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(54) Title: INTERRUPTIBLE SPRINKLER HEAD

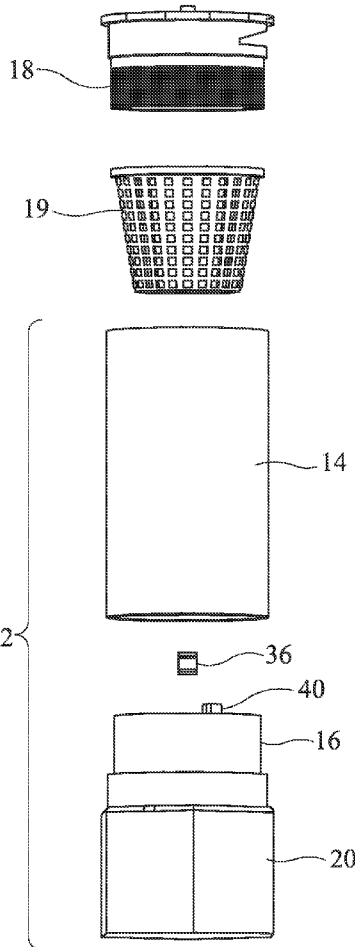


FIG. 1

(57) Abstract: In some embodiments, a sprinkler head is disclosed. The sprinkler head can include a spray stem comprising an upper stem rotatably coupled to a base stem; a spray nozzle coupled to a distal end of the upper stem; and a connector for removably coupling the sprinkler head to a pressurized liquid source. An interior cavity of the base stem can be in fluid communication with an interior cavity of the connector, and the upper stem can rotate between an operational position where an upper stem interior cavity is in fluid communication with the base stem interior cavity and a maintenance position where the upper stem interior cavity is not in fluid communication with the base stem interior cavity. A pop-up sprinkler head including the spray stem described herein is also described.



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INTERRUPTIBLE SPRINKLER HEAD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application No. 61/993,115, filed May 14, 2014, the entirety of which is incorporated by reference herein.

FIELD OF THE INVENTION

[0002] The present invention relates generally to an interruptible sprinkler head, particularly, a sprinkler head with a spray stem that rotates between an operational position and a maintenance position.

BACKGROUND

[0003] Sprinkler heads are an important part of both portable and underground sprinkler systems. However, sprinkler heads often break, which can waste water and significantly reduce the ability of the sprinkler system to distribute water over the intended area. One of the most efficient technique for determining whether a sprinkler head is broken is to turn on the water and see if any of the sprinkler heads are broken. This results in many trips back-and-forth to turn the water on and off. There are many areas for improvement in making sprinkler heads and sprinkler systems more reliable.

SUMMARY

[0004] In some embodiments, a sprinkler head is disclosed. The sprinkler head can include a spray stem comprising an upper stem rotatably coupled to a base stem; a spray nozzle coupled to a distal end of the upper stem; and a connector for removably coupling the sprinkler head to a pressurized liquid source. An interior cavity of the base stem can be in fluid communication with an interior cavity of the connector, and the upper stem can rotate between an operational position where an upper stem interior cavity is in fluid communication with the base stem interior cavity and a maintenance position where the upper stem interior cavity is not in fluid communication with the base stem interior cavity.

[0005] In some embodiments, a pop-up sprinkler head is disclosed. The pop-up sprinkler head can include a sprinkler body having an upper aperture and a lower opening adapted for connection to a pressurized liquid source, and a spray stem comprising an upper stem rotatably coupled to a base stem such that the upper stem rotates between an operational position where an upper stem interior cavity is in fluid communication with a base stem interior cavity and a maintenance position where the upper stem interior cavity is not in fluid communication with the base stem interior cavity. The pop-up sprinkler head can be adapted so that the spray stem slides between a retracted position where a majority of the spray stem is within the sprinkler body and an extended position where the spray stem extends through the upper aperture and above an upper extent of the sprinkler body.

[0006] These and other features, objects and advantages of the present invention will become more apparent to one skilled in the art from the following description and claims when read in light of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Fig. 1 is an exploded view of a sprinkler head as described herein.

[0008] Fig. 2 is a semi-transparent view of an assembled sprinkler head of Fig. 1.

[0009] Fig. 3 is a side for of an assembled sprinkler head of Fig. 1.

[0010] Fig. 4 is a top perspective view of an upper stem as described herein.

[0011] Fig. 5 is a top perspective view of a base stem as described herein.

[0012] Fig. 6 is a cross-sectional view of the sprinkler head of Fig. 3 in the operational position.

[0013] Fig. 7 is a cross-sectional view of the sprinkler head of Fig. 3 in the maintenance position.

[0014] Fig. 8 is a front view of a base stem for use in a pop-up sprinkler head.

[0015] Fig. 9 is a front, perspective view of the base stem of Fig. 8.

[0016] Fig. 10 is a top, perspective view of the base stem of Fig. 8.

[0017] Fig. 11 is a bottom, perspective view of the base stem of Fig. 8.

[0018] Fig. 12 is a front, perspective view of an upper stem that could be used with the base stem of Fig. 8.

[0019] Fig. 13 is a bottom, perspective view of the upper stem of Fig. 12.

[0020] Fig. 14 is a bottom view of the upper stem of Fig. 12.

[0021] Fig. 15 is a close-up, bottom perspective view of the upper stem of Fig. 12.

[0022] Fig. 16 is a front view of an assembled spray stem without a spray nozzle.

[0023] Fig. 17 is a bottom, perspective view of the assembled spray stem of Fig. 16 in the maintenance position.

[0024] Fig. 18 is a bottom, perspective view of the assembled spray stem of Fig. 16 in the operational position.

[0025] Fig. 19 is a bottom view of the assembled spray stem of Fig. 16 in an operational position, with a partial overlap of the orifices.

[0026] Fig. 20 is a partially-transparent view of Fig. 19.

[0027] Fig. 21 is a partially-transparent, bottom view of the assembled spray stem of Fig. 16 in the maintenance position.

[0028] Fig. 22 is a cross-sectional view of a pop-up sprinkler head incorporating a spray stem (such as that shown in Figs. 18-20) in the operational position, but in the retracted position (no water pressure).

[0029] Fig. 23 is a cross-sectional view of a pop-up sprinkler head incorporating a spray stem (such as that shown in Figs. 18-20) in the operational position and the extended position.

[0030] Fig. 24 is an example of a cross-sectional view of the pop-up sprinkler of Fig. 22 taken along cut line A-A.

[0031] Fig. 25 is a second example of a cross-sectional view of the pop-up sprinkler of Fig. 22 taken along cut line A-A.

[0032] Fig. 26 is a third example of a cross-sectional view of the pop-up sprinkler of Fig. 22 taken along cut line A-A.

[0033] Figs. 27A and 27B are perspective views of a base stem with a projection located immediately adjacent to the upper face opening thereof.

[0034] Figs. 28A and 28B are perspective views of an upper stem with a groove located immediately adjacent to the lower face opening thereof.

DETAILED DESCRIPTION

[0035] A sprinkler head 10 is disclosed. The sprinkler head 10 is designed for ease of maintenance and repair of the spray nozzle and filter at the distal end of the sprinkler head spray stem. In some embodiments, the user can turn on a water supply to the sprinkler system to check the operation of the spray nozzles. When a clogged spray nozzle is identified, the spray stem is twisted to cut off the water supply to the upper spray stem and, therefore, the spray nozzle. If the sprinkler head is a pop-up sprinkler head, the spray stem will remain extended outside the sprinkler body because the external water pressure has not been removed. Thus, the spray stem remains extended, but water is not spraying during the maintenance process. The spray nozzle and/or filter can be removed and cleaned and the spray nozzle and/or filter replaced, if necessary. Once the maintenance has been completed, the spray stem is twisted back to the operational position and the water flow returns to the spray nozzle. This allows for convenient maintenance and repair without requiring the user to (1) go back and forth between the sprinkler control box and the sprinkler head to turn the water pressure

on and off, and (2) stay dry because the water does not flow into the spray nozzle in the maintenance position.

[0036] As shown in Figs. 1-28, a sprinkler head 10 is disclosed. The sprinkler head 10 can include a spray stem 12 that includes an upper stem 14 rotatably coupled to a base stem 16; a spray nozzle 18 coupled to a distal end of the upper stem 14; and a connector 20 for removably coupling the sprinkler 10 head to a pressurized liquid source (S). The base stem interior cavity 22 can be in fluid communication with a connector interior cavity 24. The upper stem 14 can rotate between an operational position, as shown in Figs. 6, 18-20 & 22-23, where an upper stem interior cavity 26 is in fluid communication with the base stem interior cavity 22, and a maintenance position, as shown in Figs. 7, 17 & 21, where the upper stem interior cavity 26 is not in fluid communication with the base stem interior cavity 22.

[0037] As used herein, "pressurized" refers to pressures generally present in domestic water supplies, such as those conventionally used for domestic, commercial, or agricultural sprinkler systems used to maintain grass and landscaping plants.

[0038] As used herein, "not in fluid communication" is intended to include no fluid communication at all, as well as, instances where, when functioning at the standard operating pressure for the sprinkler system, the flow rate in the maintenance position is <33.3% of the flow rate in the operating position, or less than 25%, or less than 20%, or less than 15%, or less than 10%, or less than 7.5%, or less than 5%, or less than 2.5% of the operating position flow rate.

[0039] In some embodiments, as best shown in Figs. 1-3, the spray nozzle 18 can be removably coupled to a distal end of the upper stem 14. For example, the spray nozzle 18 can screw or snap into or onto the distal end of the upper stem 14.

[0040] As shown in Fig. 1, 2 & 22, the sprinkler head 10 can also include a filter 19. The filter 19 can fit within the upper stem interior cavity 26 and can be removed when the spray nozzle 18 is removed from the distal end of the upper stem 14. In some embodiments, as best shown in Fig. 2, the filter 19 can be held within the upper stem interior cavity 26 by the spray nozzle 18. In other embodiments, the filter 19 and the spray nozzle 18 can be integrally formed.

[0041] In some embodiments, an upper face 28 of the base stem 16 is rotatably coupled to a lower face 30 of the upper stem 14, where the upper face 28 includes at least one base stem orifice 32 and the lower face 30 includes at least one upper stem orifice 34. In some embodiments, as shown in Figs. 6, 18-20 & 22-23, the at least one base stem orifice 32 and the at least one upper stem orifice 34 overlap in the operational position. As shown in Figs. 7, 17 & 21, the at least one base stem orifice 32 and the at least one upper stem orifice 34 do not overlap in the maintenance position.

[0042] In some embodiments, the base stem orifice(s) 32 are the same size and shape as the upper stem orifice(s) 34 with which they align in the operational position. As used herein, two orifices "overlap" if they partially or fully overlap (*i.e.*, allow water to flow through the two orifices from the base stem interior cavity 22 to the upper stem interior cavity 26).

