a motor or other suitable drive mechanism) in communication therewith. In one variation, the drive mechanism can be operatively connected to the driven roller(s) by a belt or series of belts (e.g., one or more belts engaging a belt pulley or belt gear connected to each of the driven rollers).

[0009] The dispensing assembly further can include at least one guide roller that engages the sheet material and is rotatable with the rotation of the driven roller to help facilitate feeding and dispensing of the sheet material. The dispenser assembly further can include additional guide or pressing rollers positioned adjacent each of the driven rollers to help guide the sheet material during dispensing thereof.

[0010] Each of the driven rollers can be configured to rotate in a desired or selected direction, and typically can be rotated by the drive mechanism for a selected number of rotations as needed to dispense the selected amounts of sheet material from their corresponding supply of rolled sheet material, but generally will remain stationary when the drive mechanism is reversed or driven in the opposite direction. For example, each driven roller can include or can be coupled to a clutch mechanism (e.g., a hybrid or one-way clutch mechanism) or other disengagable drive connection that engages the driven roller and causes it to rotate when driven/rotated in one direction and disengages the driven roller and allows it to stay substantially stationary when driven in the opposite direction.

[0011] For example, the first driven roller can be rotated when the drive mechanism is driven in a first direction to dispense sheet material from the first supply of rolled sheet

material, while the second driven roller can remain generally stationary such that sheet material is not dispensed from the second supply of rolled sheet material. When the drive mechanism is driven in a second direction, the second driven roller can be rotated to dispense selected predetermined amounts of sheet material from the second supply of rolled sheet material, while the first driven roller can be disengaged and remain generally stationary such that sheet material is not dispensed therefrom.

[0012] Accordingly, the dispenser assembly of the present disclosure provides for selective dispensing of sheet material from the plurality of supplies of sheet material as needed. or example, upon a change or reversing of the driving direction of the drive mechanism, the dispenser can switch the dispensing of sheet material from the one supply of sheet material to the other. This change or switch/transfer of feeding from one supply to another can be substantially automatic, i.e., in response to a signal from a sensor or monitoring system, by a command from a control system for the dispenser, manually by a switch upon receipt of one or more signals from a device external to the dispenser assembly, etc.

[0013] An activation system can be incorporated into the dispenser assembly or into another dispenser for cooperating with a control system of the dispenser assembly to selectively activate or deactivate aspects of the dispenser assembly as needed. The activation system can include a front sensor assembly configured to detect a potential user in close proximity to the dispenser assembly. In embodiments, the front sensor assembly can include an IR emitter and an IR detector configured to indicate to the control system when the IR rays emitted by the emitter are reflected toward the IR detector so that the control system activates a dispenser activation sensor assembly and a visible light indicator mounted in a recess in the dispenser assembly.

[0014] In embodiments, the dispenser activation sensor assembly can include an opposing beam sensor, including an IR launcher positioned opposite to an IR receiver and oriented so that the IR launcher directs IR rays toward the IR receiver. When the IR beam is broken (e.g., by a user's hand), the dispenser activation sensor assembly can send a signal to the control system to run a dispensing operation to dispense material.

[0015] In embodiments, the visible light indicator can illuminate at least a portion of the front recess of the dispenser assembly with visible light (e.g., proximate to and/or along the dispenser activation sensor assembly). Accordingly, the visible light indicator can guide a user with respect to where the user should gesture in order to activate a dispensing operation. The visible light indicator can be configured to illuminate in one or more colors of light in order to provide information about the state and/or status of aspects of the dispenser assembly (e.g., supply levels, battery life, etc.).

[0016] The dispensing assembly further can include a monitoring system configured to determine if sheet material extending from one or more of the supplies of sheet material is engaged with a respective driven roller assembly. The monitoring system can include a sheet material detection sensor including an emitter and a detector oriented so that IR rays from the emitter are reflected toward the detector by the sheet material when it is present. In the case that the IR rays are not detected by the detector, the monitoring system can send a signal to the control system that the respective supply of sheet material is depleted. The control system can then switch to dispense from a different supply of sheet material and/or send a signal to an operator that additional supply is needed.

[0017] In embodiments, the dispenser assembly further can include a supply support apparatus mounted within a housing of the dispenser assembly. For example, the supply support apparatus can be mounted to an interior of a front cover of the housing, which front cover can be pivoted away from a backing portion of the housing (e.g., along a hinge). As the front cover is pivoted away from the remainder of the housing, the supply support apparatus can move with the front cover, which can provide space and easy access to the supply support apparatus for loading supply material into the dispenser assembly. In embodiments, the supply support apparatus can include one or more assemblies that can pivot with respect to the front cover for easier loading of the supply materials.

[0018] In embodiments, the dispenser assembly can further include an auto-assist paper dispensing system that is configured to allow a user to electronically activate a minimum quantity of paper to be supplied and subsequently allow for the user to manually supplement the quantity of paper being supplied.

[0019] Still other aspects, embodiments, and advantages of these exemplary aspects and embodiments, are discussed in detail below. Moreover, it is to be understood that both the foregoing information and the following detailed description are merely illustrative examples of various aspects and embodiments and are intended to provide an overview or framework for understanding the nature and character of the claimed aspects and embodiments. Accordingly, these and other objects, along with advantages and features of the present invention herein disclosed, will become apparent through reference to the following description and the accompanying drawings. Furthermore, it is to be understood that the features of the various embodiments described herein are not mutually exclusive and can exist in various combinations and permutations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The accompanying drawings, which are included to provide a further understanding of the embodiments of the present disclosure, are incorporated in and constitute a part of this specification, illustrate embodiments of the present disclosure, and together with the detailed description, serve to explain the principles of the embodiments discussed herein. No attempt is made to show structural details of this disclosure in more detail than can be necessary for a fundamental understanding of the exemplary embodiments discussed herein and the various ways in which they can be practiced. According to common practice, the various features of the drawings discussed below are not necessarily drawn to scale. Dimensions of various features and elements in the drawings can be expanded or reduced to more clearly illustrate the embodiments of the disclosure.

[0021] FIG. **1** provides a schematic illustration of a dispenser assembly for selectively dispensing a desired amount of sheet material from a plurality of supplies of sheet material according to principles of the present disclosure.

[0022] FIG. **2** provides a front elevational view of the dispenser assembly of FIG. **1**.

[0023] FIGS. **3** and **4** are views of interior portions of the dispenser assembly of FIG. **1**.

[0024] FIG. **5** is a cross sectional view of the dispenser assembly of FIG. **1** showing a support assembly rotatable mounted to upper surface of the enclosure of the dispensing system.

[0025] FIG. **6** is a perspective view showing a support assembly rotatable mounted to upper surface of the enclosure of the dispensing system.

[0026] FIGS. **7** to **9** are cross sectional views of the dispenser assembly of FIG. **1** showing a support assembly rotatable mounted to upper surface of the enclosure of the dispensing system and showing an elongate brake member, the roll of sheet material being shown decreasing from a full condition to an empty condition.

[0027] FIGS. **10** to **18** are schematic views of a mandrels that are configured for mounting thereto respective support assemblies.

[0028] FIG. **19** is a perspective view showing a first and a second driven roller of the dispenser system.

