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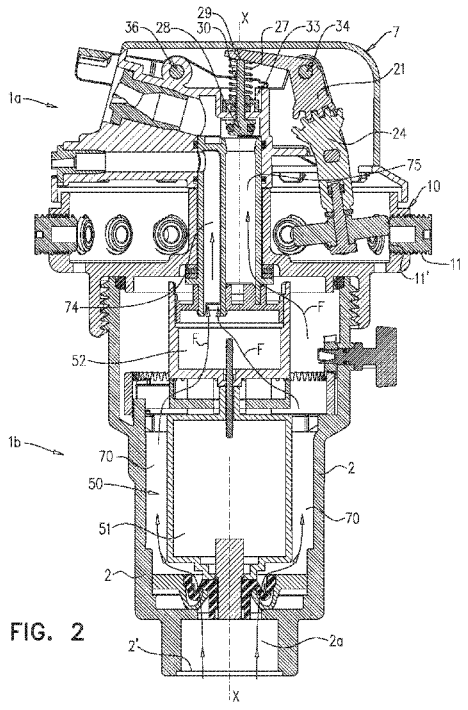


FIG. 2

(57) Abstract: A rotary sprinkler comprises a rotatable irrigation head with one or more nozzles, associated with liquid feed lines, which extend thereto from a sprinkler base housing, and further comprises a static biasing control base located below the irrigation head, e.g. between the sprinkler base housing and the irrigation head. The sprinkler can comprise a flow regulator arm, whose movement, at least indirectly, results in reducing the cross- sectional area of liquid flow towards at least one of the nozzles, and a flow deflector arm configured to interfere with a liquid jet discharged from at least one of the nozzles in order to affect the angle and range of the liquid jet. The static biasing control base can comprise an array of biasing elements, which can bias a cam follower configured to rotate together with the irrigation head and transfer its rotational displacement to the flow regulator arm and flow deflector arm, e.g. through respective gear elements. The gear elements can be adjusted to control a ratio between the extent of deflection of the two arms due to the rotation of the cam follower. The rotatable irrigation head can comprise a cover for preventing exposure of the dynamic control elements to the exterior of the sprinkler.

ROTARY SPRINKLER FOR VARYING IRRIGATION PATTERN

TECHNOLOGICAL FIELD

The presently disclosed subject matter is generally in the field of irrigation sprinklers, and more particularly, rotary sprinklers for irrigation of areas with varying irrigation patterns.

BACKGROUND

One example of an irrigation sprinkler of the kind, to which the presently disclosed subject matter refers, is disclosed US 20100012746. The sprinkler comprises a housing fitted with a flow chamber accommodating a motor for rotating a sprinkler head mounted on the housing, the housing comprising a first nozzle and a second nozzle, in flow communication with the outlet end of the flow chamber. The first nozzle is fitted for discharging liquid at a substantially short range. The sprinkler further comprises a dynamic liquid deflector associated with the second nozzle, and biased by an array of biasing elements, each adapted to dynamically bias the liquid deflector to a predetermined angle, and to thereby determine a deflection angle thereof.

SUMMARY

The presently disclosed subject matter is directed to a rotary sprinkler adapted to be attached to a liquid feed port located in, or in the vicinity of, an area to be irrigated such that an irrigation liquid, e.g. water, may be introduced through a sprinkler base housing and be discharged through its irrigation head rotatable about a longitudinal vertical axis of the sprinkler.

The rotatable irrigation head of the sprinkler has one or more nozzles, associated with liquid feed lines, which extend thereto from the sprinkler base housing.

Some of the operational parameters of the sprinkler, that include the flow rate and the spread of the liquid discharged are variable for at least one of the nozzles by the operation of an irrigation control unit during the rotation of the rotatable irrigation head.

In accordance with one aspect of the presently disclosed subject matter, the irrigation control unit comprises a static biasing control base located below the irrigation head, and more particularly, between the sprinkler base housing and the irrigation head.

Locating the biasing control base between the sprinkler base housing and the rotatable irrigation head results in that the sprinkler is compact in the vertical direction.

The irrigation control unit further comprises dynamic control elements, a majority of which are located within the irrigation head and are rotatable therewith.

The dynamic control elements can comprise at least a flow regulating mechanism and a flow deflecting mechanism.

The flow regulator mechanism can comprise a flow regulator arm, whose movement, at least indirectly, results in reducing the cross-sectional area of liquid flow towards at least one of the nozzles.

The liquid deflector mechanism can comprise a deflector arm configured to interfere with a liquid jet discharged from at least one of the nozzles in order to affect the angle and range of the liquid jet.

The static biasing control base comprises an array of biasing elements, which can bias a cam follower configured to rotate together with the irrigation head and transfer its rotational displacement to the flow regulator arm and deflector arm, e.g. through respective gear elements. Position of the biasing elements can be adjusted to suit displacement of the dynamic control elements during rotation of the irrigation head to a desired irrigation pattern.

According to another aspect of the presently disclosed subject matter, the ratio between the extent of deflection of the two arms due to the rotation of the cam follower can be controlled by the adjustment of the corresponding gears. This enables suiting the change of the flow rate through the nozzle, obtained due to the operation of the flow regulating arm, to the interference of the deflector arm with the liquid jet and vice versa.

According to a further aspect of the presently disclosed subject matter, the sprinkler can have an adjustable angle within which the irrigation head can be rotatable, which is useful for areas, in which irrigation is not desired at certain directions.

The above-mentioned adjustments can be performed at the time of the installation of the sprinkler, which can be performed by first mounting its sprinkler base housing to the dedicated liquid feed port and then assembling with the housing the static biasing control base with the irrigation head.