[0043] As shown in Fig. 4-7, in some embodiments, the at least one upper stem orifice 34 includes one upper stem orifice 34, and the at least one base stem orifice 32 includes one base stem orifice 32. As shown in Figs. 9, 13 & 17-18, in some embodiments, the at least one upper stem orifice 34 includes a plurality of upper stem orifices 34, and the at least one base stem orifice 32 includes a plurality of base stem orifices 32. In some embodiments, as best shown in Figs. 6, 7, 13, 22, 23, 27 and 28, the lower face 30 is recessed within the upper stem 14 (*e.g.*, a proximal portion of the upper stem 14), and a portion of the upper stem 14 slides over a portion of the base stem 16.

[0044] In some embodiments, the rotation of the upper stem 14 relative to the base stem 16 is limited to less than 360 degrees. In some embodiments, the rotation of the upper stem 14 relative to the base stem 16 is limited to less than 270 degrees, or less than 180 degrees, or less than 150 degrees, or less than 120 degrees.

[0045] In some embodiments, the upper face 28 of base stem 16 is rotatably coupled to the lower face 30 of upper stem 14. For example, the stems 14, 16 can be rotatably coupled by a fastener 36 (*e.g.*, a rivot). In some embodiments, one of the upper face 28 and the lower face 30 includes a groove 38, and the other of the upper face 28 and the lower face 30 comprise a projection 40. In such embodiments, the projection 40 slides within the groove 38 to limit rotation of the upper stem 14 relative to the base stem 16 to less than 360 degrees. In some embodiments, the rotation of the upper stem 14 relative to the base stem 16 is limited by the groove-projection

arrangement to less than 270 degrees, or less than 180 degrees, or less than 150 degrees, or less than 120 degrees.

[0046] In some embodiments, as shown in Figs. 6-7 & 22-23, the upper face 28 includes an upper face opening 29 and the lower face 30 includes a lower face opening 31, where the fastener 36 passes through the upper face opening 29 and the lower face opening 31 and is secured to the back side of the upper and lower faces 28, 30. In some embodiments, the upper face 28 is round and the upper face opening 29 is concentric with a center of the upper face 28. In some embodiments, the lower face 30 is round and the lower face opening 31 is concentric with a center of the lower face 30.

[0047] In some embodiments, one of the openings 29, 31 is circumscribed by a circular projection 60 and the circular projection nests within the other opening 31, 29. For example, as shown in Fig. 5-7 & 22-23, in some embodiments one of the openings 29, 31 can have stepped sides and the circular projection 60 can fit within a wider portion of the stepped opening, while the fastener 36 fits through the circular projection 60 and the narrower portion of the stepped opening.

[0048] In some embodiments, one of the upper face 28 and the lower face 30 include a second groove 38_B, and the other of the upper face 28 and the lower face 30 comprise a second projection 40_B, wherein said first and second projections 40_A, 40_B slide within the first and second grooves 38_A, 38_B to limit rotation of the upper stem to less than 270 degrees. In some embodiments, the rotation of the upper stem 14 relative to the base stem 16 is limited by the groove-projection arrangement to less than 180 degree, less than 150 degrees, or less than 100 degrees.

[0049] In some embodiments, the lower face 30 is round and the at least one upper stem orifice 34 is symmetric about a diameter of the lower face 30. In some embodiments, the lower face 30 is round, and the at least one upper stem orifice 34 and the groove 38/projection 40 are symmetric about a diameter of the lower face 30. In some embodiments, the upper face 28 is round and the at least one base stem orifice 32 is symmetric about a diameter of the upper face 28. In some embodiments, the upper face 28 is round, and the at least one base stem orifice 32 and the projection 40/groove 38 are symmetric about a diameter of the upper face 28.

[0050] In some embodiments, as shown in Figs. 27-28, the groove 38 is immediately adjacent to one of the openings 29, 31, and the projection 40 is immediately adjacent to the other one of the openings 31, 29. In some embodiments, as shown in Figs. 27A and 27B, the inner surface of one of the openings 29, 31 is continuous with an inner surface of the projection 40. In some embodiments, as shown in Fig. 28, the groove 38 is formed by a cut-out adjacent to one of the opening 29, 31 and, as will be apparent, when the spray stem 12 is assembled, the inner wall of the groove 38 is the fastener 36 extending through the upper face opening 29 and lower face opening 31. In such embodiments, when the spray stem 12 is assembled, the projection 40 extends between the fastener 36 and an outer wall of the groove 38. It should be understood that, for any of the embodiments disclosed herein, particular placement of the projection 40 and groove 38 can be reversed (*i.e.*, from base stem 16 to upper stem 14 or vice versa) or relocated (*i.e.*, either immediately adjacent to the openings 29, 31 or not).

[0051] In some embodiments, such as that shown in Figs. 6-7, a proximal end 42 of the base stem 16 comprises the connector 20. In some embodiments, the base stem 16 and the connector 20 can be formed of an integral piece made from a single piece (e.g., formed in the same injection mold). In some embodiments, the connector 20 can be rotatably coupled to a proximal end of the base stem 16 to facilitate coupling to a pressurize liquid (e.g., water) source.

[0052] In some embodiments, such as those shown in Figs. 22-23, the sprinkler head can be a pop-up sprinkler head 100. The pop-up sprinkler head 100 can include a spray stem 12 with a rotatable mechanism that can be identical to those already described and those described below. The primary difference between the spray stem 10 used in the pop-up sprinkler head 100 and the shrub spray sprinkler head 10 disclosed above is that the base stem 12 is adapted to slidably couple to a cylindrical or generally cylindrical sprinkler body 42, which includes the connector 20 at a first end of the sprinkler body 42.

[0053] In some embodiments, the sprinkler body 42 includes the connector 20 at a first end and an upper aperture 44 at a second end opposite the first end. In some embodiments, the spray stem 12 slides between a retracted position where a majority of the spray stem 12 is within the sprinkler body 42 and an extended position where the spray stem 12 extends through the upper aperture 44 and above an upper extent of the sprinkler body 42. An example of the spray stem 12 in a retracted position is shown in Fig. 22, while an example of the same pop-up sprinkler head 100 with the spray stem in the extended position is shown in Fig. 23.

[0054] In some embodiments, the spray stem 12 is biased toward the retracted position. For example, as shown in Figs. 22-23, a coiled spring 46 can have one end resting against a base stem lip 48 and an opposite end resting against an opposing surface 50 of the sprinkler body 42. As shown in Figs. 22-23, the spray stem 12 can pass through the longitudinal axis of the coiled spring 46. In some embodiments, as shown in Fig. 22-23, the opposing surface 50 can be an interior surface of a sprinkler body lid 52.

[0055] In some embodiments, the sprinkler body lid 52 can be removably coupled to the sprinkler body base 54. For example, the sprinkler body lid 52 can screw onto the sprinkler body base 54. As is apparent from Figs. 22-26, corresponding portions of the sprinkler body lid 52 and the sprinkler body base 54 can be cylindrical.

[0056] In some embodiments, the spray stem 12 slides toward the extended position (e.g., Fig. 23) when pressurized liquid is supplied to the connector 20 and the spray stem 12 slides toward the retracted position (e.g., Fig. 22) when liquid pressure is removed.

[0057] In some embodiments, a majority of the upper stem 14 extends out of the sprinkler body 42 in the extended position. In some embodiments, at least 70% of the upper stem 14 extends out of the sprinkler body 42 in the extended position. In some embodiments, at least 85%, at least 90%, at least 95%, of the entire upper stem 14 extends out of the sprinkler body 42 in the extended position.

[0058] In some embodiments, the base stem 16 and the sprinkler body 42 are slidably coupled to one another. In some embodiments, the base stem 16 is in direct

contact with the sprinkler body 42, while the base stem 16 and the sprinkler body 42 can be slidably coupled via a ratchet ring. In such embodiments, the ratchet ring can include an inner opening that the base stem fits through and an outer edge that slidably couples to the sprinkler body. The surfaces of the ratchet ring and the base stem that contact one another can include a series of peaks and valleys so that they do not rotate relative to one another unless a threshold force in the direction of rotation is overcome. This enables a user to twist the upper stem 14 relative to the base stem 16 to turn the water flow on or off, and also adjust the spray zone by twisting the base stem 16 relative to the sprinkler body 42 via the ratchet ring.

[0059] In some embodiments, the base stem 16 and the sprinkler body 42 are slidably coupled to one another by at least one channel 56 and fin 58 configuration. In some embodiments, there is at least one pair of opposing channels 56 and fins 58. For example, as shown in Fig. 26, in some embodiments there are two pairs of opposing channels 56 and fins 58. In some embodiments, there can be at least two pairs of opposing channels 56 and fins 58, or at least three pairs of opposing channels 56 and fins 58, or at least four pairs of opposing channels 56 and fins 58.

[0060] In some embodiments, such as that shown in Fig. 24-25, a space between a pair of adjacent fins 58_A can define a channel 56_A in the base stem 16 or sprinkler body 42. Similarly, in such embodiments, the corresponding portion of the sprinkler body 42 or base stem 16 that fits into the channel 56_A can serve as a fin 58_B. The designations A and B are used in this paragraph to clarify which features are on a first

(A) of the base stem 16 or sprinkler body 42, and which are on the other (B) of the sprinkler body 42 or base stem 16.

[0061] In some embodiments, the base stem 16 is coupled to the sprinkler body 42 to avoid rotation of the base stem 16 relative to the sprinkler body 42. Examples of techniques for preventing rotation of the base stem 16 relative to the sprinkler body 42 include the channel 56 and fin 58 configuration described above. This ensures that when the spray stem 12 is in the extended position and the upper stem 14 is rotated, the upper stem 14 rotates relative to the base stem 16 between the operational position and the maintenance position, while the base stem 16 does not rotate relative to the sprinkler body 42.

[0062] In some additional embodiments, a pop-up sprinkler head 100 is described. The pop-up sprinkler head 100 can include a sprinkler body 42 and a spray stem 12 comprising an upper stem 14 rotatably coupled to a base stem 16. The sprinkler body 42 can include an upper aperture 44 and a lower opening 20 adapted for connection to a pressurized liquid source. The upper stem 14 can be rotated relative to the base stem 16 between an operational position where an upper stem interior cavity 26 is in fluid communication with a base stem interior cavity 22 and a maintenance position where the upper stem interior cavity 26 is not in fluid communication with the base stem interior cavity 22. The spray stem 12 can slide between a retracted position where a majority of the spray stem 12 is within the sprinkler body and an extended position where the spray stem 12 extends through the upper aperture and above an

upper extent of the sprinkler body 42. In some embodiments, a spray nozzle 18 is coupled to a distal end of the upper stem 14.