[0029] FIGS. **20** and **21** are views of the plurality of raised circumferentially extending surfaces on the respective driven rollers of FIG. **19** that are configured to be in contact with the sheet material on the roll of sheet material throughout operation.

[0030] FIGS. **22-26** are views of an activation system extending in at least a portion of a front end of the enclosure with features for sensing proximity of a user and sensing activation gestures for initiating a dispensing operation of the dispenser assembly.

[0031] FIGS. **27-30** are views of a material detection modules mounted in the enclosure adjacent each of the driven rollers for determining whether sheet material is being fed the driven rollers.

[0032] FIGS. **31-39** are views of an anti-static system associated with the dispenser assembly of FIG. **1**.

[0033] FIGS. **40-47** are views of a dispensing mechanism of the dispenser apparatus of FIG. **1** showing a belt drive coupled to a respective main roller and a driven roller and showing a tensioning system operably coupled to the belt drive to ensure that the belt drive is maintained in contact with the respective driven and main rollers throughout the dispensing process.

[0034] FIGS. **48-52** are views of the brake assembly for a dispensing system configured to allow the user to manually retrieve additional sheet material by pulling manually after the initial sheet material is dispensed automatically and showing a brake assembly having an elongate brake member being configured to pivot from an at rest position with respect to the housing for select braking contact with an upper guide roller of the roller assembly to cause the sheet material to cease feeding between a main roller and the upper guide roller such that the user can tear off the feed length of sheet material after which the brake assembly is configured to operatively bias back toward the at rest position.

[0035] FIGS. **53** and **54** are views of a bias member for the brake assembly that is configured to urge the elongate brake member of the brake assembly toward the at rest position.

[0036] FIGS. **55** and **56** are views of a toggle switch configured to selectively cut power to the coupled motor when the brake member moves away from the at rest position.

[0037] FIGS. **57-59** are schematic views of the brake assembly for a dispensing system through operation according to principles of the present disclosure.

[0038] FIGS. **60** and **61** are views of an alternative embodiment of support assembly according to principles of the present disclosure.

[0039] FIGS. **62** and **63** are views of an alternative embodiment of support assembly according to principles of the present disclosure.

[0040] FIGS. **64** and **65** are views of an alternative embodiment of support assembly and a braking assembly according to principles of the present disclosure.

[0041] FIGS. **66** and **67** are views of an alternative embodiment of support assembly and a braking assembly according to principles of the present disclosure.

[0042] FIGS. **68-73** are views of an alternative embodiment of support assembly and a braking assembly according to principles of the present disclosure.

[0043] FIGS. **74-77** are views of an alternative embodiment of support assembly and a braking assembly according to principles of the present disclosure.

DETAILED DESCRIPTION

[0044] The present invention can be understood more readily by reference to the following detailed description, examples, drawings, and claims, and their previous and following description. However, before the present devices, systems, and/or methods are disclosed and described, it is to be understood that this invention is not limited to the specific devices, systems, and/or methods disclosed unless otherwise specified, and, as such, can, of course, vary. It is also to be understood that the terminology used herein is for the purpose of describing particular aspects only and is not intended to be limiting.

[0045] The following description of the invention is provided as an enabling teaching of the invention in its best, currently known embodiment. To this end, those skilled in the relevant art will recognize and appreciate that many changes can be made to the various aspects of the invention described herein, while still obtaining the beneficial results of the present invention. It will also be apparent that some of the desired benefits of the present invention can be obtained by selecting some of the features of the present invention without utilizing other features. Accordingly, those who work in the art will recognize that many modifications and adaptations to the present invention are possible and can even be desirable in certain circumstances and are a part of the present invention. Thus, the following description is provided as illustrative of the principles of the present invention and not in limitation thereof.

[0046] As used throughout, the singular forms "a," "an" and "the" include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to "a sheet" can include two or more such sheets unless the context indicates otherwise.

[0047] Ranges can be expressed herein as from "about" one particular value, and/or to "about" another particular value. When such a range is expressed, another aspect includes from the one particular value and/or to the other particular value. Similarly, when values are expressed as approximations, by use of the antecedent "about," it will be understood that the particular value forms another aspect. It will be further understood that the endpoints of each of the ranges are significant both in relation to the other endpoint, and independently of the other endpoint.

[0048] As used herein, the terms "optional" or "optionally" mean that the subsequently described event or circum-

stance can or cannot occur, and that the description includes instances where said event or circumstance occurs and instances where it does not.

[0049] The word "or" as used herein means any one member of a particular list and also includes any combination of members of that list. Further, one should note that conditional language, such as, among others, "can," "could," "might," or "can," unless specifically stated otherwise, or otherwise understood within the context as used, is generally intended to convey that certain aspects include, while other aspects do not include, certain features, elements and/or steps. Thus, such conditional language is not generally intended to imply that features, elements and/or steps are in any way required for one or more particular aspects or that one or more particular aspects necessarily include logic for deciding, with or without user input or prompting, whether these features, elements and/or steps are included or are to be performed in any particular embodiment.

[0050] The phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. As used herein, the term "plurality" refers to two or more items or components. The terms "comprising," "including," "carrying," "having," "containing," and "involving," whether in the written description or the claims and the like, are open-ended terms, i.e., to mean "including but not limited to." Thus, the use of such terms is meant to encompass the items listed thereafter, and equivalents thereof, as well as additional items. Only the transitional phrases "consisting of" and "consisting essentially of," are closed or semi-closed transitional phrases, respectively, with respect to any claims. Use of ordinal terms such as "first," "second," "third," and the like in the claims to modify a claim element does not by itself connote any priority, precedence, or order of one claim element over another or the temporal order in which acts of a method are performed but are used merely as labels to distinguish one claim element having a certain name from another element having a same name (but for use of the ordinal term) to distinguish claim elements.

[0051] Disclosed are components that can be used to perform the disclosed methods and systems. These and other components are disclosed herein, and it is understood that when combinations, subsets, interactions, groups, etc. of these components are disclosed that while specific reference to each various individual and collective combinations and permutation of these cannot be explicitly disclosed, each is specifically contemplated and described herein, for all methods and systems. This applies to all aspects of this application including, but not limited to, steps in disclosed methods. Thus, if there are a variety of additional steps that can be performed it is understood that each of these additional steps can be performed with any specific embodiment or combination of embodiments of the disclosed methods.

[0052] The present methods and systems can be understood more readily by reference to the following detailed description of preferred embodiments and the examples included therein and to the Figures and their previous and following description.

[0053] FIG. **1** shows a dispenser assembly **10** for dispensing a rolled sheet material **11**, such as tissue rolls, paper towel rolls, or other suitable rolled sheet material products. As shown in FIG. **1**, the dispenser assembly **10** can include a dispenser housing **12**, which can have a front shell or cover **12**A that is movable/removable to allow access to the components of the dispenser assembly **10**, and a back shell or backing portion **12**B that is configured to mount or otherwise connect (e.g., via fasteners, adhesive, etc.) to the dispenser assembly **10** to a wall, partition, or other suitable support within a facility, such as a restroom, hospital room, etc. The dispenser housing **12** can be formed from plastic materials, metallic materials, other suitable synthetic or composite materials, or combinations thereof. The dispenser housing **12** further includes one or more chambers or compartments **13** defined therein and sized, dimensioned, and/or configured to receive and house a plurality of supplies **14** of sheet material **11** therein. As shown, the dispenser housing **12** also can include a discharge **15**, e.g., including one or more apertures or openings, that facilitates dispensing of the sheet material **11** of the supplies of sheet material **14** from the dispenser assembly **10**.