The rotation of the sprinkler irrigation head can be operated by a drive accommodated within the sprinkler base housing. One example of such drive is a

hydraulic motor, whose liquid flow is configured to rotate a shaft of the irrigation head. Other embodiments may be based on non-hydraulic motors, e.g. electric motor.

According to a still further aspect of the presently disclosed subject matter, the rotatable irrigation head of the rotary sprinkler can comprise a cover for preventing exposure of the dynamic control elements to the exterior of the sprinkler. The sprinkler cover can be formed with designated openings for the nozzles allowing the jet to be discharged freely therethrough, without being interfered by any elements of the sprinkler except for the liquid deflector arm.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to better understand the subject matter that is disclosed herein and to exemplify how it may be carried out in practice, embodiments will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Fig. 1 is a schematic side view of a sprinkler according to one embodiment of the presently disclosed subject matter;

Fig. 2 is a schematic planar illustration of the interior of the sprinkler shown in Fig. 1;

Fig. 3 is a schematic perspective illustration of the interior of an irrigation head of the sprinkler shown in Figs. 1 and 2;

Fig. 4 is a schematic side view of dynamic elements within one embodiment of the irrigation head; and

Fig. 5 is a schematic perspective view of a rotation limit and a motor units within one embodiment of a sprinkler

DETAILED DESCRIPTION OF EMBODIMENTS

Referring to Figs. 1 there is provided a rotary sprinkler **1** having an essentially cylindrical body extending along a longitudinal axis **X-X** and comprising an upper portion **1a** and a lower portion **1b** each of which can be assembled separately, allowing the upper portion **1a** to be rotatably mounted to the lower portion **1b** before or after mounting of the lower portion to a liquid supply line (not shown).

The lower portion **1b** comprises a sprinkler base housing **2** having an upstream end **2'** with a sprinkler inlet **2a** configured for being fitted to the liquid supply line, and a

downstream end **2"** for providing fluid communication between the sprinkler inlet and the upper portion **1a** .

The sprinkler upper portion **1a** comprises:

- an irrigation head **3** configured for being rotated by a drive accommodated within the sprinkler base housing **2** and to provide a short-range jet of liquid having constant flow rate and direction, and a long-range jet of liquid, whose parameters can be varied according to a pre-determined irrigation pattern;

- an irrigation control unit **6** comprising a static control base **10** fixedly mounted to the sprinkler base housing **2**, adjacent its downstream end **2"** and under the rotatable irrigation head **3,** and dynamic control elements configured to cooperate with the static control base **10** and to operate within the irrigation head **3** so as to control the flow rate and orientation of the long-range jet; and

- a neck **5** constituting an integrally assembled body with the irrigation head **3,** rotatably received within the sprinkler base housing **2**, and configured for serving as a central rotational shaft for the irrigation head **3** and for passing liquid from the downstream end **2"** of the sprinkler base housing **2** to the irrigation head.

With reference to Fig. 3, in the present example, the neck **5** comprises two feed lines, **74** and **75**, each having a upstream ends **74'** and **75'** within the sprinkler base housing **2**, and downstream ends **74"** and **75"** within the irrigation head **3**, and the irrigation head **3** has a body formed with the following:

- a first, short-range discharge nozzle **8** having a first nozzle inlet **8'** merging with the downstream end **74"** of the feed line **74**, and a first nozzle outlet **8"**;

- a second, long-range discharge nozzle **9** having a second nozzle inlet **9'** in fluid communication with the downstream end **75"** of the feed line **75** via a flow control chamber **9a** and a second nozzle outlet **9"** ; and

- with reference to Fig. 4, an irrigation head operational stage **4** having a number of engagement portions, which when engaged by the dynamic control elements of the irrigation control unit **6**, allow their movement relative to the stage required for the control of the above parameters of the long-range jet. In the present example, the engagement portions of the operational stage **4** are a main pivot portion **37,** a jet deflector pivot portion **36** and a flow regulator pivot portion **34**.

Turning to Fig. 1, the sprinkler **1** further comprises a top cover **7** configured to be attached to the body of the irrigation head **3** so as to rotate therewith and formed with two

openings **7'** and **7"** via which the respective outlets **8"** and **9"** protrude so as to allow the discharge of liquid therethrough. The shape and the orientation of each of the nozzle outlets can influence the discharged liquid jet parameters, such as: angle, spread and distance.

The static control base **10** of the irrigation control unit **6** has an annular sidewall **10'** formed with a plurality of circumferentially spaced cylindrical positioning bores **12** having radially extending central axes, receiving therein biasing elements **11,** which can be fixed in the corresponding bores to have their radially inner ends **11'** spaced to different extents from the sidewall, to form a positioning profile of the control base corresponding to the predetermined irrigation pattern mentioned above. In the present example, the biasing elements **11** are in the form of screws engaging the positioning bores **12** via a thread formed therein.

Referring to Fig. 4, the dynamic control elements are the following:

- a liquid deflector **14** that comprises a deflector arm **16** pivotally articulated to the deflector pivot portion **36** of the operational stage **4;**

- a flow regulator **20** that comprises a flow regulator arm **21** configured to pivot at the flow regulator pivot portion **34** and to exert a downward force on a distal end **29** of a plunger **25**, biased upwardly by a biasing spring **27**, to cause the movement of a proximal end **28** of the plunger into the flow control chamber **9a** for controlling the flow rate of liquid therefrom into the long-range nozzle **9**; and

- a transmission mechanism **17**, configured to translate the profile formed by the ends **11'** of the biasing elements **11**, into the pivoting rotational movements of the liquid deflector arm **16** and flow regulator arm **21.**