[0063] The foregoing is provided for purposes of illustrating, explaining, and describing embodiments of this invention. Modifications and adaptations to these embodiments will be apparent to those skilled in the art and may be made without departing from the scope or spirit of this invention.

CLAIMS

What is claimed is:

1. A sprinkler head, comprising:
 - a spray stem comprising an upper stem rotatably coupled to a base stem;
 - a spray nozzle coupled to a distal end of the upper stem; and
 - a connector for removably coupling the sprinkler head to a pressurized liquid source,wherein a base stem interior cavity is in fluid communication with a connector interior cavity, and
 - wherein the upper stem rotates between an operational position where an upper stem interior cavity is in fluid communication with the base stem interior cavity and a maintenance position where the upper stem interior cavity is not in fluid communication with the base stem interior cavity.
2. The sprinkler head according to claim 1, wherein an upper face of the base stem is rotatably coupled to a lower face of the upper stem, wherein the upper face comprises at least one base stem orifice and the lower face comprises at least one upper stem orifice, wherein the at least one base stem orifice and the at least one upper stem orifice overlap in the operational position, while the at least one base stem orifice and the at least one upper stem orifice do not overlap in the maintenance position.
3. The sprinkler head according to claim 2, wherein said at least one upper stem orifice comprises a plurality of upper stem orifices, and said at least one base stem orifice comprises a plurality of base stem orifices.
4. The sprinkler head according to any of the preceding claims, wherein rotation of the upper stem relative to the base stem is limited to less than 360 degrees.

5. The sprinkler head according to claim 4, wherein an upper face of said base stem is rotatably coupled to a lower face of upper stem, wherein one of the upper face and the lower face comprise a groove, and the other of the upper face and the lower face comprise a projection, wherein said projection slides within the groove to limit rotation of the upper stem to less than 360 degrees.

6. The sprinkler head according to any of the preceding claims, wherein one of the upper face and the lower face comprise a second groove, and the other of the upper face and the lower face comprise a second projection, wherein said projections slide within the grooves to limit rotation of the upper stem to less than 270 degrees.

7. The sprinkler head according to any of the preceding claims, wherein a proximal end of the base stem comprises said connector.

8. The sprinkler head according to any of the preceding claims, wherein the connector is rotatably coupled to a proximal end of the base stem.

9. The sprinkler head according to any of the preceding claims, further comprising:

a sprinkler body comprising said connector at a first end and an upper aperture at a second end opposite said first end,

wherein the spray stem slides between a retracted position where a majority of the spray stem is within the sprinkler body and an extended position where the spray stem extends through the upper aperture and above an upper extent of said sprinkler body.

10. The sprinkler head according to claim 9, wherein said spray stem is biased toward said retracted position.

11. The sprinkler head according to any of claims 9 to 10, wherein said spray stem slides toward the extended position when pressurized liquid is supplied to the connector and slides toward the retracted position when liquid pressure is removed.

12. The sprinkler head according to any of claims 9 to 11, wherein a majority of the upper stem extends out of the sprinkler body in the extended position.

13. The sprinkler head according to any of claims 9 to 12, wherein said base stem and said sprinkler body are slidably coupled to one another by at least one channel and groove configuration.

14. The sprinkler head according to any of claims 9 to 13, wherein said base stem is coupled to said sprinkler body to avoid rotation of said base stem relative to said sprinkler body.

15. The sprinkler head according to any of claims 9 to 14, wherein an upper face of the base stem is rotatably coupled to a lower face of the upper stem, wherein the upper face comprises at least one base stem orifice and the lower face comprises at least one upper stem orifice, wherein the at least one base stem orifice and the at least one upper stem orifice overlap in the operational position, while the at least one base stem orifice and the at least one upper stem orifice do not overlap in the maintenance position.

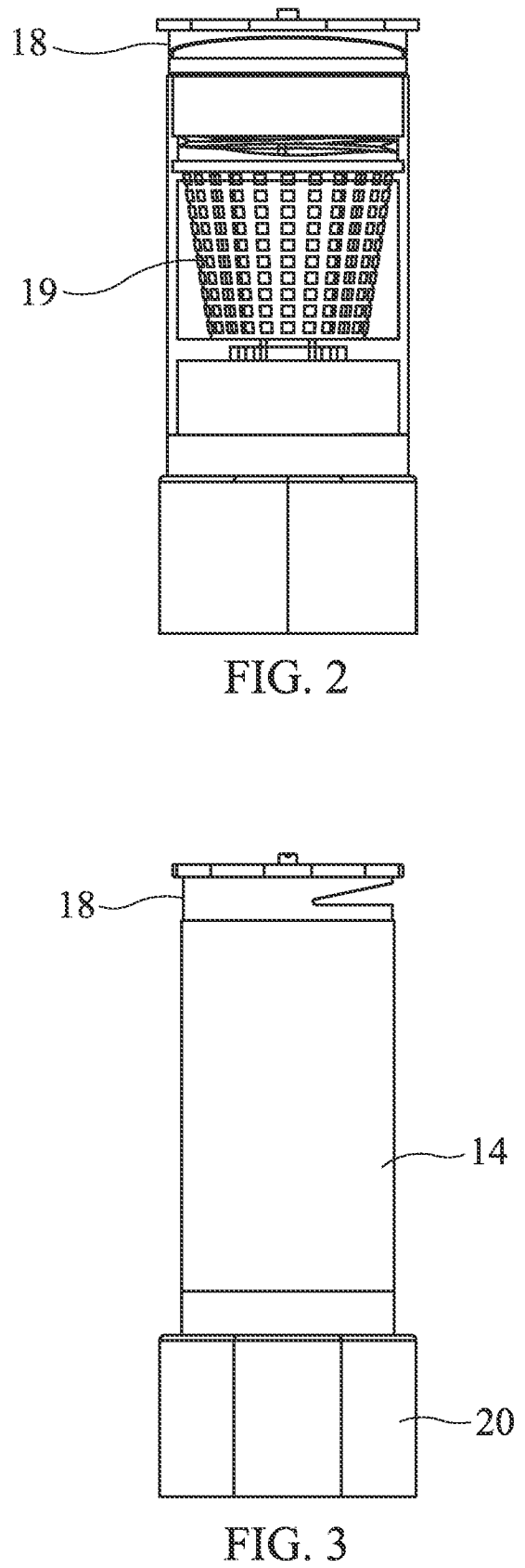
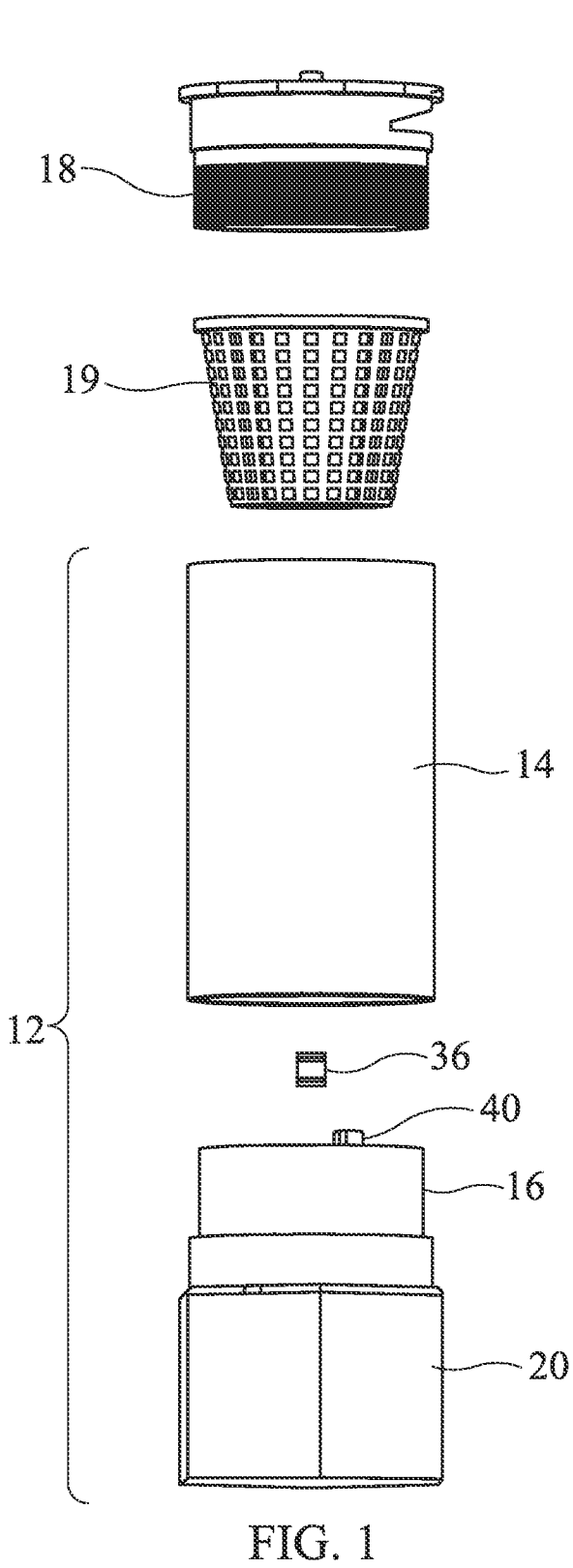
16. The sprinkler head according to claim 15, wherein said at least one upper stem orifice comprises a plurality of upper stem orifices, and said at least one base stem orifice comprises a plurality of base stem orifices.

17. The sprinkler head according to claim any of claims 9 to 16, wherein rotation of the upper stem relative to the base stem is limited to less than 360 degrees.

18. The sprinkler head according to claim 17, wherein an upper face of said base stem is rotatably coupled to a lower face of upper stem, wherein one of the upper face and the lower face comprise a groove, and the other of the upper face and the lower face comprise a projection, wherein said projection slides within the groove to limit rotation of the upper stem to less than 360 degrees.

19. A pop-up sprinkler head, comprising:
a sprinkler body having an upper aperture and a lower opening adapted for connection to a pressurized liquid source,
a spray stem comprising an upper stem rotatably coupled to a base stem such that the upper stem rotates between an operational position where an upper stem interior cavity is in fluid communication with a base stem interior cavity and a maintenance position where the upper stem interior cavity is not in fluid communication with the base stem interior cavity, wherein said spray stem slides between a retracted position where a majority of the spray stem is within the sprinkler body and an extended position where the spray stem extends through the upper aperture and above an upper extent of said sprinkler body.

20. The sprinkler head according to claim 19, further comprising a spray nozzle coupled to a distal end of the upper stem.