[0054] As generally shown, each supply **14** of sheet material typically includes a mandrel or roll or spindle **130** with sheet material **11** wrapped or spun thereabout. The dispenser assembly **10** further includes a plurality of support assemblies **120** rotatably supporting a plurality of supplies **14** within the dispenser housing **12**. That is, each supply of sheet material **14** is configured to be supported by a corresponding support assembly positioned with the chamber(s) **13** of the dispenser housing **12**. The plurality of supplies **14** of sheet material can include a first supply **18** of sheet material that is supported by a corresponding first support assembly **20**, and a second supply **22** of sheet material that is supported by a second support assembly **24**.

[0055] In embodiments, the dispenser assembly **10** includes a dispensing system or mechanism **50** for selectively dispensing predetermined amounts (i.e., particular, selected lengths) of sheet material **11** from the plurality of supplies **18**/**22** of sheet material. In embodiments, the dispensing system **50** can include a drive mechanism **60** mounted in the enclosure **51**. As shown, and without limitation, the enclosure **51** can include two intake openings **35** aligned with the respective roller assemblies and receiving sheet material **11** from the respective supplies **18**/**22** of sheet material. As shown and as one skilled in the art will appreciate, the exemplified enclosure **51** further can include two output openings **36** for dispensing the sheet material **11** from the respective roller assemblies out of the enclosure **51**. As shown, the dispensing system **50** can be positioned in chamber **13** of the dispenser housing **12** such that at least a portion of the enclosure **51** of the dispensing system **50** extends in the opening of the discharge **15**. In embodiments, the output openings **36** of the enclosure **51** of the dispensing system **50** can be aligned with the discharge **15** for dispensing the sheet material **11** from the dispenser assembly **10**.

[0056] In a further embodiment and as shown in FIGS. **10**-**18**, the dispenser assembly **10** for dispensing a rolled sheet material includes an auto feed system **100** that can comprise a pair of opposing support members **120** that are spaced apart such that a roll of sheet material **14** can be mounted therebetween on a paper drum mandrel **130**. Additional embodiments of exemplary auto feed systems **100** are illustrated in FIGS. **60**-**77**. Each support member **120** has a proximal end that is configured to be rotatably mounted to an upper surface of the enclosure **51** of the dispensing system **50** and a distal end defining a bore **424** for operative receipt of a bearing member. In embodiments, each end of the paper drum mandrel can have a bearing member that is sized or otherwise configured for receipt within the opposed

bores on the support members. In embodiments, the center of each bore can be positioned a fixed distance from the proximal end and can prescribe an arc as the sheet material **11** on the roll is used up.

[0057] As shown in this aspect, each of the support members **120** has a first arm **122** that has a proximal end **124** that is configured to be rotatably mounted to an upper surface of the enclosure **51** of the dispensing system **50** and a second arm **126** that has a distal end **128** that defines a slot for operative receipt of the operative end of a paper mandrel **130**. The first and second arms **122**, **126** are integral to each other and are positioned in a common plane at an acute angle with respect to each other. As illustrated in FIG. **7**, in a first position, in which the roll of paper material mounted on the paper mandrel is at full size, the angled relationship of the respective first and second arms allows for the center of gravity of the full roll of paper material and paper mandrel to be positioned at a maximal distance from the driven roller and which aids in offsetting the weight of the full roll of paper material and paper mandrel that would otherwise be born entirely thereon the driven roller. Subsequently, as shown in FIGS. **8** and **9** as the paper material is used up and the operative diameter of the paper roll is reduced, the spacing of the center of gravity of the roll of paper material and paper mandrel relative to the driven roller also is complementarily reduced. In operation, the shifting of the center of gravity as the paper roll is reduced in diameter helps to ensure that paper material is fed consistently, which increases motor efficiency.

[0058] Additional views illustrate aspects of the dispensing assembly in operation. As shown, as the sheet material is used up and the diameter of the roll decreases, the paper drum mandrel **130** moves down and along the prescribed arc such that the sheet material is maintained in contact with the driven roller. As further shown, as the sheet material is used up and the operable radius of the roll of sheet material is reduced, the paper drum mandrel **130** is maintained at a desired distance from the upper surface of the enclosure **51** of the dispensing system **50** and/or the underling drive roller. As shown, in one non-limiting embodiment, this desired distance can be 7 mm. In various exemplary embodiments, it is contemplated that this desired distance can be between 1-20 mm, or be at least 1 mm.

[0059] Further, in embodiments, the paper drum mandrel **130** can be configured for a frictional fit to a paper roll mounted thereto. Referring to FIGS. **13-18**, the paper drum mandrel can have a housing **132** having a proximal end **134** and a distal end **136**, in which each of the respective proximal and distal ends defines a mounting rod **138** that extends outwardly from the outer surface of the proximal and distal ends. As shown, it is contemplated that the housing defines a longitudinal axis and that each of the respective proximal and distal ends extends co-axially to the longitudinal axis of the housing. Still further, the housing of the paper drum mandrel **130** defines an interior cavity **140** and a plurality of spaced longitudinally spaced slots **142**. As shown, the slots can extend parallel to the longitudinal axis of the housing and between the respective proximal and distal ends of the housing.

[0060] Further, in embodiments, the paper drum mandrel **130** can include a bias element **144** that can be mounted therein the interior cavity of the housing. As shown, the bias element can include a rod **145** having a first end and a second end. The first and second ends being configured to be complementarily received within respective sleeves **146** that are formed and extends inwardly from the inner surfaces of the respective proximal and distal ends of the housing. When mounted, the rod of the biasing element is positioned co-axial to the longitudinal axis of the housing. The bias element further includes a plurality of bias members **148**. Each bias member is connected to the rod proximate a middle portion of the rod and extends outwardly and away from the middle portion of the rod such that the distal end portions of each bias member is spaced from the respective first and second ends of the rod. Still further, it is contemplated that the distal end portion of each bias member can be formed to be operatively received therein one spaced longitudinally spaced slot of the housing such that at least a portion of the distal end portions of the bias member extends proudly above the exterior surface of the housing when the bias member is in a relaxed state. As shown, each bias member is configured to apply a bias force acting away from the longitudinal axis of the rod when an opposing external force, acting inward towards the longitudinal axis, is applied the respective bias member.

[0061] In optional embodiments, the auto feed system **100** can comprise a pair of opposing support members that are spaced apart such that a roll of sheet material can be mounted therebetween on a paper drum mandrel **130**. In this exemplary aspect, each support member can define a slot that is positioned at an acute angle relative to horizontal. Further, in this aspect, each end of the paper drum mandrel can be configured to have a bearing member that is sized or otherwise configured for receipt within the opposed slots on the support members.