More particularly, the flow regulator arm **21** has a transmission-associated end **21'**, at which it is configured to be pivoted, and a plunger-associated end **21"** configured to exert the above force on the plunger **25**; the deflector arm **16** has a transmission-associated end **16'**, at which it is configured to be pivoted, and a deflecting end **16"** with a deflecting portion **16a**; and the transmission mechanism **17** comprises:

- a cam follower, including a disk-like roller follower **18** and a roller axle **19**, on which the roller follower is rotatably mounted, so as to come in contact with the inner ends **11'** of the biasing elements **11** and to thereby move radially the roller axle **19**, when the cam follower is rotated together with the irrigation head **3**;

- a flow-control transmission arm **24** having one end **24'**, with which it is mounted on the roller axle **19**, and another end **24"** configured to engage the transmission-associated end **21'** of the flow regulator arm **21**, wherein the lengths of the arms **24** and **21** and the roller follower **18** are calculated to overcome counterforces generated for example by the liquid within the flow control chamber **9a**, the biasing spring **27** and friction; and

- a deflection-control transmission arm **15** having one end **15'** with a pivot axle **32** fixed thereto, and another end **15"** configured to engage the transmission-associated end **16'** of the deflector arm **16**, the pivot axle **32** passing through the flow-control transmission arm **24** at a location disposed between its ends **24'** and **24"** so as to be pivoted thereby when the end **24'** of the flow-control transmission arm is moved radially by the axle **19**, the free end of the pivot axle **32** is pivotally received within the main pivot portion **37** of the operational stage **4** of the irrigation head **3**, and is fixed on its other end to end **15'** of the deflector-control transmission arm **15**.

The deflecting portion **16a** of the deflector arm **16** is so oriented that, when the deflector arm **16** is pivoted at the pivot portion **36** to different pivoting angles corresponding to the positioning profile of the static control base **10**, it selectively changes the vertical orientation of the liquid jet emitted from the long-range nozzle **9**. The deflecting portion **16a** can be formed in order to divert, split, converge, or control other parameters, such as speed and drop size of the liquid jet or portions thereof. For example: it can be essentially flat and can have grooves therein adapted for splitting the discharged liquid jet into a number of streams for better coverage of the irrigated area.

During rotation of the irrigation head **3**, the roller follower 18 of the cam follower, alternately comes in contact with a biasing end **11'** of a different biasing element **11**, whereby the extent of obstruction and flow of liquid out of the second nozzle **9** varies according to the radial distance of each of the biasing end from the main axis **X-X** of the cylindrical body. The displacement of the roller follower **18** towards the main axis **X-X**, entails a corresponding pivotal displacement of the deflector arm **16** towards the long-range nozzle **9** extending the interference. Similarly, a displacement of the roller follower **18** away from the main axis **X-X**, entails a corresponding pivotal displacement of the deflector arm **16** upwards thus reducing the interference of the long-range nozzle **9**.

In the described example, the ends of each pair of the above arms that are configured to engage each other, are in the form of gears.

Turning to Fig. 2, the sprinkler base housing **2** is formed with a flow chamber **70** in flow communication **F** with the first flow path **74** and the second flow path **75**.

The sprinkler base housing **2** further accommodates a motor unit **50**, which can be constituted by a hydraulic motor operated by a flow of liquid through a turbine housing **52**. The motor unit **50** drives an axial rotation of rotatable irrigation head **3** around axis **X-X** by the neck **5** fitted at the upper portion of the motor unit **50**.

It should be noted that the motor unit can be constituted by a non-hydraulic motor such as an electrical motor.

Turning to Fig. 5, in order to further control the irrigation pattern of the rotary sprinkler, the sprinkler can comprise a rotation limiting unit **60** for limiting the angle in which the irrigation head **3** can rotate about the **X-X** axis.

In the described example, the rotation limiting unit can comprise a direction changer **61** and a static adjustment ring **62**. The direction changer **61** is fixed between a motor gear housing **51** and the turbine housing **52** and is configured for receiving the rotational movement of the sprinkler. A rotation flange **68** is formed on the changer **61** and protrudes away from axis **X-X** towards the internal side of the adjustment ring **62.**

The static adjustment ring **62** coincides with the inner circular wall of the sprinkler base housing **2** at a vertical position adapted to allow a rib **63,** formed at the internal wall of ring **62,** to face flange **68** during the rotation of direction changer **61**.

A rotatable adjustment knob **65** extends through the sprinkler base housing **2** into its internal side, while maintaining the sprinkler base housing **2** sealed. The rotational movement of the knob is transmitted to the ring **62** by an adjustment gear **64** which interengages the adjustment ring **62,** on which a gear is formed.

In operation, when turning knob **65**, its rotational movement is transmitted through gear **64** to ring **62**, the rotational movement of ring **62** adjusts the circular location of the rotation rib **63.** The rotation of the sprinkler head around axis **X-X** will be limited to stop when flange **68** encounters rib **63**.

In assembly, after mounting the sprinkler onto the main feed line in order to irrigate a certain area, the following adjustments can be made:

- the biasing elements **11** can be adjusted within the respective positioning hole of the static control base **10** according to the geometric shape of the perimeter of the area to be irrigated;

- the ratio between the extent of deflection of the two arms due to the rotation of the transmission mechanism **17** can be controlled by the adjustment of the corresponding interengaged transmission arms **24** and **15**. This enables suiting the change of the flow rate through the long-range nozzle **9** obtained due to the operation of the flow regulating arm **21**, to the interference of the deflector arm **16** with the liquid jet and vice versa.

- the angle in which the irrigation head **3** can rotate about the **X-X** axis, can be adjusted by turning the knob 65, hence, setting the limiting position of flange **68**.