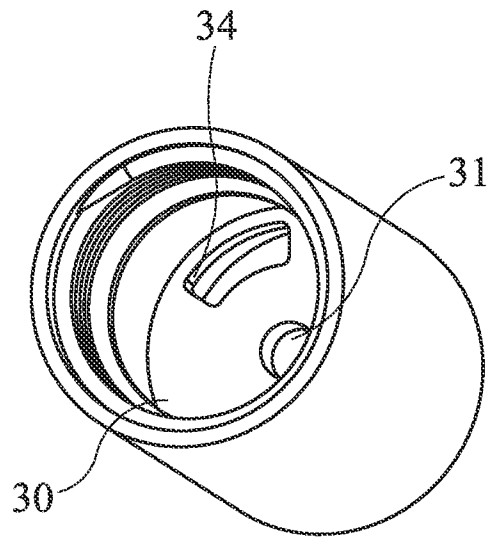


FIG. 4

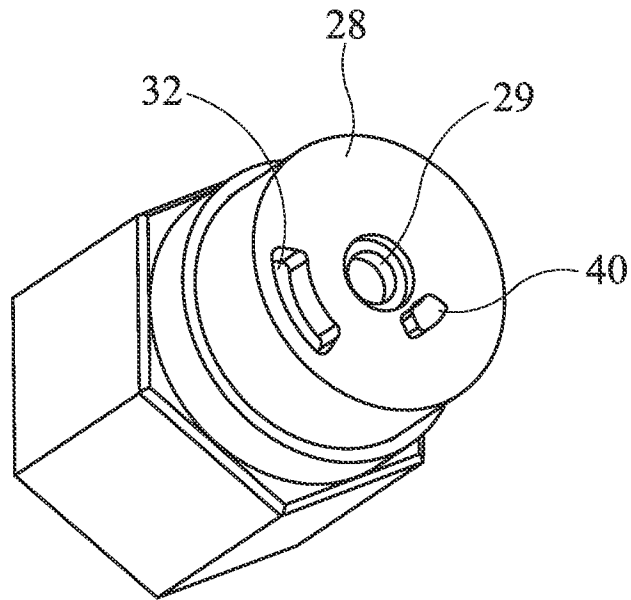


FIG. 5

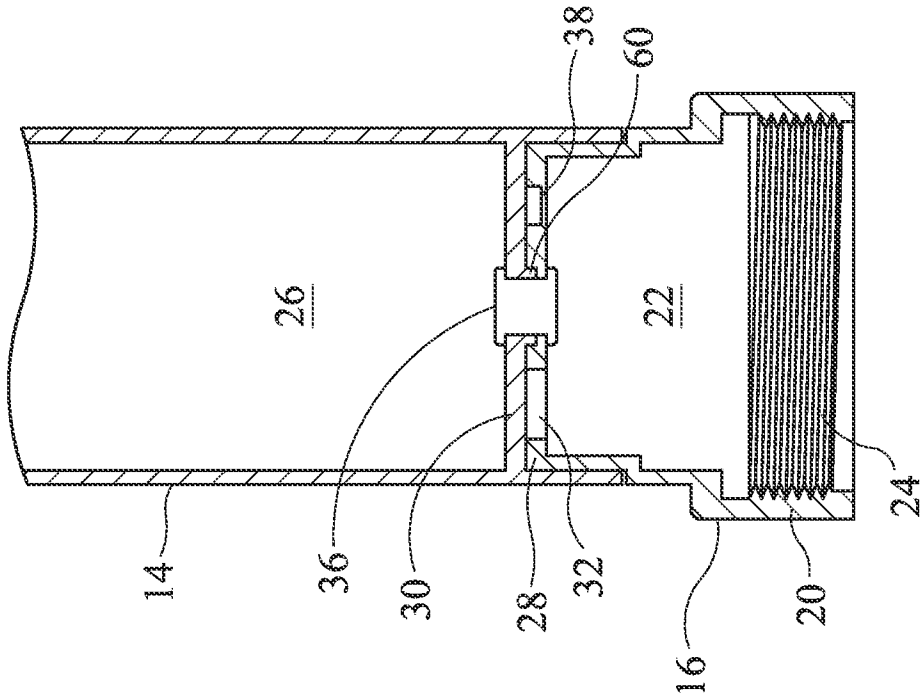


FIG. 7

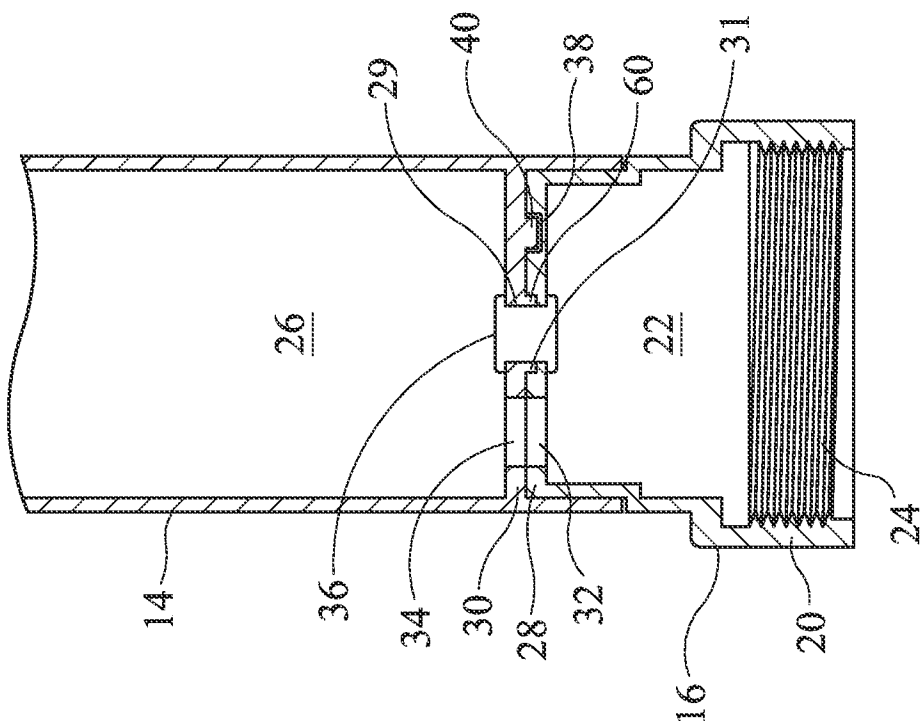


FIG. 6

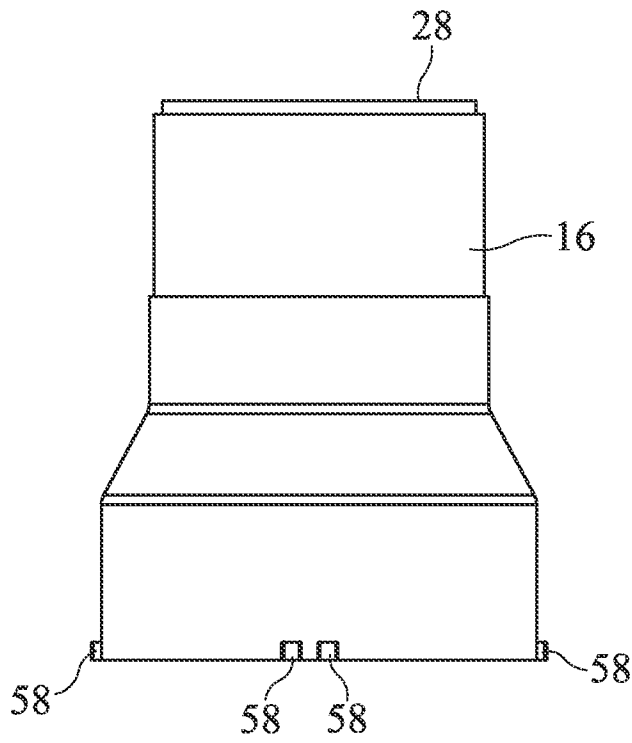


FIG. 8

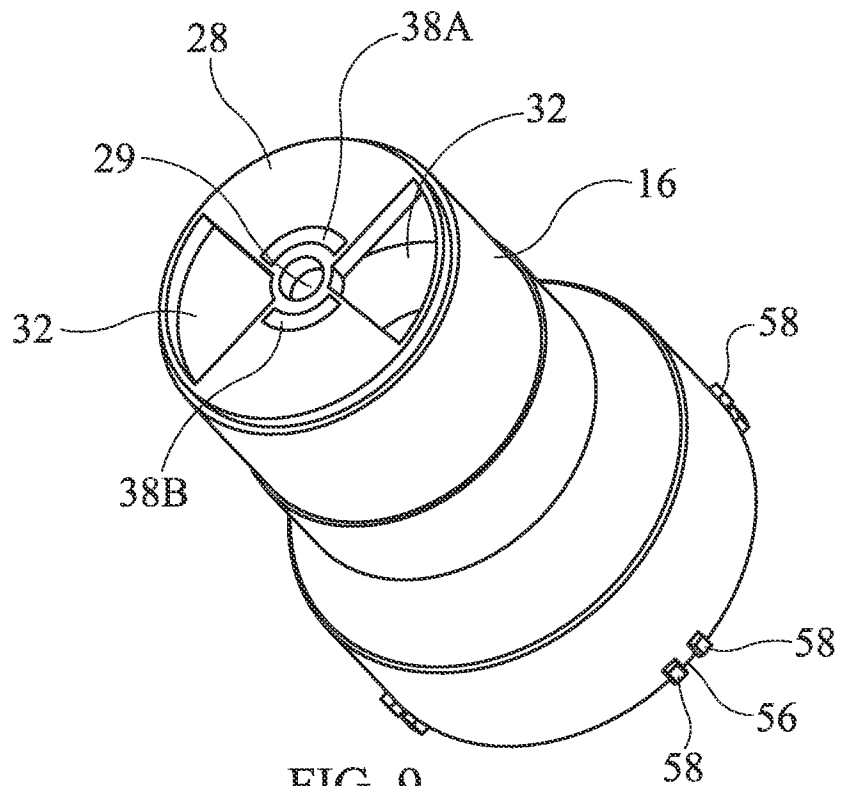
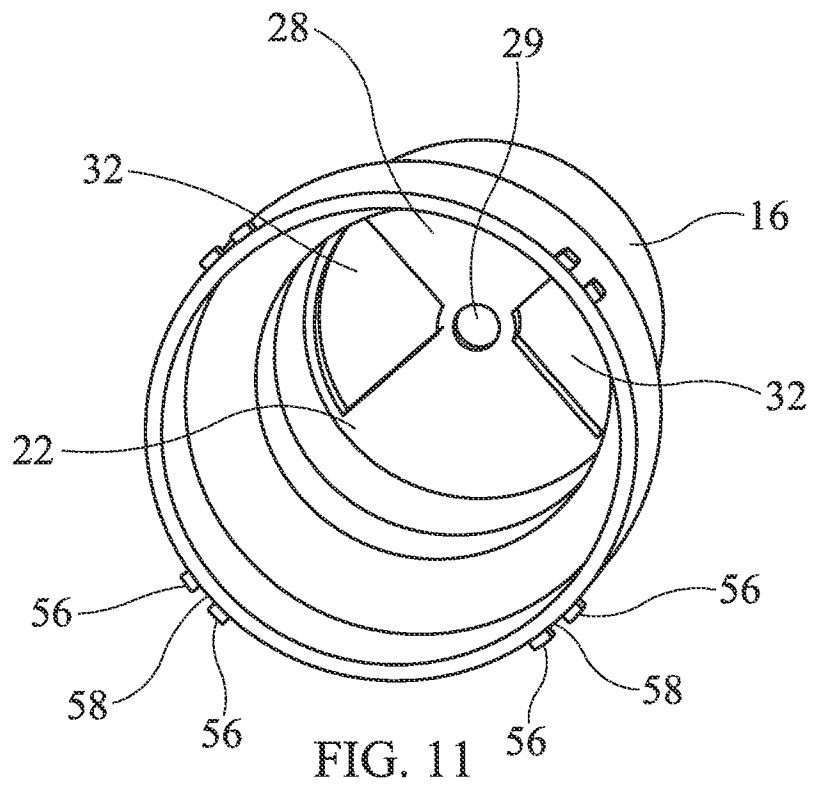
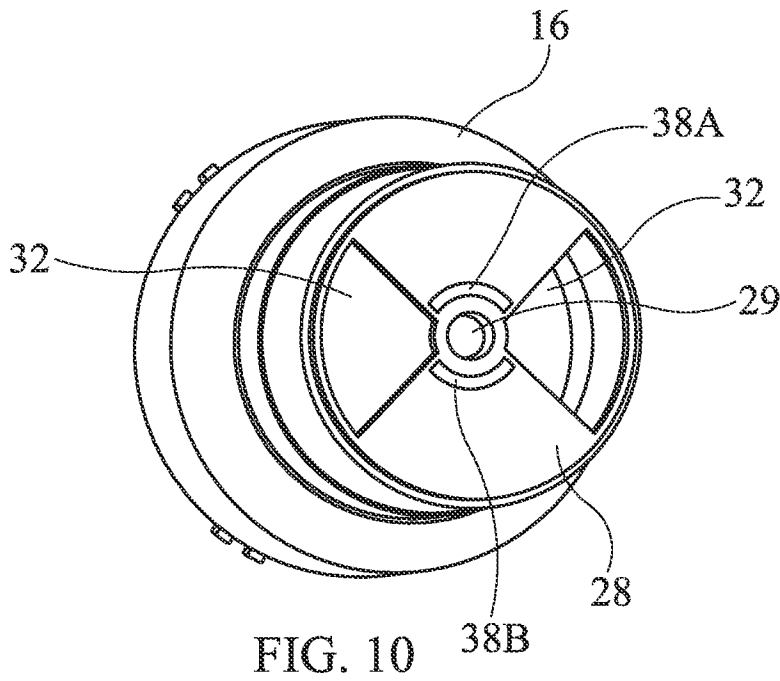