[0062] In optional embodiments, the auto feed system **100** can comprise a pair of opposing support members **420** that are spaced apart such that a roll of sheet material can be mounted therebetween on a paper drum mandrel **130**. In this exemplary aspect, each support member has a proximal end rotatably mounted to an upper surface of the housing and a distal end defining a bore for operative receipt of a bearing member. Further, in this aspect, each end of the paper drum mandrel is configured to have a bearing member that is sized or otherwise configured for receipt within the opposed bores on the support members. In embodiments, the center of each bore can be positioned a fixed distance from the proximal end and can prescribe an arc as the sheet material **11** on the roll is used up. Operationally, as the sheet material is used up and the diameter of the roll decreases, the paper drum mandrel **130** moves down and along the prescribed arc such that the sheet material is maintained in contact with the driven roller.

[0063] In a further optional embodiment, the auto feed system **400** can comprises a pair of opposing support members that are spaced apart such that a roll of sheet material can be mounted therebetween on a paper drum mandrel **130**. In this exemplary aspect, each support member has a proximal end rotatably mounted to an upper surface of the housing and a distal end defining a bore for operative receipt of a bearing member. Further, in this aspect, each end of the paper drum mandrel has a bearing member that is sized or otherwise configured for receipt within the opposed bores on the support members. In embodiments, the center of each bore can be positioned a fixed distance from the proximal end and can prescribe an arc as the sheet material **11** on the roll is used up. In operation, as the sheet material is used up and the diameter of the roll decreases, the paper

drum mandrel **130** moves down and along the prescribed arc such that the sheet material is maintained in contact with the driven roller. As further shown, as the sheet material is used up and the operable radius of the roll of sheet material is reduced, the paper drum mandrel is maintained at a desired distance from the housing and/or the underling drive roller.

[0064] In embodiments, an auto-assist paper dispensing system **200** is illustrated. As shown, the auto-assist paper dispensing system **200** can include a dispensing assembly for each supply of paper material and can further exemplarily include a pair of brake assemblies that are rotatably mounted relative to the interior housing.

[0065] In embodiments, each dispensing assembly can include at least one driven roller **210** for engaging and driving the sheet material **11** from the respective supplies **18**/**22** of sheet material. For example, the first supply **18** of sheet material can be dispensed by a corresponding first driven roller **210** and the second supply of rolled sheet material **22** can be dispensed by a corresponding second driven roller **210**. The first driven roller will engage and draw or urge sheet material from the first supply **18** of sheet material along a first discharge path toward and out of the output opening **36** of the enclosure **51** and out of the discharge **15** of the dispenser housing **12**, while the second driven roller will engage and draw or urge sheet material **11** from the second supply **22** of sheet material along a second discharge path toward and out of the output opening **36** of the enclosure **51** and out of the discharge **15** of the dispenser housing **12**. The driven rollers **210** can be formed from a plastic material, though other materials, such as wood, elastomeric materials, such as rubber, or other composite or synthetic materials or combinations thereof, can be used without departing from the scope of the present disclosure.

[0066] As shown, the drive system of the dispensing system **200** includes a pair of motors **61**. In embodiments, the motor can be a brushed or brushless electric motor. As exemplarily shown, it is contemplated that the dispensing assembly for this aspect would have at least one pair of an opposed driven roller **210** and a main roller **220** that are each coupled to a motor **61**, such as an exemplary brushed or brushless electrical motor, via a belt drive **62**. The dispensing assembly would also include an upper guide roller **230** and a spaced lower guide roller **232** that are positioned in opposition to the main roller **230**. In this aspect, the driven roller **210** would be in contact with the sheet material on the roll throughout operation. As shown, it is contemplated that the arc that the paper supply prescribes in operation bisects the outer surface of the driven roller **210**. Thus, as shown, as the sheet material is used up and the diameter of the roll decreases, the paper drum mandrel **130** moves down and along the prescribed arc such that the sheet material **14** is maintained in contact with the driven roller **210**.

[0067] In embodiments, respective guide rollers can be positioned along or substantially proximate, adjacent, etc, and engaging the supplies **14** of sheet material, with the upper guide roller **230** being positioned to extend along a portion of the main roller for engaging sheet material from the driven roller and the lower guide roller **232** being positioned to extend along a portion of the main roller for engaging sheet material **11** exiting from the main roller and directing the sheet material toward the discharge of the housing, e.g., to facilitate dispensing of the sheet material **11** from the dispenser assembly **10**. The guide rollers **230**, **232** can be formed from a plastic material, though other materials, such as wood, elastomeric materials, such as rubber, or other composite or synthetic materials or combinations thereof, can be used without departing from the scope of the present disclosure.

[0068] In optional embodiments, the dispensing system **200** can be configured to communicate with a control circuitry of the dispenser assembly **10** to receive instructions and power for selectively activating and driving the driven rollers of each roller assembly through a dispensing cycle (e.g., a determined time, number of revolutions, etc.), to feed the selected or desired amount/length of the sheet material through the discharge **15** of the dispenser housing **12**. In addition, the drive mechanism can be driven in a first direction to drive a respective driven roller **210** and move the sheet material from the corresponding supply **18** of sheet material along the discharge path toward and out from the discharge **15** of the dispenser housing **12**.

[0069] In optional embodiments, a gear clutch assembly can be mounted on a drive shaft of the motor **60** and can be connected to the driven roller. In embodiments, the drive mechanism could be otherwise configured without departing from the disclosure. For example, it is contemplated that the drive belt could be omitted and the respective driven and main rollers could be configured to be driven via a geared connection or any other suitable engagement.

[0070] Referring to FIGS. **40**-**45**, in embodiments it is contemplated that the dispensing assembly can include a tensioning system **300** operably coupled to the belt drive **62** to ensure that the belt drive is maintained in contact with the respective driven and main rollers throughout the dispensing process. In this aspect, the tensioning system includes a slot **302** formed in a sidewall of the housing. The proximal end of the slot **304** is in communication with a trough **306** that is shaped and sized to receive a spring **310**. A housing **320** having a first end portion **322** configured to be received in the slot **304** for axial movement along the axis of the slot and a second end portion **324** that is configured to receive a roller **326** that is positioned within an interior portion of the second end portion transverse to the axis of the slot **304**. Further, the housing **320** defines a rod **328** extending outwardly from an outer surface of the second end portion that is configured to operable receive the distal end **312** of the spring **310**. In position, the spring **310** is positioned to move along an axis that is parallel to the axis of the slot **304** and as such is configured to bias the housing **320** along the axis of the slot in a first direction.

[0071] As shown, the tensioning system **300** is positioned between the respective main and driven rollers such that the belt drive **62** operatively passes over the slot **302**. In operation, the belt drive has an outer surface that is configured to slide over the roller **326** that is positioned within the second end portion **324** of the housing **320** and, due to the biasing force applied to the housing, a desired level of tension is applied to the belt drive **62**.