In operation of the sprinkler, liquid from the feed line on which the sprinkler is fixed, enters the flow chamber **70** of the sprinkler base housing **2**. Part of the liquid flows through the hydraulic motor **50**, resulting in the rotation of the irrigation head **3** with respect to the sprinkler base housing **2** of the sprinkler. When exiting the hydraulic motor **50**, the liquid further flows through the first feed line **74**, within neck 5 to the short-range nozzle **8** and provides a constant amount of liquid at a constant angle to the area to be irrigated. The liquid that flows, directly through neck 5, through the second feed line **75,** reaches the flow control chamber **9a** within the irrigation head **3,** where it can be obstructed by the proximal end **28** of the plunger **25**, to an extent determining the amount of water to pass towards the long-range nozzle **9**, in correspondence with the extent of the radial protrusion of the biasing elements **11**.

After reaches the long-range nozzle **9**, the liquid jet emitted out of the nozzle can be obstructed by the deflecting portion **16a** of the liquid deflector **14**, determining the actual irrigation range.

Thus, in each direction the discharge nozzles are oriented, the angle of the discharged jet and the liquid flow rate can be different, allowing the coverage of virtually any geometric planar shape of irrigation area. Furthermore, a correspondence between the deflection extent of the liquid by the liquid deflector **14** and the obstruction of the liquid flow by the flow regulator **20** provides substantially uniform precipitation of water across all of the irrigated area.

Whilst one sprinkler has been described above in detail and shown in the drawings, it is to be understood that other sprinklers can be designed based on the

principles of the presently disclosed subject matter, having one or more elements different from those of the described sprinkler. For example:

- the sprinkler head can comprise a single nozzle with the varying parameters as described above, operated by a non-hydraulic motor;

- the sprinkler can comprise more than two nozzles having such varying parameters;

- the number of feed lines can be different from that of the nozzles, meaning that one nozzle can have fluid communication with more than one feed line;

- the sprinkler base housing fitted to the liquid supply line, can be static or can be rotatable, while allowing the irrigation head to rotate relative to the sprinkler base housing about axis **X-X**;

- the flow regulator arm **21**, the ends of plunger **25**, and the flow control chamber **9a**, can be formed in shapes and dimensions to suit a desired control of the flow rate of liquid therefrom into the long-range nozzle **9**;

- the nozzle outlets can be exchangeable in order to select the best form to suit the desired liquid jet parameters.

CLAIMS:

1. A rotary sprinkler comprising:

   - a sprinkler base housing;

   - an irrigation head rotatable about a longitudinal vertical axis of the sprinkler and having one or more nozzles associated with liquid feed lines, which extend thereto from the sprinkler base housing;

   - an irrigation control unit operable so that during the rotation of the irrigation head at least one of flow rate and spread of liquid discharged therethrough is variable for at least one of the nozzles; and

   - a static biasing control base constituting a part of the irrigation control unit and located below the irrigation head.

2. A rotary sprinkler according to Claim 1, wherein the static biasing control base is located between the sprinkler base housing and the irrigation head.

3. A rotary sprinkler according to Claim 1, wherein the irrigation control unit further comprises dynamic control elements, a majority of which are located within the irrigation head and are rotatable therewith.

4. A rotary sprinkler according to Claim 3, wherein the dynamic control elements comprise at least a flow regulating mechanism and a flow deflecting mechanism.

5. A rotary sprinkler according to Claim 4, wherein the flow regulator mechanism comprises a flow regulator arm, whose movement, at least indirectly, results in reducing the cross-sectional area of liquid flow towards at least one of the nozzles.

6. A rotary sprinkler according to Claim 4, wherein the liquid deflector mechanism comprises a deflector arm configured to interfere with a liquid jet discharged from at least one of the nozzles in order to affect the angle and range of the liquid jet.

7. A rotary sprinkler according to Claim 6, wherein the static biasing control base comprises an array of biasing elements, which can bias a cam follower configured to rotate together with the irrigation head and transfer its rotational displacement to the flow regulator arm and deflector arm.

8. A rotary sprinkler according to Claim 7, wherein the transfer is configured to be performed through respective gear elements.

9. A rotary sprinkler according to Claim 8, wherein the gear elements can be adjusted to control a ratio between the extent of deflection of the two arms due to the rotation of the cam follower.

10. A rotary sprinkler according to Claim 7, wherein position of the biasing elements is adjustable to suit displacement of the dynamic control elements during rotation of the irrigation head to a desired irrigation pattern.

11. A rotary sprinkler according to Claim 1, wherein an angle, within which the irrigation head is rotatable, is adjustable to allow avoiding irrigation in pre-determined directions.

12. A rotary sprinkler according to Claim 3, wherein the rotatable irrigation head comprises a cover for preventing exposure of the dynamic control elements to the exterior of the sprinkler.

13. A rotary sprinkler according to Claim 12, wherein the dynamic control elements comprise a deflector arm configured to interfere with a liquid jet discharged from at least one of the nozzles in order to affect the angle and range of the liquid jet; wherein the cover is formed with designated openings for the nozzles allowing the jet to be discharged freely therethrough, without being interfered by any elements of the sprinkler except for the liquid deflector arm.

14. A rotary sprinkler comprising:

- a sprinkler base housing;

- an irrigation head rotatable about a longitudinal vertical axis of the sprinkler and having one or more nozzles associated with liquid feed lines, which extend thereto from the sprinkler base housing;

- an irrigation control unit operable so that during the rotation of the irrigation head at least one of flow rate and spread of liquid discharged therethrough is variable for at least one of the nozzles;

- dynamic control elements constituting a part of the irrigation control unit, a majority of which are located within the irrigation head and are rotatable therewith;

- a flow regulator arm constituting a part of the dynamic control elements, whose movement, at least indirectly, results in reducing the cross-sectional area of liquid flow towards at least one of the nozzles;

- a flow deflector arm configured to interfere with a liquid jet discharged from at least one of the nozzles in order to affect the angle and range of the liquid jet;

- a cam follower configured to rotate together with the irrigation head and transfer its rotational displacement to the flow regulator arm and flow deflector arm; and

- gear elements configured to perform said transfer and to be adjusted so as to control a ratio between the extent of deflection of the two arms, thereby enabling suiting the change of the flow rate through the nozzle, obtained due to the operation of the flow regulator arm, to the interference of the flow deflector arm with the liquid jet and vice versa.