FIG. 9



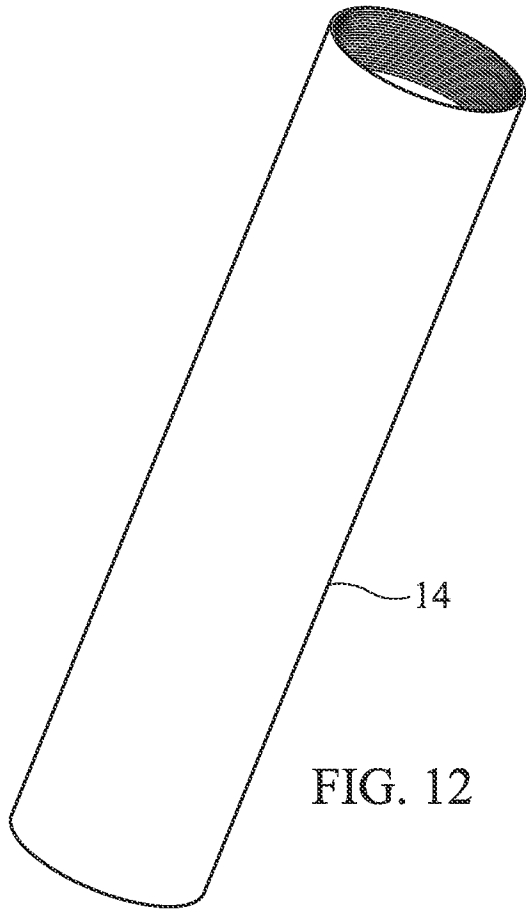


FIG. 12

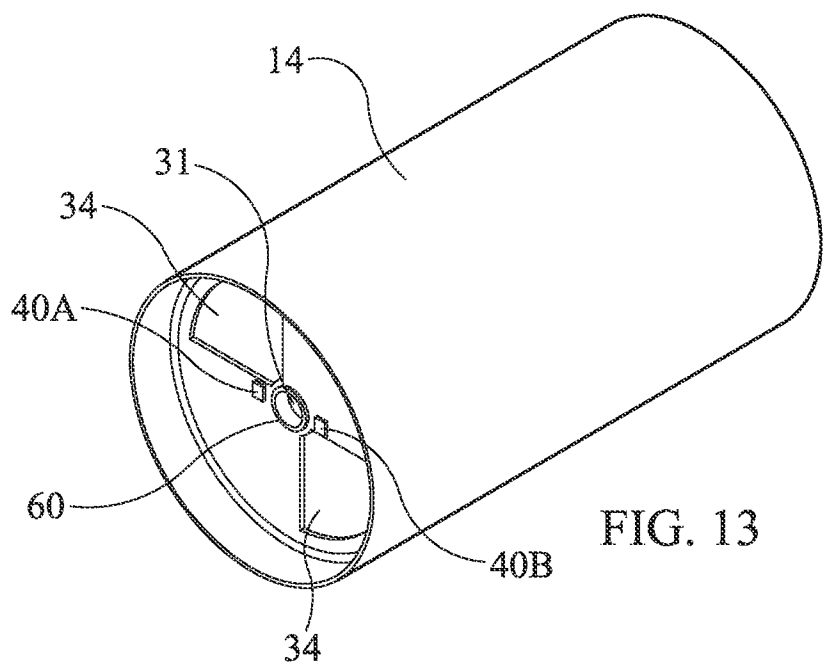


FIG. 13

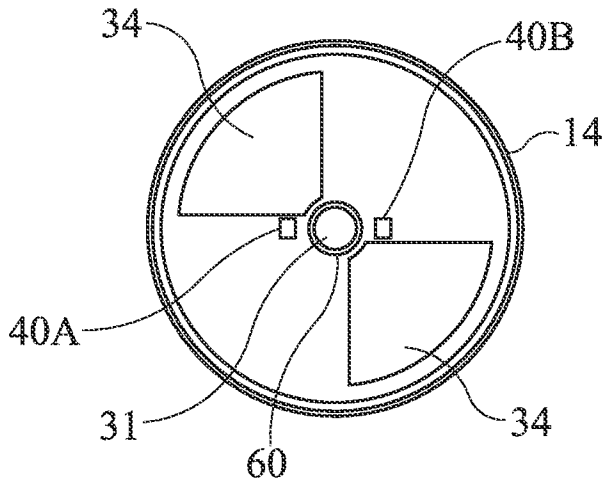


FIG. 14

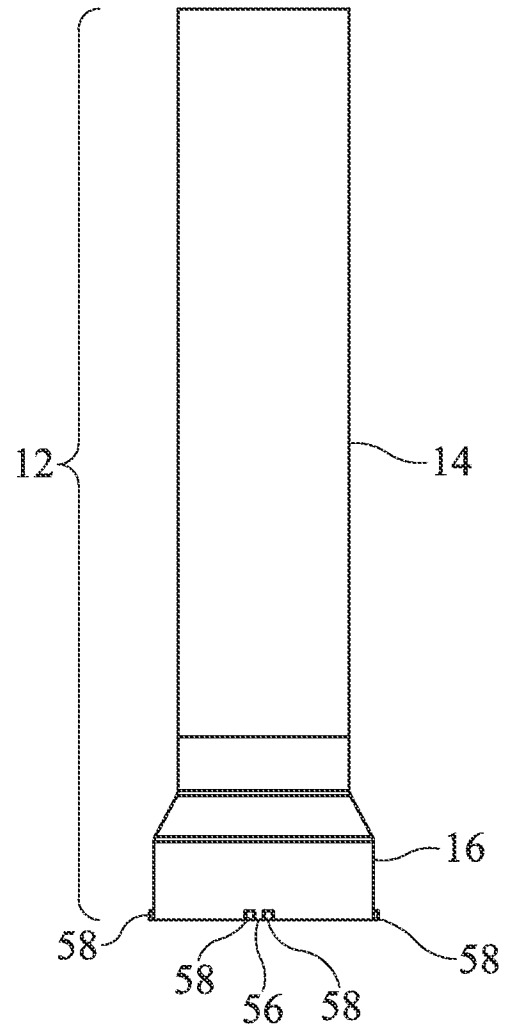


FIG. 16

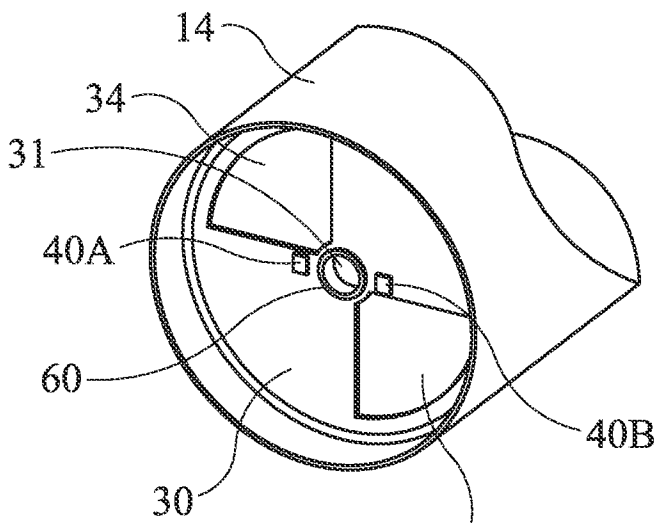


FIG. 15

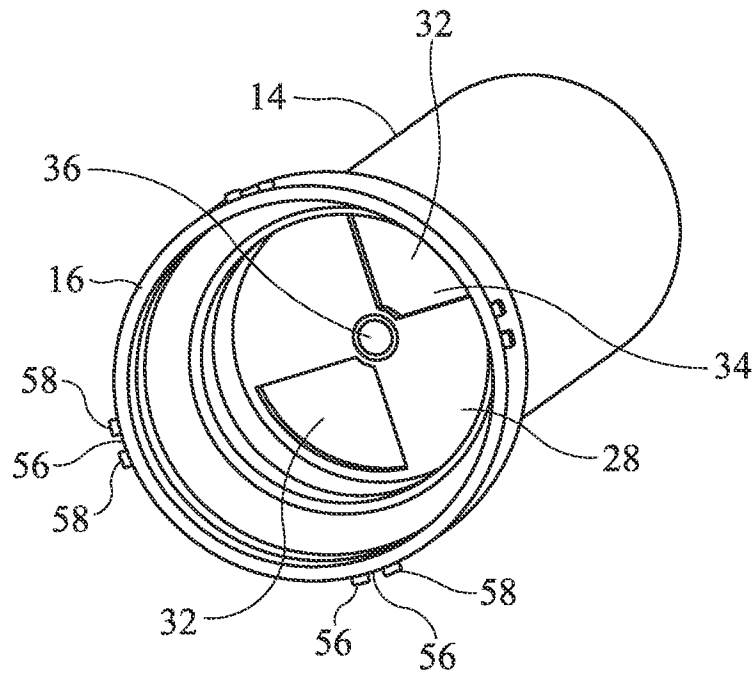


FIG. 17

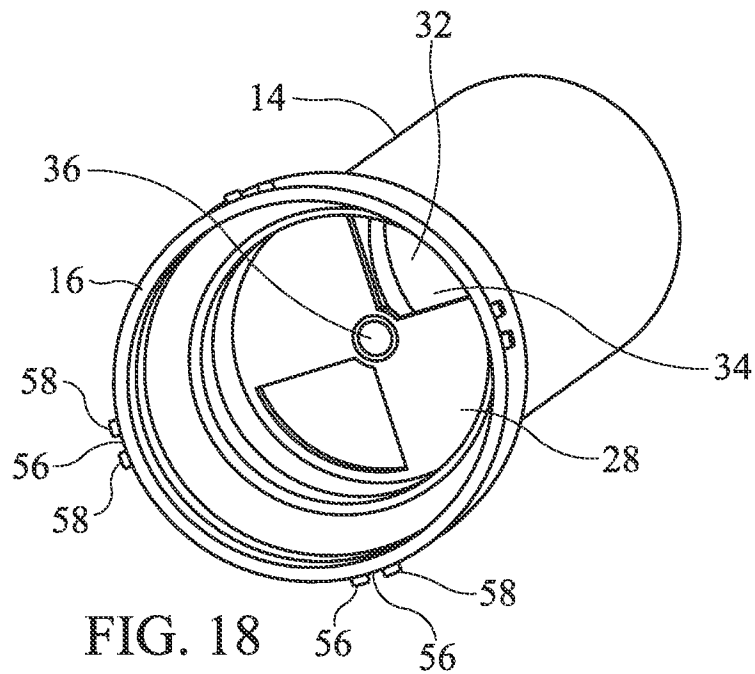


FIG. 18

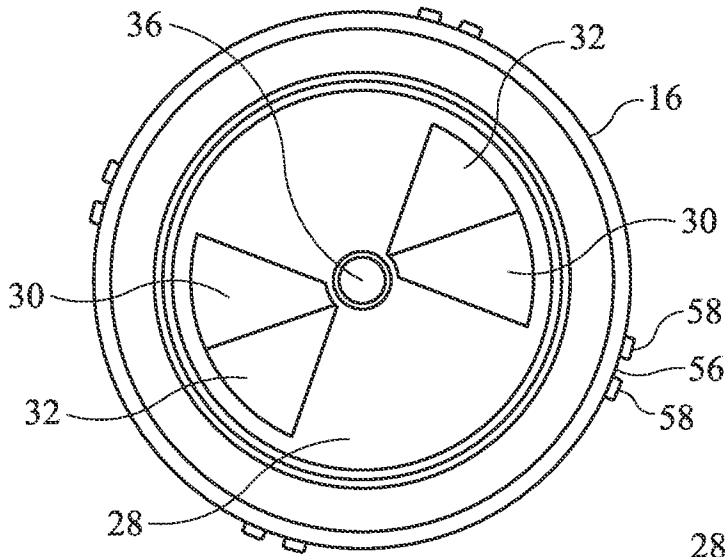


FIG. 19

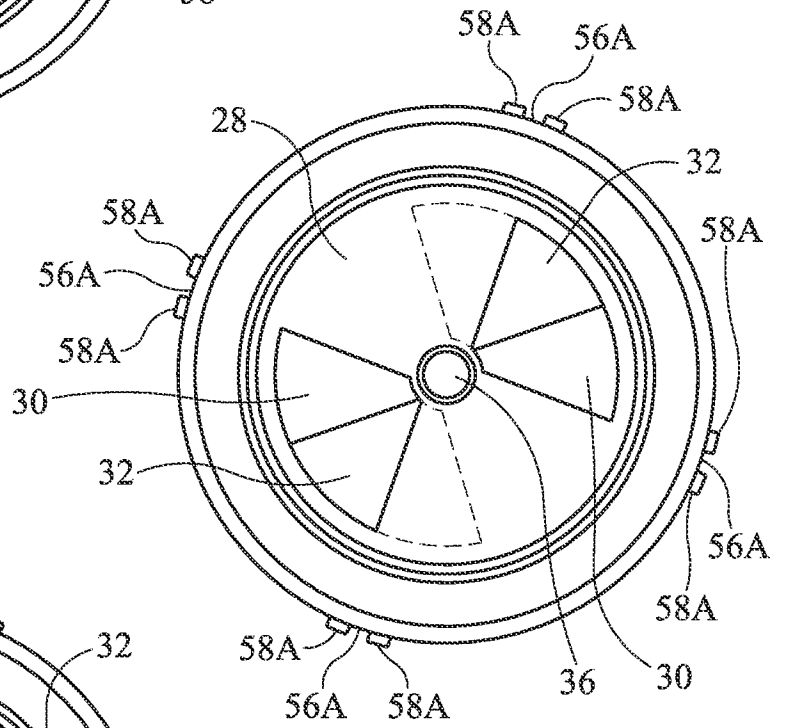


FIG. 20

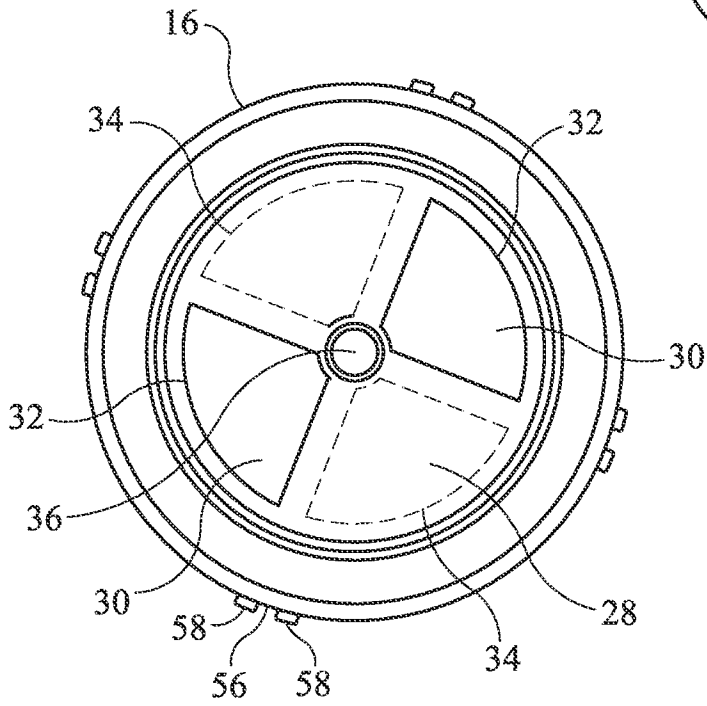


FIG. 21

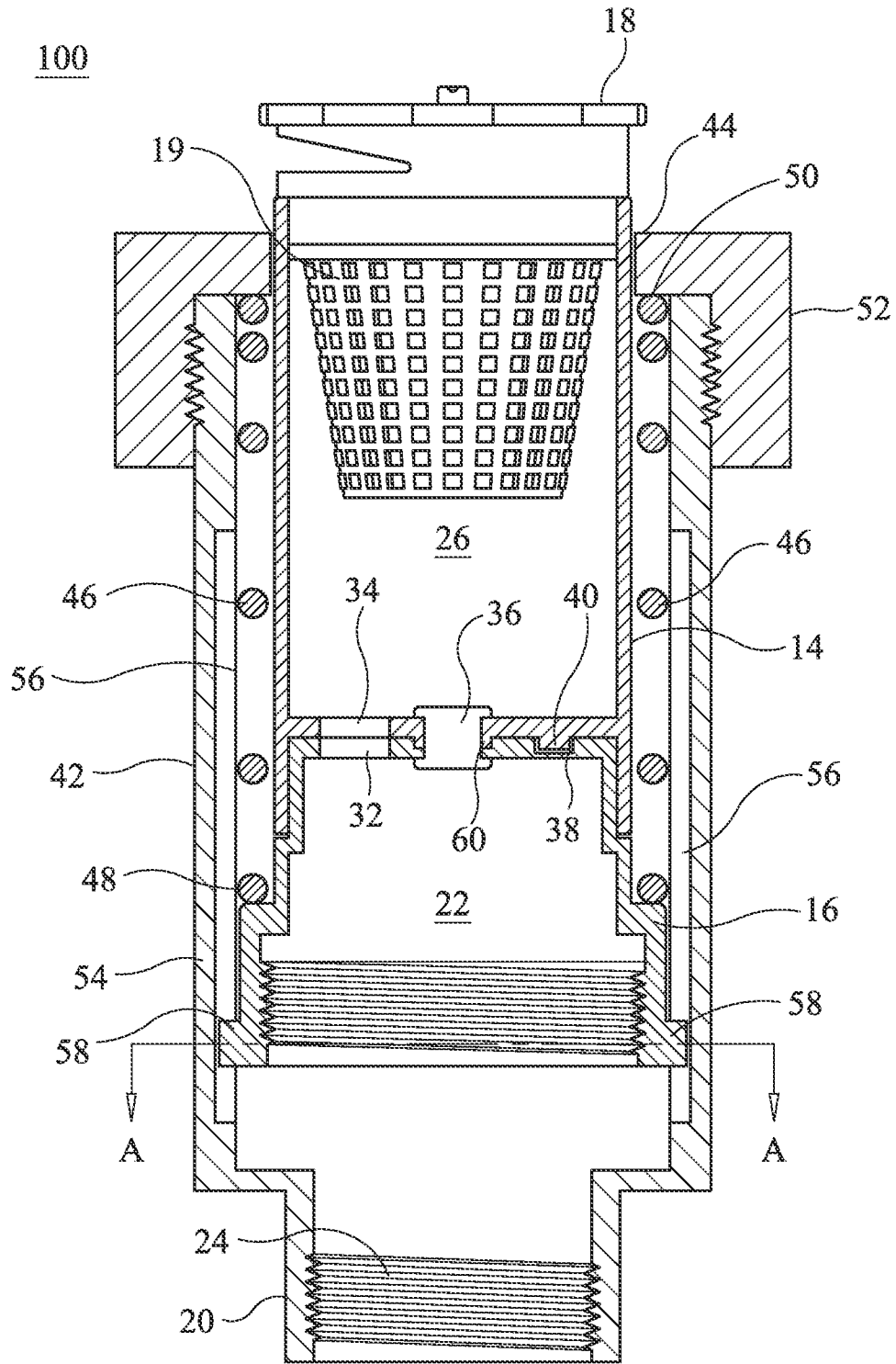


FIG. 22

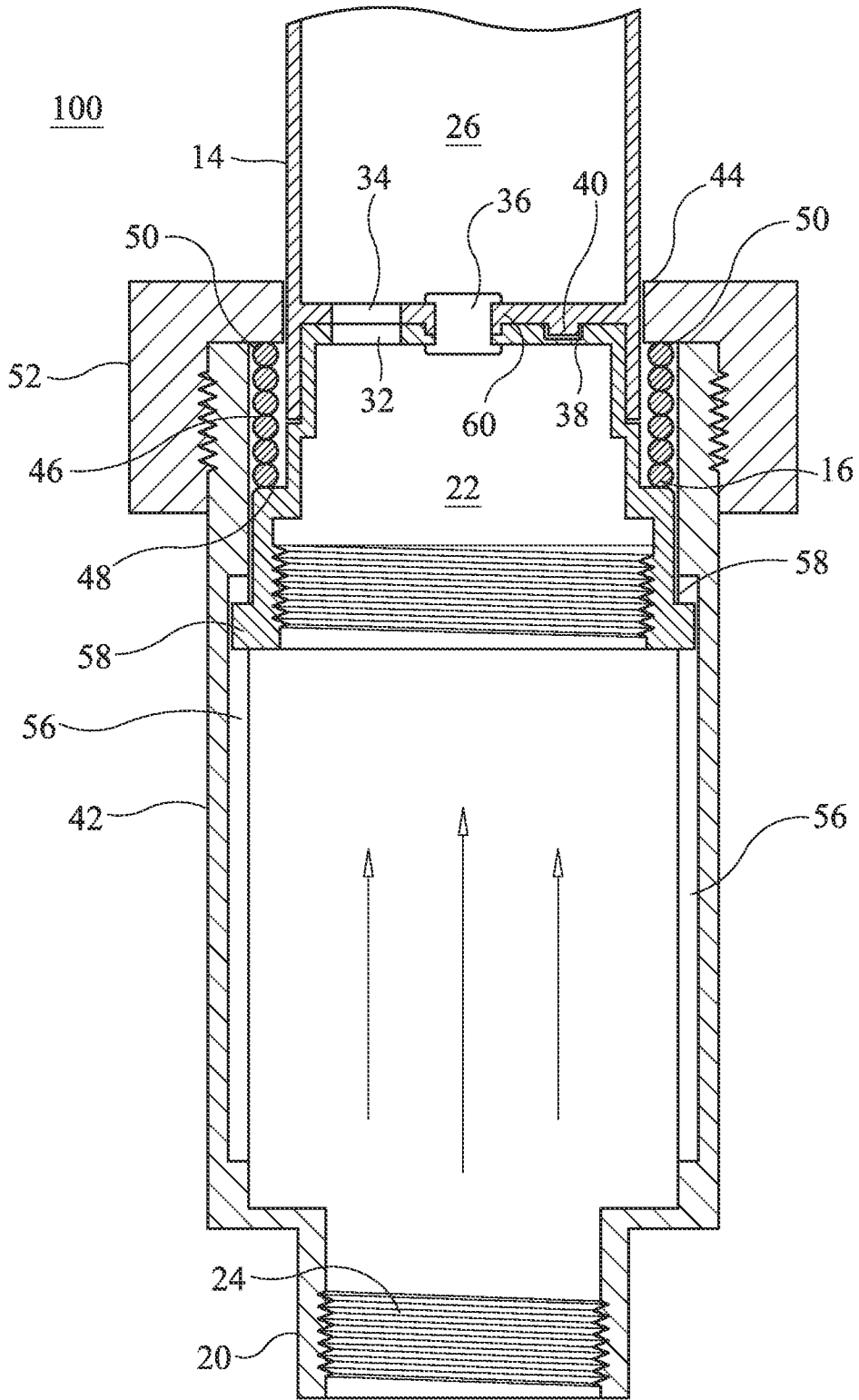


FIG. 23

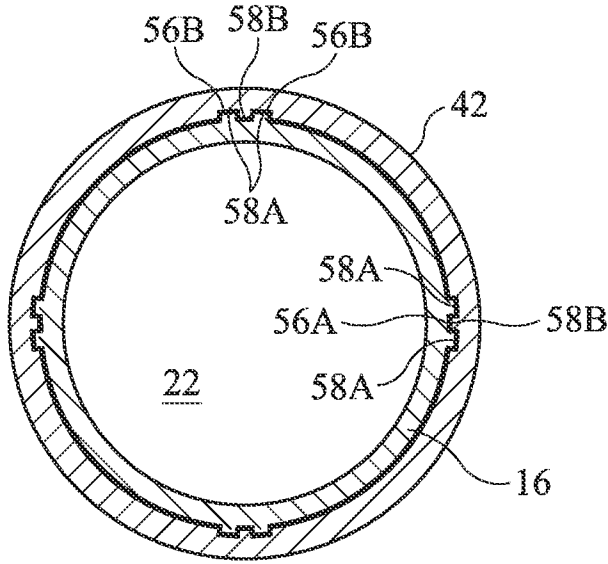


FIG. 24

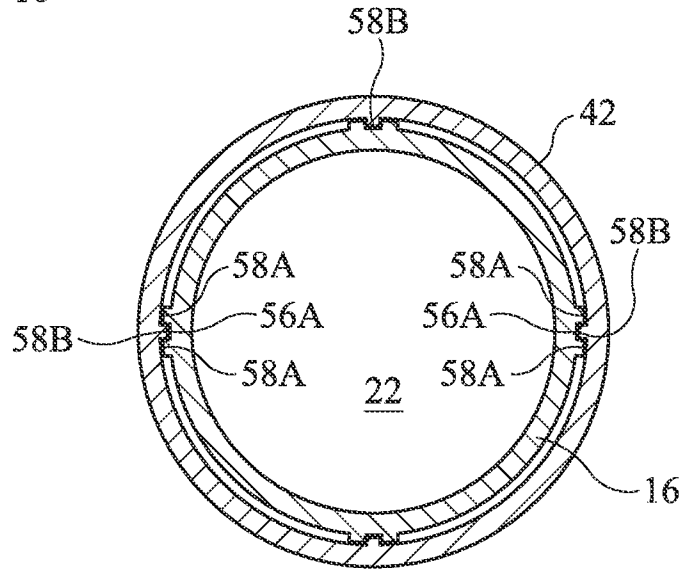


FIG. 25

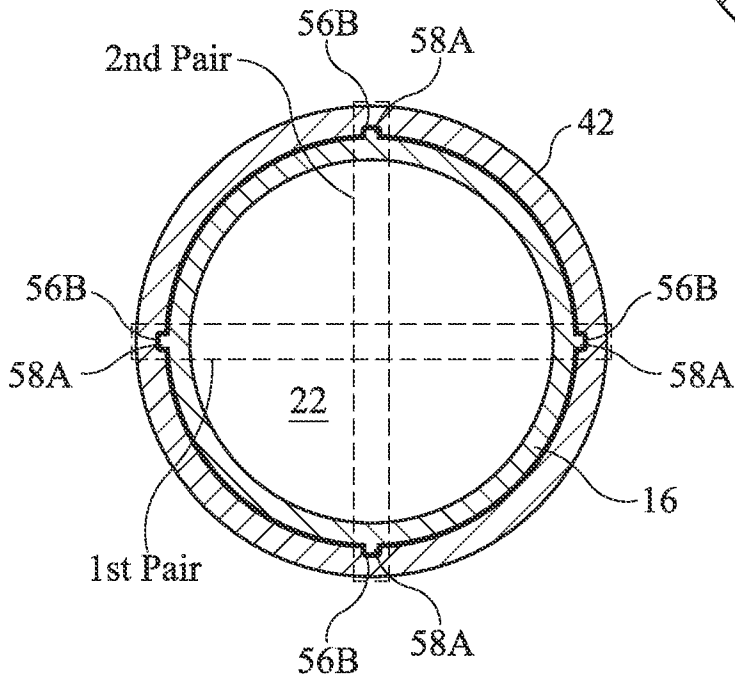