[0072] In a further exemplary aspect shown in FIGS. **19**-**21**, each driven roller **210** can further include a plurality of raised circumferentially extending surfaces **212** that are configured to be in contact with the sheet material on the roll throughout operation. In one embodiment, each of the plurality of raised circumferentially extending surfaces **212** can have a cam shape that aids is maintaining tension between respective tissue layers of the sheet material. In this aspect, and as shown, it is contemplated that the profiles of the respective raised circumferentially extending surfaces

212 can be positioned such that the adjacent raised circumferentially extending surfaces are positioned in a mirrored relationship. The cam shape of the circumferentially extending surfaces **212** allows for intermittent roll suspension during roll rotation, which allows for paper tension to be properly maintained through operation as the roll of paper material is used up.

[0073] In embodiments and similar to that disclosed above, the dispensing assembly shown can include a brake assembly **400**. In embodiments, the brake assembly is an elongate brake member **402** having a distal end **404** and an opposed proximal end **406**. The elongate member of the brake assembly also has a lower edge extending between the opposed distal and proximal ends. In this aspect and as illustrated in embodiments, the brake assembly **400** is rotatably mounted relative to the interior housing of the dispenser system **50** and the distal end of a brake member **402** is rotatably coupled to the lower guide roller **232**. In this aspect, the proximal end of the brake member is configured as a brake plate **410** that can be operatively moved into select contact with the upper guide roller **230**. In the rest position, the brake member **402** is spaced from the surface of the upper guide roller **230**. As shown in Fig. XXX, upon reaching of the brake position after downward rotative pressure on the lower guide roller **232** and the complementary clockwise rotation of the proximal end of the brake member, the brake plate can be brought into contact with the upper guide roller **230**, which causes the sheet material to cease feeding between the main roller and the upper guide roller **230** such that the user can tear off the feed length of sheet material after which the brake assembly will operatively bias back toward the at rest position.

[0074] As shown, the dispensing system is configured to allow the user to manually retrieve additional sheet material by pulling manually after the initial sheet material is dispensed automatically. As shown, when the user pulls the paper downward or downward at a first acute angle towards the front of dispenser, the drive roller is allowed to rotate freely, which thereby allows the user to manually select additional lengths of the sheet material. As shown, in one embodiment, the dispensing system can include one or more brake assemblies **400** that can be configured to pivot with respect to the housing for select braking contact with at least one of the guide rollers of the dispensing assembly.

[0075] In embodiments, a portion of the lower edge of the elongate brake member **402** of the brake assembly can have a serrated profile **412** extending at least partially between the opposed distal and proximal ends. This serrated profile **412** can be shaped or otherwise configured to tear the supplied sheet material **11** upon the manual application of sheet material the serrated profile of the lower edge. The upper edge of the elongate member of the brake assembly also can define at least one pressure plate that is configured to be selectively engaged to a portion of at least one object roller, such as for example, the main drive roller, a driven roller and/or a guide roller.

[0076] In some embodiments, upon mounting of the brake assembly into the dispenser housing, the elongate brake member is capable of rotative movement about a rotation axis and, as the lower edge portion of the elongate member is positioned in the discharge **15** area of the housing, the lower edge portion of the elongate member is configured for rotative movement from an intermediate position (at rest position) in the discharge **15** area toward a brake position in which the lower edge portion of the elongate member is articulated (rotated) toward an edge of the discharge area. In addition, in embodiments, once a user has manually dispensed the desired length of additional sheet material and the paper is drawn forward to a predetermined angle β (the brake position), the pressure plate can engage the object roller to prevent rotation of the object roller, which allows the sheet material **11** to be cut on the serrated profile **412** of the lower edge of the elongate member.

[0077] In embodiments, the brake assembly **400** can further exemplarily include a bias member, e.g., an extension spring as shown in some of the illustrated embodiments, that is configured to urge the elongate member of the brake assembly toward the at rest position. Thus, in operation, after the user applies sufficient force on the sheet material **11** when the brake assembly has been rotated to the brake position, to cut or tear the sheet material on the serrated profile **412** of the lower edge of the elongate member, the elongate member will, under the urging of the bias member, rotate back to the at rest position.

[0078] In embodiments, the dispensing assembly can also include a toggle switch **450** that is mounted in proximity to the distal end of the elongate member. In this embodiment, the toggle switch is configured to bias away from the housing as the elongate member rotates away from the at rest position. In this aspect, as the toggle switch will send a signal to the control system to shut off power to the respective motor **60** when the switch moved away from the at rest position. As shown, in the rest position, there is a predetermined distance between the pressure plate of the elongate member and the object roller, which is the lower roller in this example.

[0079] FIG. **58** shows a condition in which the user pulls the sheet material **11** downward or downward at a slight angle towards the front of dispenser such that at a predetermined angle α, the sheet material touches the serrated profile **412** on the lower edge of the elongate member and the drive motor is configured in idle—which allows the user to manually pull any additional amount of paper mechanically without motor activation before tearing the paper.

[0080] In FIG. **59**, the user pulls the sheet material **11** downward towards the front of dispenser such that at a predetermined angle β, the brake assembly has reached the brake position in which the pressure plate contact the lower roller to prevent rotation of the lower roller and prevent feeding of the sheet material. As noted above, in the brake position, the sheet material is prevented from further feeding and the user can manually cut or tear the now fixed sheet material on the serrated profile **412** of the lower edge of the elongate member.

[0081] In other optional and exemplary non-limiting examples of the auto-assist paper dispensing system **200**, the brake assembly **400** can be rotatably mounted relative to the interior housing and the distal end of the brake member can be rotatably coupled to a lower roller **42**C. In this exemplary aspect, the distal end of the brake member further can be operatively coupled to a brake plate that can be moved axially into select contact with the main drive roller **56**. In the rest position, the brake member is spaced from the surface of the main drive roller. Upon reaching of the brake position, the brake member is brought into contact with the main drive roller, which causes the sheet material to cease feeding such that the user can tear off the feed length of sheet

material after which the brake assembly will operatively bias back toward the at rest position.

[0082] According to other aspects of the present disclosure, an activation system **500** can be incorporated into the dispenser assembly or into another dispenser for cooperating with a control system of the dispenser assembly to selectively activate or deactivate aspects of the dispenser assembly as needed. In embodiments, the activation system **500** can include a front sensor assembly **510** configured to detect a potential user in close proximity to the dispenser assembly. In embodiments, the front sensor assembly can include at least one IR emitter **520** and an opposing at least one IR detector **530** configured to indicate to the control system when the IR rays emitted by the emitter are reflected toward the IR detector. The front sensor assembly can be configured to sense movement in close proximity to the assembly (denoted by the sensing cone that is illustrated). Thus, in operation, the front sensor assembly can be configured to control power actuation in the dispenser assembly and can be configured to activate a dispenser activation sensor assembly and/or a visible light indicator mounted in a recess in the dispenser assembly.

[0083] In exemplary embodiments, the dispenser activation sensor assembly can include an opposing beam sensor **540**, including a plurality of IR launchers positioned in opposition to an IR receiver and oriented so that each IR launcher directs IR rays toward the IR receiver in a desired, programed timed sequence. In one exemplary aspect, the IR receiver is positioned in an upper portion of the hand sensing cavity of the housing each of the IR launchers is positioned in a lower portion of the hand sensing cavity. Preferably, and without limitation, each of the IR launchers are positioned equidistant from each other. Further, each of the IR launchers can be positioned in a common plane with each other and with the IR receiver. In operation, when the IR beam is broken (e.g., by a user's hand being sensed in the hand sensing cavity), the dispenser activation sensor assembly can send a signal to the control system to run a dispensing operation to dispense material.