15. A rotary sprinkler according to Claim 14, wherein an angle within which the irrigation head is rotatable, is adjustable to allow avoiding irrigation in pre-determined directions.

16. A rotary sprinkler according to Claim 14, wherein the rotatable irrigation head comprises a cover for preventing exposure of the dynamic control elements to the exterior of the sprinkler.

17. A rotary sprinkler according to Claim 16, wherein the cover is formed with designated openings for the nozzles allowing the jet to be discharged freely therethrough, without being interfered by any elements of the sprinkler except for the flow deflector arm.

18. A rotary sprinkler comprising:

- a sprinkler base housing;

- an irrigation head rotatable about a longitudinal vertical axis of the sprinkler and having one or more nozzles associated with liquid feed lines, which extend thereto from the sprinkler base housing;

- an irrigation control unit operable so that during the rotation of the irrigation head at least one of flow rate and spread of liquid discharged therethrough is variable for at least one of the nozzles;

- dynamic control elements constituting a part of the irrigation control unit, a majority of which elements being located within the irrigation head and being rotatable therewith; and

- a sprinkler cover for preventing exposure of the dynamic control elements to the exterior of the sprinkler.

19. A rotary sprinkler according to Claim 18, wherein the dynamic control elements comprise a flow deflector arm configured to interfere with a liquid jet discharged from at least one of the nozzles in order to affect the angle and range of the liquid jet.

20. A rotary sprinkler according to Claim 18, wherein the sprinkler cover is formed with designated openings for the nozzles allowing the jet to be discharged freely therethrough, without being interfered by any elements of the sprinkler except for the flow deflector arm.

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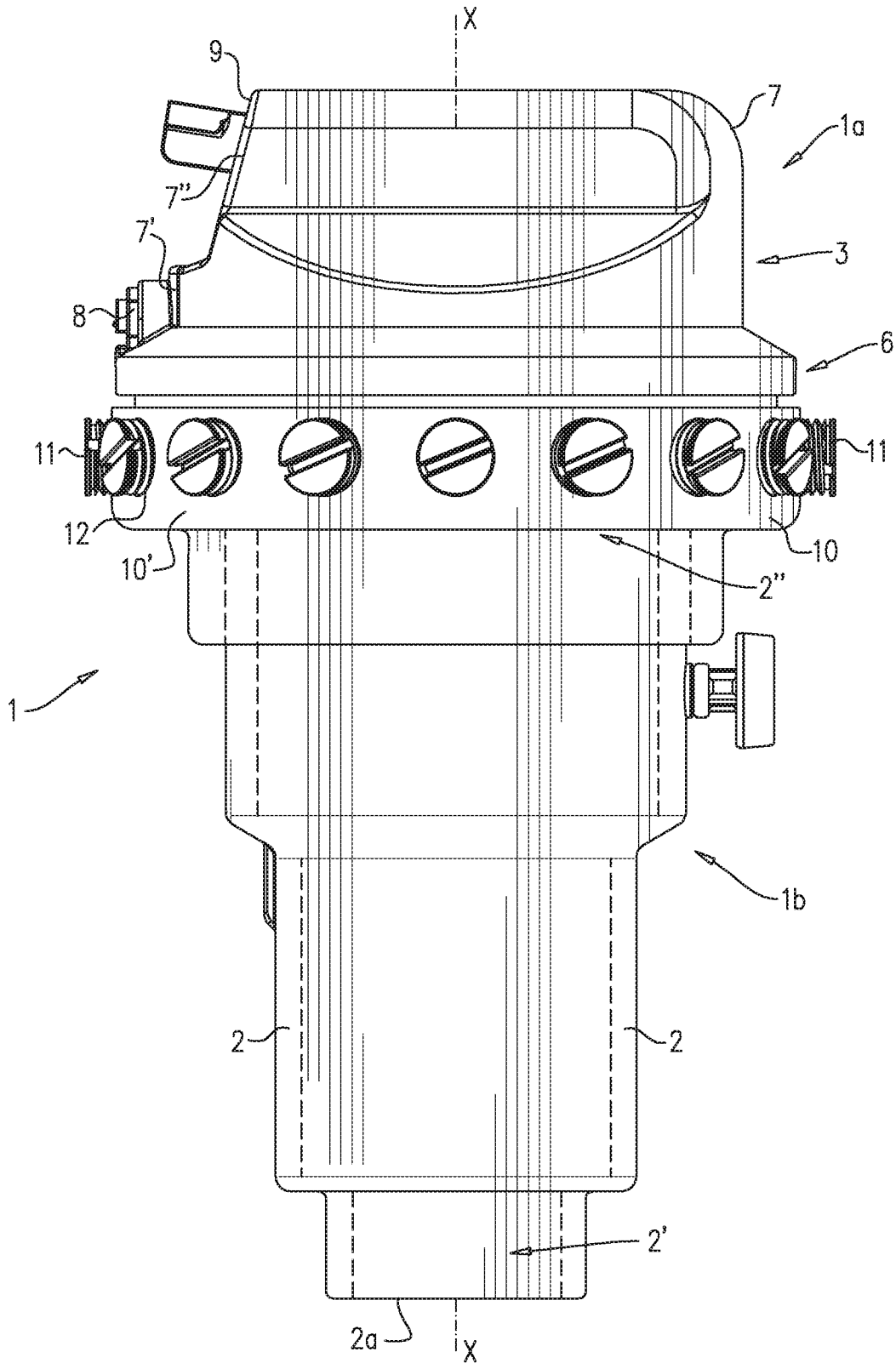