FIG. 26

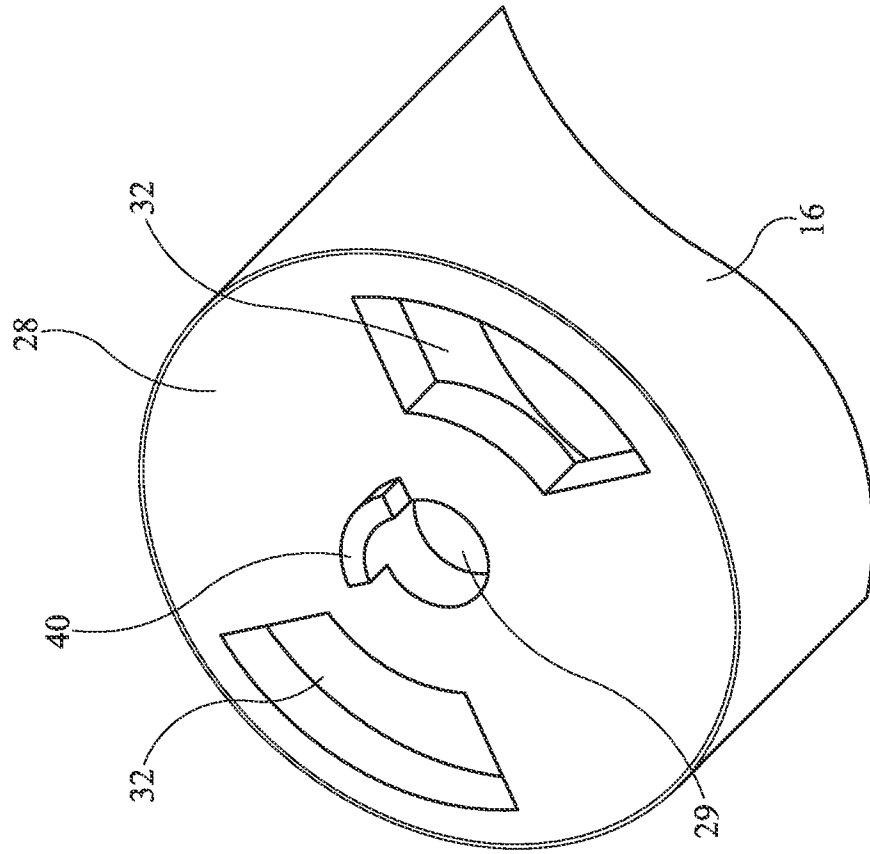


FIG. 27B

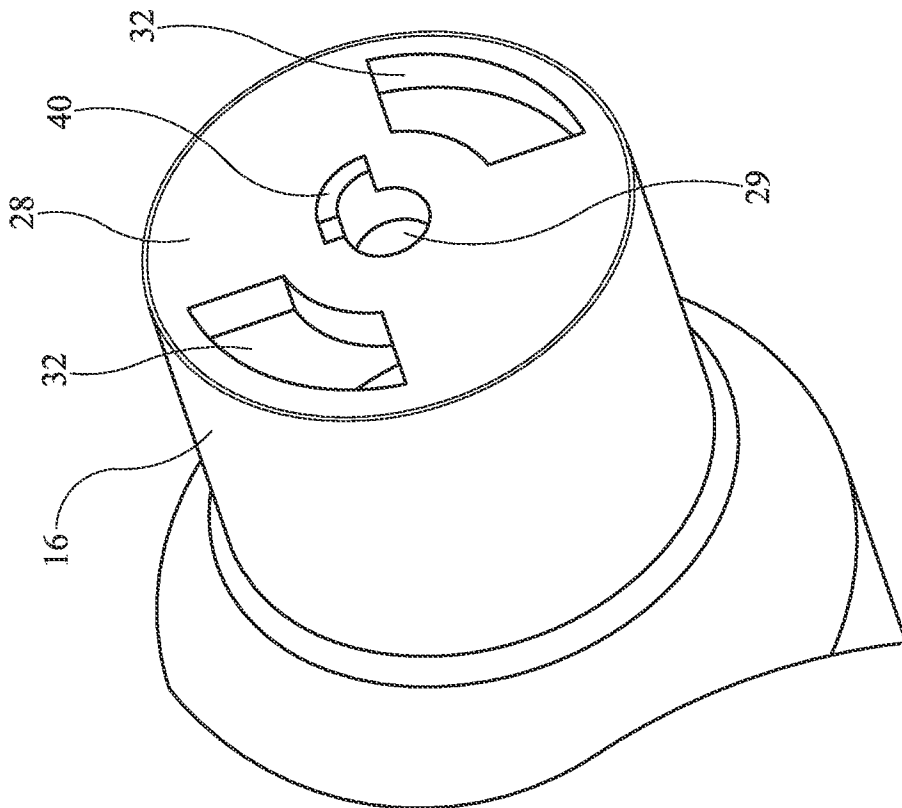


FIG. 27A

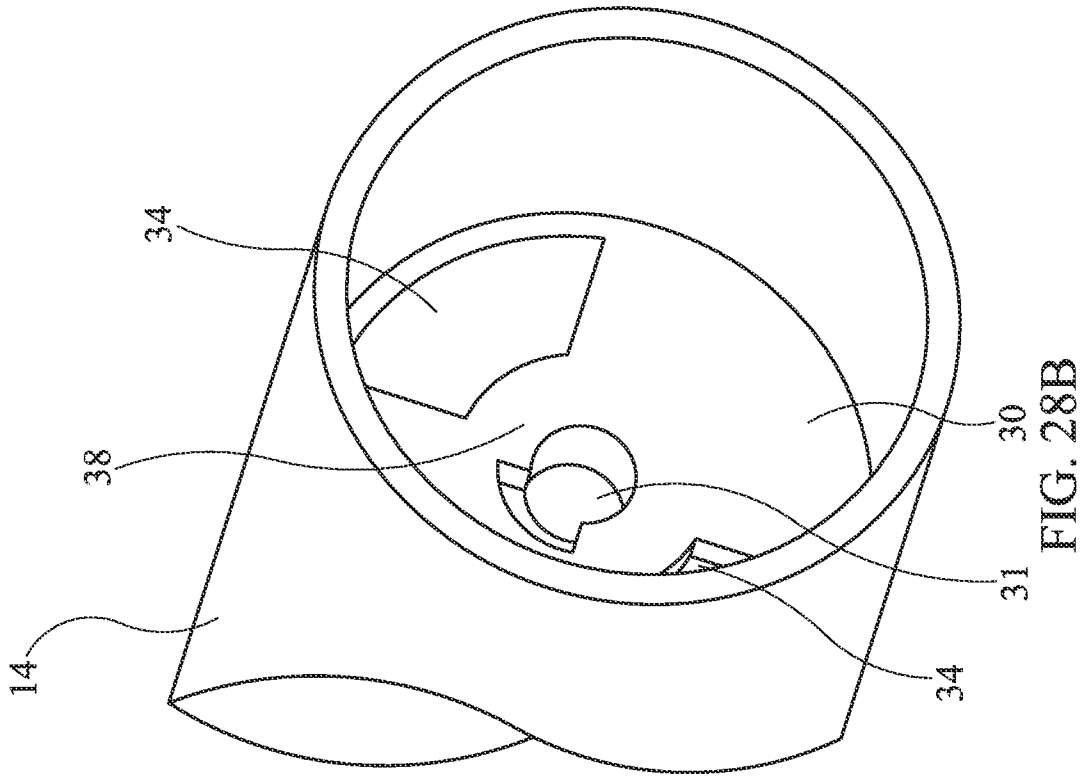


FIG. 28B

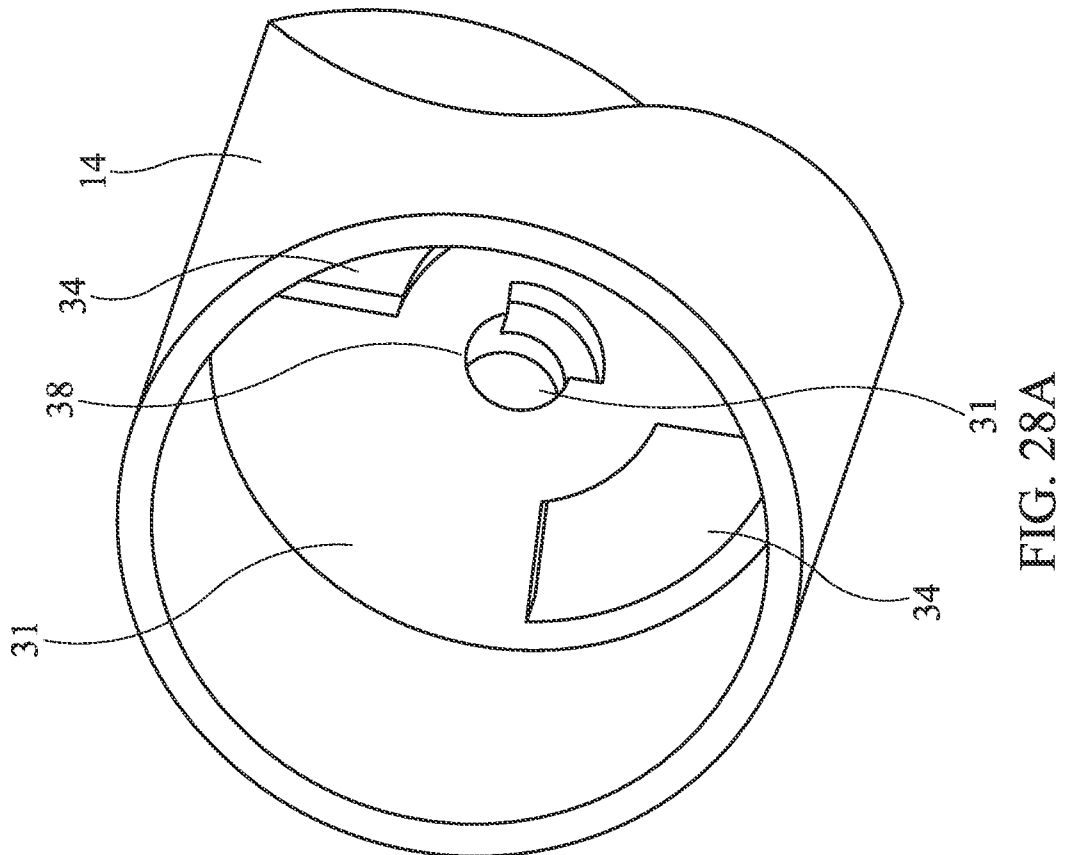


FIG. 28A

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2015/030559

| | | |
|---|---|-------------|
| A. CLASSIFICATION OF SUBJECT MATTER | | |
| B05B 3/02 (2006.01) B05B 3/06 (2006.01) | | |
| According to International Patent Classification (IPC) or to both national classification and IPC | | |
| B. FIELDS SEARCHED | | |
| Minimum documentation searched (classification system followed by classification symbols) | | |
| B05B 3/00-3/06, 15/00-15/10, A62C 37/00-37/10 | | |
| 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) | | |
| PatSearch (RUPTO internal), USPTO, PAJ, Esp@cenet, Information Retrieval System of FIPS | | |
| C. DOCUMENTS CONSIDERED TO BE RELEVANT | | |
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | |
| Relevant to claim No. | | |
| A | US 5226599 A1 (GARDENA KRESS & KASTNER GMBH) 13.07.1993 | 1-5, 19, 20 |
| A | US 4681259 A1 (ANTHONY MANUFACTURING CORP.) 21.07.1987 | 1-5, 19, 20 |
| A | US 4434855 A1 (GEORGE R. GIVEN, JR.) 06.03.1984 | 1-5, 19, 20 |
| A | US 4784325 A1 (RAIN BIRD CONSUMER PROD MFG) 15.11.1988 | 1-5, 19, 20 |
| <input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex. | | |
| * Special categories of cited documents: | "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 "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "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 | |
| 03 September 2015 (03.09.2015) | 15 October 2015 (15.10.2015) | |
| Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37 | Authorized officer M. Nechaeva Telephone No. 8 (499) 240-25-91 | |

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2015/030559

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

- 1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

- 2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

- 3. Claims Nos.: 6-18
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

- 1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
- 2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
- 3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
- 4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.