[0084] In operation, and referring to FIG. **25**, it is contemplated that, upon actuation by the front sensor assembly, each IR launcher is programmed to direct IR rays from the plurality of IR launchers toward the IR receiver in a desired, programed timed sequence. In embodiments, and as shown in line IRM, each IR launcher can be programmed to direct IR rays from the plurality of IR launchers toward the IR receiver in a sequenced operation (i.e., the first IR launcher IR**1**, followed by the second IR launcher IR**2**, and finally the third IR launcher IR**3**), followed by a dwell period. This sequence is repeated until an object is sensed in the hand sensing cavity or if the front sensor assembly deactivates dispenser activation sensor assembly. In operation, and as exemplarily shown on the right of line IR**1**, if the IR receiver does not receive the incoming IR signal from one of the respective IR launchers, indicating the possible presence of an operator's hand, the IR launcher that had its signal blocked (denoted here exemplarily as IR**1**), will active two consecutive IR signals with de minimus spacing between the two IR signal generations. If the IR receiver does not receive either of the two consecutive IR signals, the dispenser activation sensor assembly confirms the presence of the operator's hand and actuates a dispensing operation.

[0085] In exemplary embodiments, the dispenser can further include an anti-static system **600**. In this aspect, portions of the discharge chute of the dispenser housing can be formed of a conductive material. In one example, the portion of the discharge chute of the dispenser housing that is adjacent to the main roller can be formed of the conductive material. In a further example, at least a portion of the main roller can be formed of a conductive material. In the illustrated design, the bearing on the respective main roller can be formed of a conductive material and the bearing fixture is also formed of a conductive material. As shown and as schematically illustrated in FIG. **461**, at least one metal shrapnel is connected to the bearing fixture and is connected to the housing to effectively act as a system ground.

[0086] In embodiments, one or more material detection modules **700** can be mounted in the enclosure **51** adjacent each of the driven rollers for determining whether sheet material **11** is being fed from the supplies **18**/**22** to the roller assemblies. In embodiments, each of the pair of material detection modules **702** can include an infrared (IR) launch tube **704** that is mounted to side wall and an opposed IR receiver tube **706** that is mounted to opposed side wall. In embodiments, for each of the pair of material detection modules, the infrared (IR) launch tube and opposed IR receiver tube are positioned and oriented in along a common axis such that an IR beam projecting between the respective infrared (IR) launch tube and opposed (IR) receiver tube extends over a respective cooperating roller assembly and driven roller. In various embodiments, the formed IR beam can extend substantially transverse to the longitudinal axes of the driven roller. In embodiments, for each of the pair of material detection modules, the infrared (IR) launch tube can be mounted to side wall in opposition to the (IR) receiver tube that is mounted to the opposed side wall such that the formed IR beam extending therebetween the infrared (IR) launch tube and the (IR) receiver tube **160**B passes through a trough formed by the driven rollers.

[0087] In operation, if the case that the sheet material **11** has run out or has broken, the IR beams emitted by the IR launch tube will be received by the IR receiver tube. The pair of material detection modules can be in electronic communication with the control unit, which can be operable to supply power to one or both of the material detection modules **101** as needed, send a command to determine if sheet material **11** is present in the sensor area (e.g., for the IR launch tube to emit IR beams and the IR receiver tube to monitor for received IR beams), and to receive a signal from the material detection module regarding whether the IR receiver tube detected the IR beam generated by the IR launch tube without being blocked by sheet material **11**. In embodiments, each of the pair of the material detection modules **101** can be configured to test for the presence of paper in the sensor area according to one or more rules (e.g., after a dispensing operation and/or at a predetermined time interval).

[0088] In an example, after a dispensing operation of sheet material **11**, the control unit can supply power to the material detection module mounted adjacent the first roller assembly and can send a command to determine if sheet material **11** is in the associated sensor area (e.g., in a space upstream of the driven roller). In the case that the material detection module returns a signal that sheet material **11** is detected or does not return a signal (e.g., the IR beam emitted by the IR launch tube are reflected and is not detected by the IR receiver tube), the control unit can be configured to continue

to dispense sheet material **11** from the first supply **18** of sheet material with the first roller assembly in subsequent dispensing operations In the case that the material detection module returns a signal that sheet material **11** is not detected (e.g., the IR beams emitted by the IR launch tube are not reflected and are detected by the IR receiver tube), the control unit can be configured to dispense sheet material **11** from the second supply **22** of sheet material with the second roller assembly **54** as described above. This optional embodiment allows for the detection and determination of the absence of sheet material, either due to breakage or completed use of the sheet material supply, upstream of the paper engagement area of the respective driven rollers.

[0089] In embodiments, the IR detection utilized by the material detection modules can be more accurate and more reliable than other sensing systems. For example, mechanical systems (e.g., where a lever rests against the outer surface of the supply of sheet material and pivots as the diameter decreases, and other systems) can vary in accuracy due to deviation in production of the systems. In alternative embodiments, either or both of the material detection modules **101** could be omitted or could be replaced with any suitable supply sensing system.

[0090] In embodiments, an activation system **800** can extend in at least a portion of a front end of the enclosure **51** with features for sensing proximity of a user and sensing activation gestures for initiating a dispensing operation of the dispenser assembly **10**. In embodiments, the activation system can include a front recess **802** defined in the front portion of the enclosure **51** and a dispenser activation sensor assembly **804** at least partially disposed in the front recess. As shown, the dispenser activation sensor assembly **800** can be an opposite beam IR sensor having an IR launching tube **806** and an IR receiving tube **808**, which is disposed directly opposite to the IR launching tube. Accordingly, when activated, the IR launching tube will emit IR rays directly toward the IR receiving tube so that the IR receiving tube will detect the IR rays from the IR launching tube unless the IR beam is broken, such as by a user's hand. In embodiments, the dispenser activation sensor assembly can be configured to send a signal to the control unit to initiate a dispensing operation to dispense a predetermined amount of sheet material **11** when the IR beam is broken and the IR receiving tube stops detecting the IR rays from the opposing IR launching tube. As shown, the tubes can be mounted to the enclosure **51** along opposing portions of the front recess **802**.

[0091] The dispenser activation assembly could be otherwise configured without departing from the disclosure. For example, the positions of the tubes could be reversed. In another example, while the tubes are shown with a vertical orientation in the figures, the opposing tubes could be arranged horizontally, diagonally, etc. in the front recess **122**.