FIG. 1

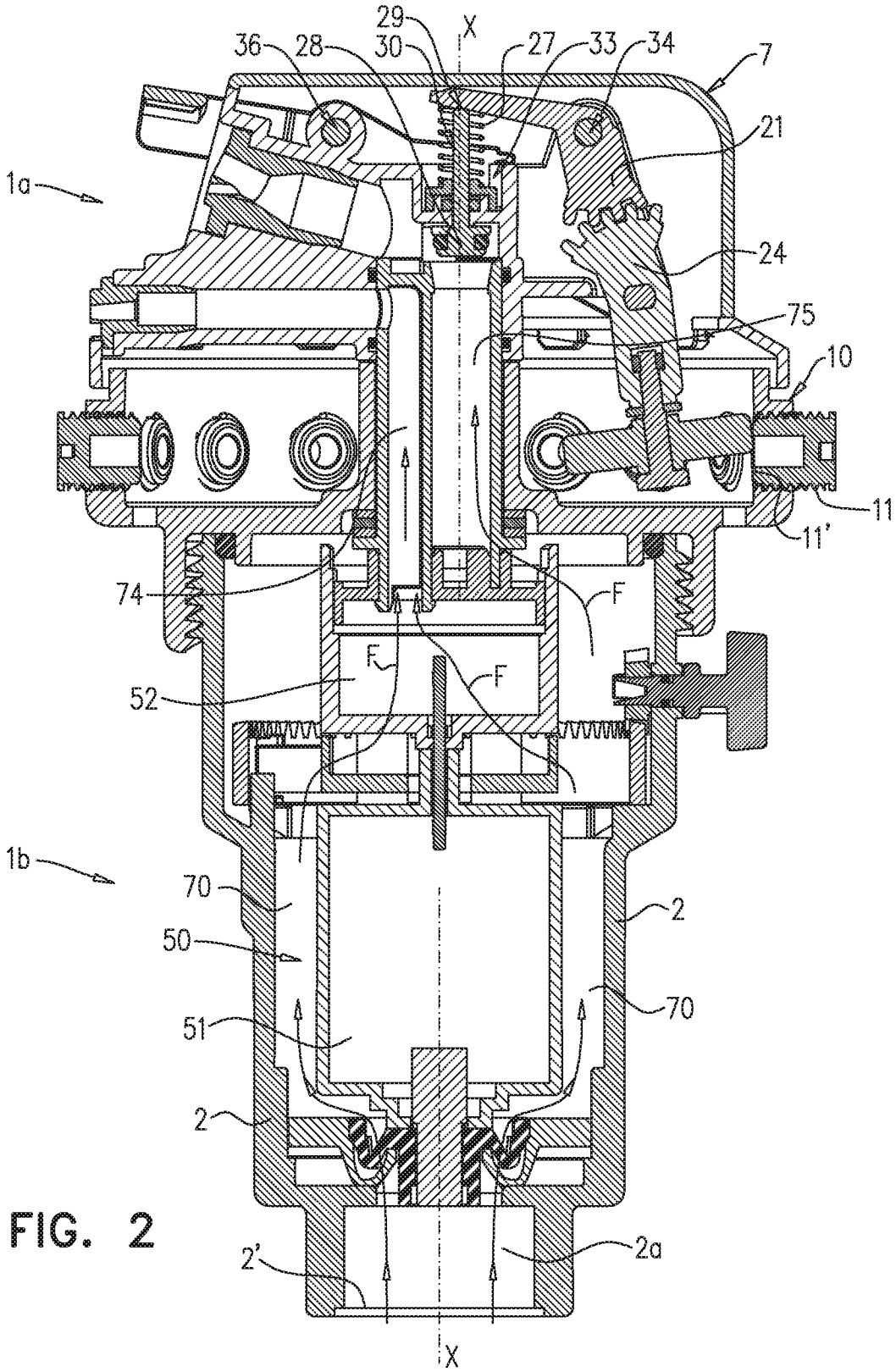

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FIG. 2

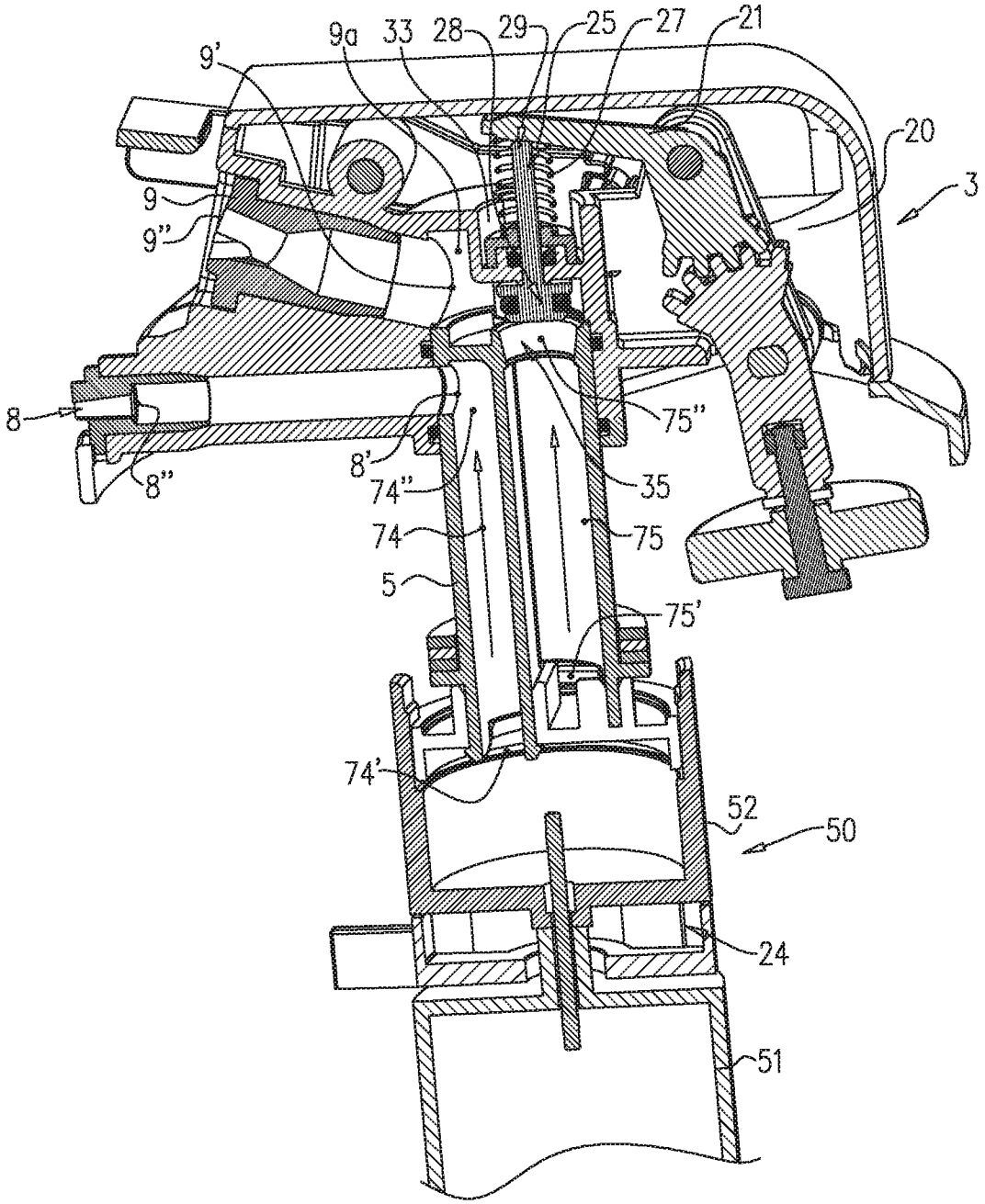


FIG. 3

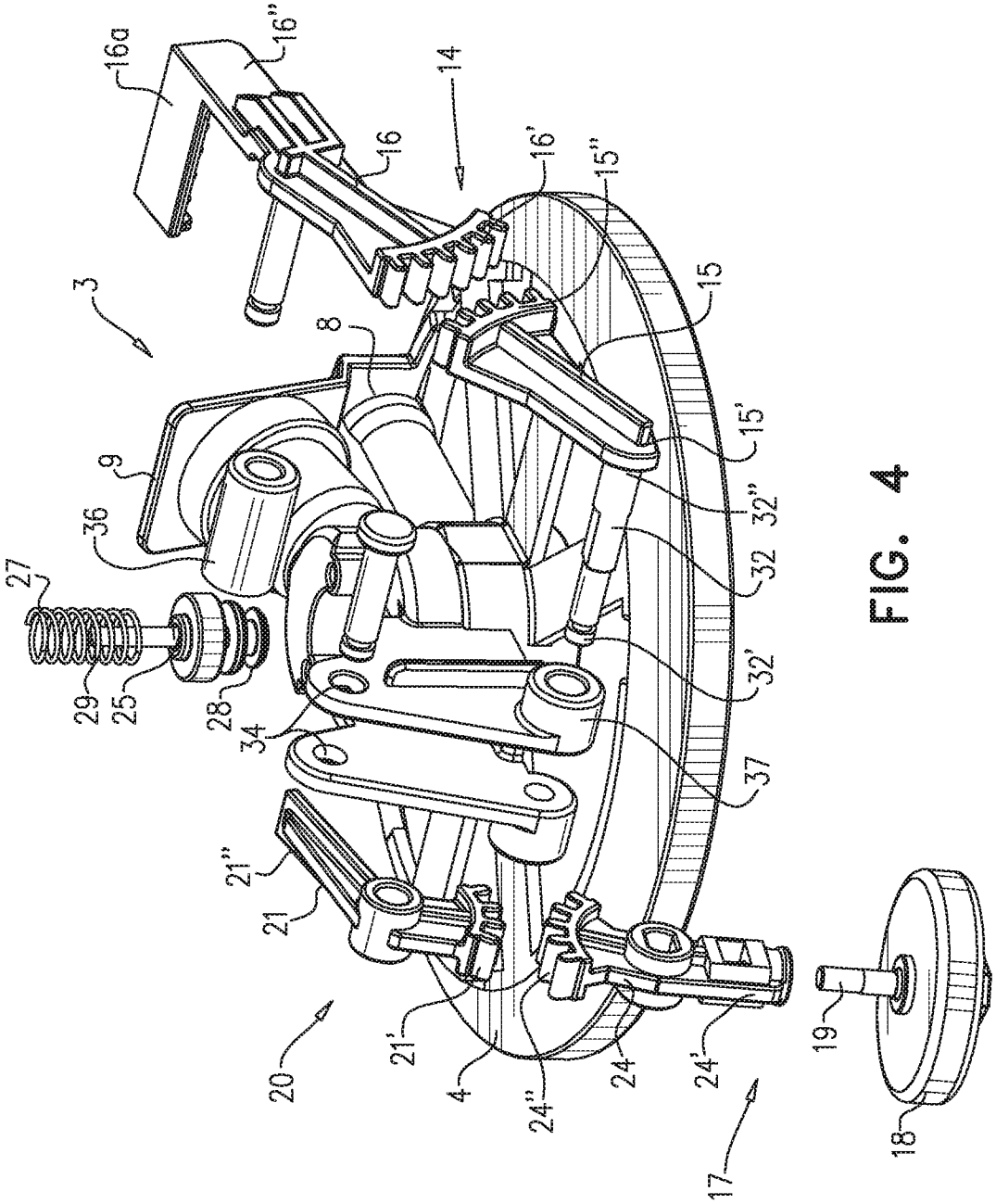

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18
17

FIG. 4

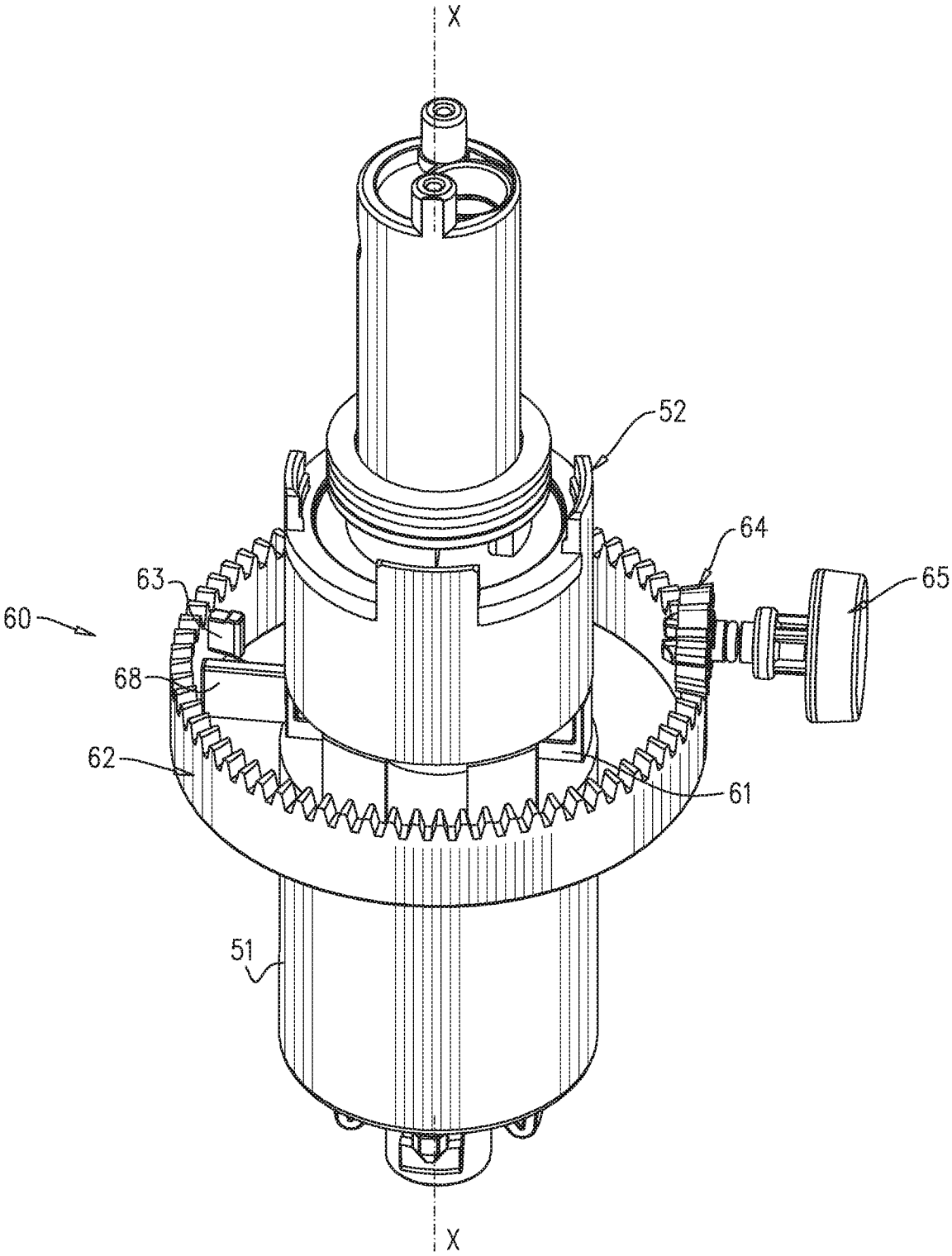


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2018/050235

A. CLASSIFICATION OF SUBJECT MATTER
IPC (2018.01) B05B 3/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC (2018.01) B05B 3/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Databases consulted: Google Patents
Search terms used: ROTARY, SPRINKLERS, VARRYING, PATTERNS, CAM, FOLLOWER, PREDETERMINED, ADJUSTABLE, CONTROLLED, DEFLECTOR.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	GB 2150862 A (SCHWARTZMAN JOEL) 10 Jul 1985 (1985/07/10) Fig. 2; Fig. 1A;	1-20
X	US 3654817 A (RAIN BIRD SPRINKLER MFG.) 11 Apr 1972 (1972/04/11) Figs. 10-11	1
X	US 5086977 A (KAH JR. CARL L. C.) 11 Feb 1992 (1992/02/11) Fig. 3	1
Y	Fig. 3	13,17,20

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
06 Jun 2018	06 Jun 2018

Name and mailing address of the ISA:	Authorized officer
Israel Patent Office Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel Facsimile No. 972-2-5651616	AGMAIL Waleed Ibrahim Ramadan Telephone No. 972-2-5651626

INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

International application No.
PCT/IL2018/050235

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