[0092] In embodiments, the activation system **800** can include a visible light indicator **820**, which can help guide the user in the use of the dispenser. As shown, the visible light indicator **820** can include a LED module configured to emit one or more colors of visible light. In the illustrated embodiments, the LED module is mounted in the enclosure **51** along the front recess **802** adjacent the IR launching tube. However, the LED module could be otherwise located along the front recess. When the dispenser activation assembly **124** is active (e.g., the IR launching tube is emitting an IR beam and the dispenser activation assembly is ready to respond to a break in the IR beam), the LED module can emit visible light into the front recess. In the illustrated embodiments, the visible light can be green to indicate that the system is ready and to invite the user to insert a hand into the front recess to break the IR beam of the dispenser activation sensor assembly and cause the dispensing mechanism **50** to dispense sheet material **11**. The LED module can be configured to emit visible light in other colors to indicate different states of the dispenser assembly **10**. For example, the LED module can emit red light if the dispenser assembly **10** is out of sheet material **11** (e.g., both supplies **18**/**22** are depleted as detected by the material detection modules **101**). In another example, the LED module can emit a different color of visible light (e.g., yellow light) to indicate a different status or operational state of the dispenser assembly **10**. The visible light indicator could be otherwise configured without departing from the disclosure. For example, the LED module could be otherwise located and/or can direct visible light in any suitable direction.

[0093] In embodiments, the activation system **800** can be configured to activate and/or deactivate additional portions of the dispenser assembly **10** and/or can cooperate with a passive infrared sensor or other suitable sensor to deactivate systems and save power when potential users are not detected in proximity. While the activation system **800** is shown and described in conjunction with the sheet material dispenser in the illustrated embodiments, it is noted that the activation system **800** could be incorporated into any suitable dispensing system (e.g., a liquid dispenser, etc.).

[0094] In embodiments, the opposing beam configuration of the dispenser activation assembly **800** of the activation system can help avoid unwanted dispensing of sheet material **11** from the dispenser assembly **10**. For example, another dispenser could activate a dispensing operation when a user moves a hand under the dispenser (e.g., near where the material is dispensed), such as by emitting IR rays below the dispenser and dispensing material when the IR rays are reflected by the hand to an IR sensor. However, such configurations can lead to unwanted triggering of a dispensing operation, such as by a nearby surface (e.g., the dispenser is mounted near a counter or floor) or a passerby could mistakenly trigger a dispensing operation. Unwanted dispensing can waste power and sheet material. Also, when such an activation system is near the output of the sheet material, the dispensed sheet material could reflect IR rays to the sensor and cause continuous dispensing of the material. Some systems use features to detect when the sheet material has been torn (e.g., a tear bar) to prevent continuous dispensing (e.g., by deactivating the dispensing sensor until the material has been torn). However, such systems add complexity to the dispenser and may use additional power, lowering the efficiency of the dispenser. Further, dispensers that rely on a reflected IR beam to activate dispensing can require extensive calibration since it will not work properly if the beam is too strong or too weak and/or the sensor is too sensitive or not sensitive enough. Also, such dispensers can require calibration to account for environmental factors (e.g., nearby surfaces) during or subsequent to installation. In contrast, embodiment of the dispenser activation assembly avoid these issues by locating the tubes in the front recess **802**, spaced from the output openings. It is unlikely that the IR beam of the dispenser activation assembly in the front recess would be mistakenly broken by passersby.

Rather, a dispensing operation will only be triggered when the IR beam in the front recess is broken, which usually will only occur from an intentional act by a user (e.g., moving a hand into the front recess). In addition, the dispensed sheet material is spaced below the front recess so it is not likely to trigger an unwanted dispensing operation, and a tear bar and/or other complications are not needed.

[0095] In embodiments, advantages of the visible light indicator of the activation system include that it provides visual guidance for a user to know where to place a hand to activate a dispensing operation. Further, by blocking the visible light emitted by the LED module, a user is given feedback that their gesture with trigger dispensing (e.g., that the IR beam emitted by the IR launching tube has been blocked from the IR receiving tube). Other dispensers that lack such guidance leave a user to guess where to wave a hand to activate a dispensing operation.

[0096] Any of the features of the various embodiments of the disclosure can be combined with replaced by, or otherwise configured with other features of other embodiments of the disclosure without departing from the scope of this disclosure.

[0097] The foregoing description generally illustrates and describes various embodiments of the present invention. It will, however, be understood by those skilled in the art that various changes and modifications can be made to the above-discussed construction of the present invention without departing from the spirit and scope of the invention as disclosed herein, and that it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as being illustrative, and not to be taken in a limiting sense. Furthermore, the scope of the present disclosure shall be construed to cover various modifications, combinations, additions, alterations, etc., above and to the above-described embodiments, which shall be considered to be within the scope of the present invention. Accordingly, various features and characteristics of the present invention as discussed herein may be selectively interchanged and applied to other illustrated and non-illustrated embodiments of the invention, and numerous variations, modifications, and additions further can be made thereto without departing from the spirit and scope of the present invention as set forth in the appended claims.

What is claimed is:

1. A sheet material dispenser, comprising:

a dispenser housing;

a plurality of roller assemblies mounted within an enclosure of the dispenser housing, each roller assembly having a driven roller configured to drive sheet material from a respective supply of rolled sheet material;

a drive mechanism operably coupled to a select one of the driven rollers to selectively drive rotation of the select one driven roller; and

a plurality of support assemblies rotatably supporting a plurality of supplies of rolled sheet material within the at least one chamber of the dispenser housing, wherein each support assembly comprises:

a pair of opposing support members that are spaced apart such that a roll of sheet material can be mounted therebetween on a paper mandrel, wherein each of the support members has a first arm that has a proximal end that is configured to be rotatably mounted to an upper surface of the enclosure and a second arm that has a distal end that defines a slot for operative receipt of a respective end of a paper mandrel,

wherein the pair of opposing support members are configured to move between a first position, in which the roll of sheet material mounted on the paper mandrel is at full size and the angled relationship of the respective first and second arms allows for the center of gravity of the full roll of paper material and paper mandrel to be positioned at a maximal distance from the driven roller to offset the weight of the full roll of sheet material and paper mandrel and wherein, as the operative diameter of roll of sheet material is reduced, the spacing of the center of gravity of the roll of paper material and paper mandrel relative to the driven roller is complementarily reduced to ensure that paper material is fed consistently to the driven roller.

2. The sheet material dispenser of claim **1**, wherein the first and second arms are integral to each other and are positioned in a common plane at an acute angle with respect to each other.

3. The sheet material dispenser of claim **1**, wherein the drive mechanism is operably coupled to a select one of the first or second driven roller to selectively drive rotation of the select one of the first or the second driven roller.

4. The sheet material dispenser of claim **1**, wherein, as the sheet material roll of paper mat is used up and the operable radius of the roll of sheet material is reduced, the paper drum mandrel is maintained at a desired distance from the upper surface of the enclosure of the dispensing system.

5. The sheet material dispenser of claim **4**, wherein the desired distance is about 7 mm.

6. The sheet material dispenser of claim **4**, wherein the desired distance is between about 1 mm to 20 mm.

7. The sheet material dispenser of claim **1**, further comprising a control circuitry in communication with the drive mechanism that is programmed to selectively actuate the motor in the first or second rotative direction to feed the sheet material from the selected supply of sheet material through the discharge defined in the dispenser housing.

8. The sheet material dispenser of claim **1**, wherein the paper drum mandrel is configured for a frictional fit to a roll of sheet material mounted thereto.

9. The sheet material dispenser of claim **1**, wherein each driven roller further includes a plurality of raised circumferentially extending surfaces that are configured to be in contact with the sheet material on the roll of sheet material throughout operation.

10. The sheet material dispenser of claim **9**, wherein each of the plurality of raised circumferentially extending surfaces has a cam shape profile to maintain tension between respective tissue layers of the sheet material and to allow for intermittent roll suspension during roll rotation, which allows for paper tension to be maintained through operation as the roll of sheet material is used up.

11. The sheet material dispenser of claim **9**, wherein respective profiles of the raised circumferentially extending surfaces can be positioned such that the adjacent raised circumferentially extending surfaces are positioned in a mirrored relationship.

12. The sheet material dispenser of claim **1**, further comprising a dispensing system configured to allow the user

to manually retrieve additional sheet material by pulling manually after the initial sheet material is dispensed automatically.

13. The sheet material dispenser of claim **12**, wherein the dispensing system comprises a brake assembly for each roller assembly, each brake assembly having an elongate brake member being configured to pivot from an at rest position with respect to the housing for select braking contact with an upper guide roller of the roller assembly to cause the sheet material to cease feeding between a main roller and the upper guide roller such that the user can tear off the feed length of sheet material after which the brake assembly is configured to operatively bias back toward the at rest position.

14. The sheet material dispenser of claim **13**, wherein, in the rest position, a proximal end of the brake member is spaced from the surface of the upper guide roller.

15. The sheet material dispenser of claim **12**, wherein the brake assembly is rotatably mounted relative to the enclosure of the dispenser housing.

16. The sheet material dispenser of claim **12**, wherein a portion of a lower edge of the elongate brake member of the brake assembly can have a serrated profile extending at least partially between the opposed distal and proximal ends and can be shaped to tear the supplied sheet upon the manual application of sheet material the serrated profile of the lower edge.

17. The sheet material dispenser of claim **12**, wherein the brake assembly further comprise a bias member configured to urge the elongate brake member of the brake assembly toward the at rest position.

18. The sheet material dispenser of claim **1**, further comprising one or more material detection modules mounted within the dispenser housing adjacent a respective intake opening of each of the roller assemblies; each material detection modules being configured to determine whether sheet material from the respective supply of rolled sheet material is being fed through the respective intake opening in a respective sensor area along a sheet path the sheet material follows between the respective intake opening and the respective roller assembly.

19. The sheet material dispenser of claim **18**, wherein each material detection module comprises an infrared (IR) launch tube and an infrared receiver tube; each material detection module being oriented so that IR rays emitted from the IR launch tube are directed toward the sensor area between the respective intake opening and the respective roller assembly.

20. The sheet material dispenser of claim **18**, wherein, when the sheet material is not present in the sensor area, the IR rays emitted by the IR launch tube are not reflected back to the IR receiver tube.

21. The sheet material dispenser of claim **1**, further comprising an activation system configured for sensing proximity of a user and sensing activation gestures for initiating a dispensing operation of the sheet material.

22. A sheet material dispenser, comprising:

a dispenser housing;

a plurality of roller assemblies mounted within an enclosure of the dispenser housing, each roller assembly having a driven roller configured to drive sheet material from a respective supply of rolled sheet material;

a drive mechanism operably coupled to a select one of the driven rollers to selectively drive rotation of the select one driven roller; and

a dispensing system configured to allow the user to manually retrieve additional sheet material by pulling manually after the initial sheet material is dispensed automatically.

23. The sheet material dispenser of claim **22**, wherein the dispensing system comprises a brake assembly for each roller assembly, each brake assembly having an elongate brake member being configured to pivot from an at rest position with respect to the housing for select braking contact with an upper guide roller of the roller assembly to cause the sheet material to cease feeding between a main roller and the upper guide roller such that the user can tear off the feed length of sheet material after which the brake assembly is configured to operatively bias back toward the at rest position.

24. The sheet material dispenser of claim **23**, wherein, in the rest position, a proximal end of the brake member is spaced from the surface of the upper guide roller.

25. The sheet material dispenser of claim **22**, wherein the brake assembly is rotatably mounted relative to the enclosure of the dispenser housing.

26. The sheet material dispenser of claim **22**, wherein a portion of a lower edge of the elongate brake member of the brake assembly can have a serrated profile extending at least partially between the opposed distal and proximal ends and can be shaped to tear the supplied sheet upon the manual application of sheet material the serrated profile of the lower edge.

27. The sheet material dispenser of claim **22**, wherein the brake assembly further comprise a bias member configured to urge the elongate brake member of the brake assembly toward the at rest position.

28. The sheet material dispenser of claim **22**, further comprising a plurality of support assemblies rotatably supporting a plurality of supplies of rolled sheet material within the at least one chamber of the dispenser housing, wherein each support assembly comprises:

a pair of opposing support members that are spaced apart such that a roll of sheet material can be mounted therebetween on a paper mandrel, wherein each of the support members has a first arm that has a proximal end that is configured to be rotatably mounted to an upper surface of the enclosure and a second arm that has a distal end that defines a slot for operative receipt of a respective end of a paper mandrel,

wherein the pair of opposing support members are configured to move between a first position, in which the roll of sheet material mounted on the paper mandrel is at full size and the angled relationship of the respective first and second arms allows for the center of gravity of the full roll of paper material and paper mandrel to be positioned at a maximal distance from the driven roller to offset the weight of the full roll of sheet material and paper mandrel and wherein, as the operative diameter of roll of sheet material is reduced, the spacing of the center of gravity of the roll of paper material and paper mandrel relative to the driven roller is complementarily.

29. The sheet material dispenser of claim **28**, wherein the first and second arms are integral to each other and are positioned in a common plane at an acute angle with respect to each other.

30. The sheet material dispenser of claim **28**, wherein the drive mechanism is operably coupled to a select one of the first or second driven roller to selectively drive rotation of the select one of the first or the second driven roller.

31. The sheet material dispenser of claim **28**, wherein, as the sheet material roll of paper mat is used up and the operable radius of the roll of sheet material is reduced, the paper drum mandrel is maintained at a desired distance from the upper surface of the enclosure of the dispensing system.

32. The sheet material dispenser of claim **22**, further comprising a control circuitry in communication with the drive mechanism that is programmed to selectively actuate the motor in the first or second rotative direction to feed the sheet material from the selected supply of sheet material through the discharge defined in the dispenser housing.

33. The sheet material dispenser of claim **22**, wherein the paper drum mandrel is configured for a frictional fit to a roll of sheet material mounted thereto.

34. The sheet material dispenser of claim **22**, wherein each driven roller further includes a plurality of raised circumferentially extending surfaces that are configured to be in contact with the sheet material on the roll of sheet material throughout operation.

35. The sheet material dispenser of claim **22**, further comprising one or more material detection modules mounted within the dispenser housing adjacent a respective intake opening of each of the roller assemblies; each material detection modules being configured to determine whether sheet material from the respective supply of rolled sheet material is being fed through the respective intake opening in a respective sensor area along a sheet path the sheet material follows between the respective intake opening and the respective roller assembly.

36. The sheet material dispenser of claim **22**, further comprising an activation system configured for sensing proximity of a user and sensing activation gestures for initiating a dispensing operation of the sheet material.

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