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(54) PIPE CONNECTORS AND USES THEM

(54) מחברים לצינוורות ושימושים בהם

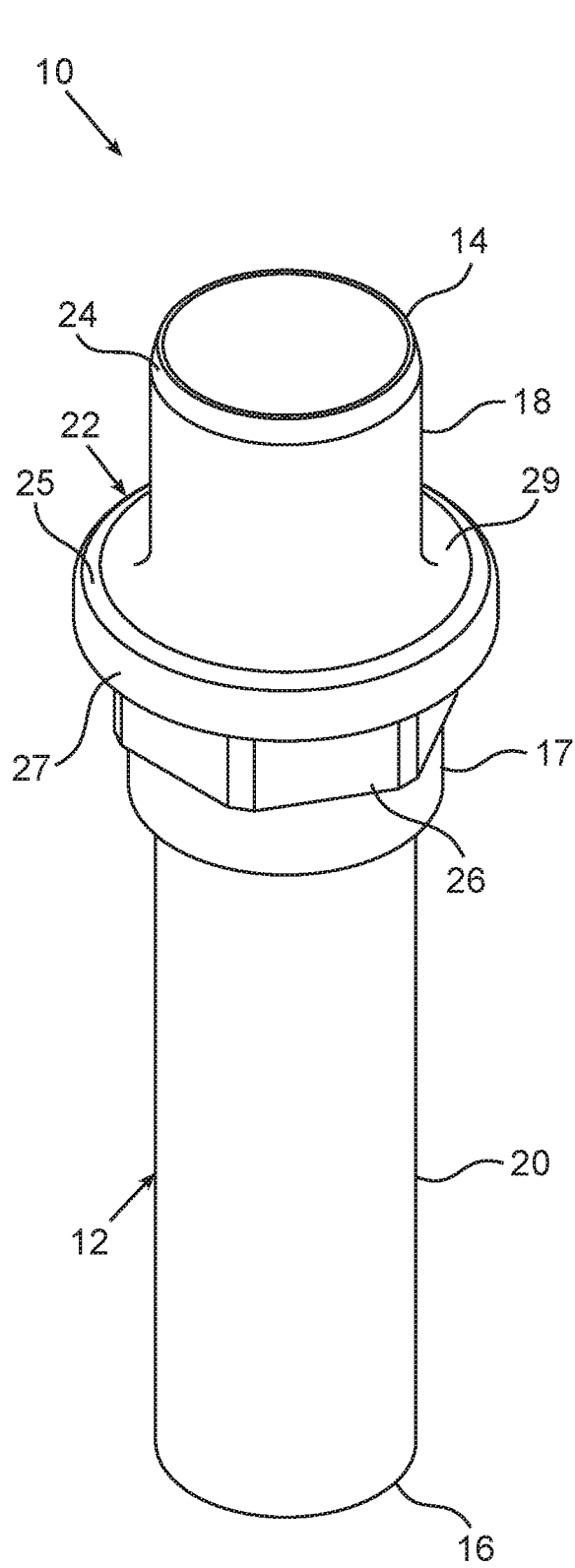


FIG. 1

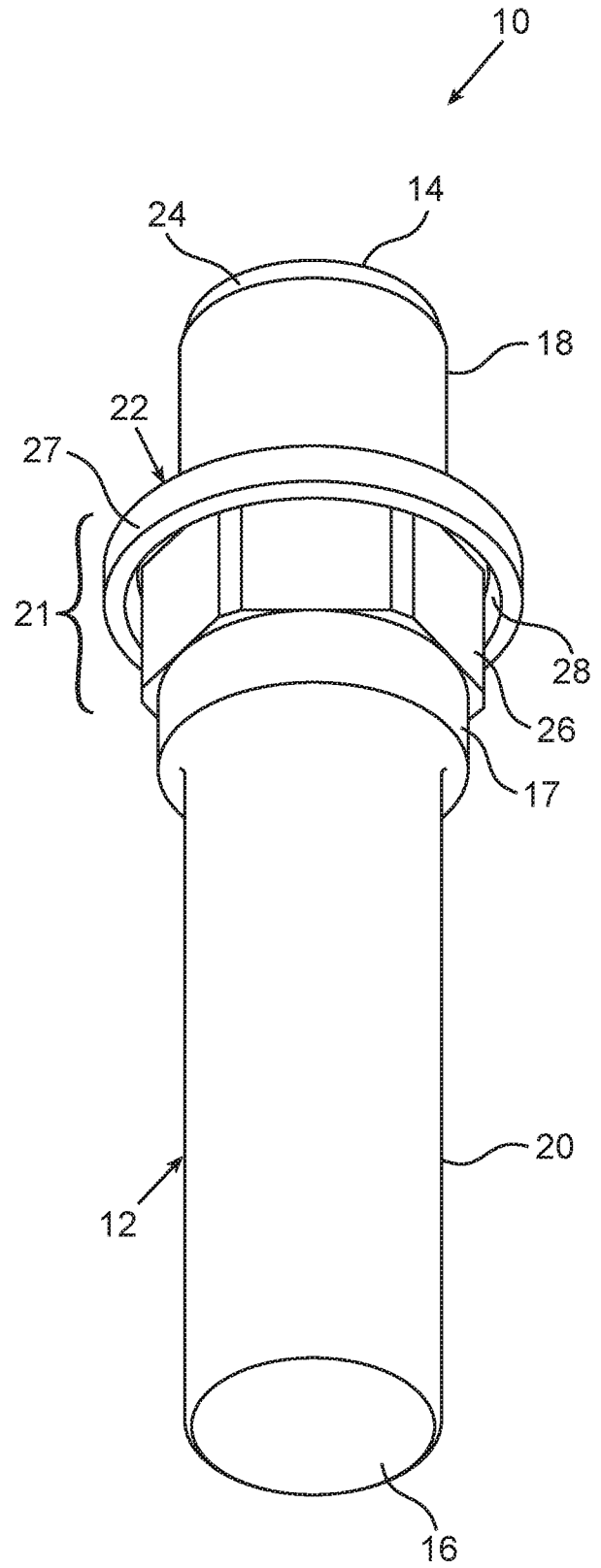


FIG. 2

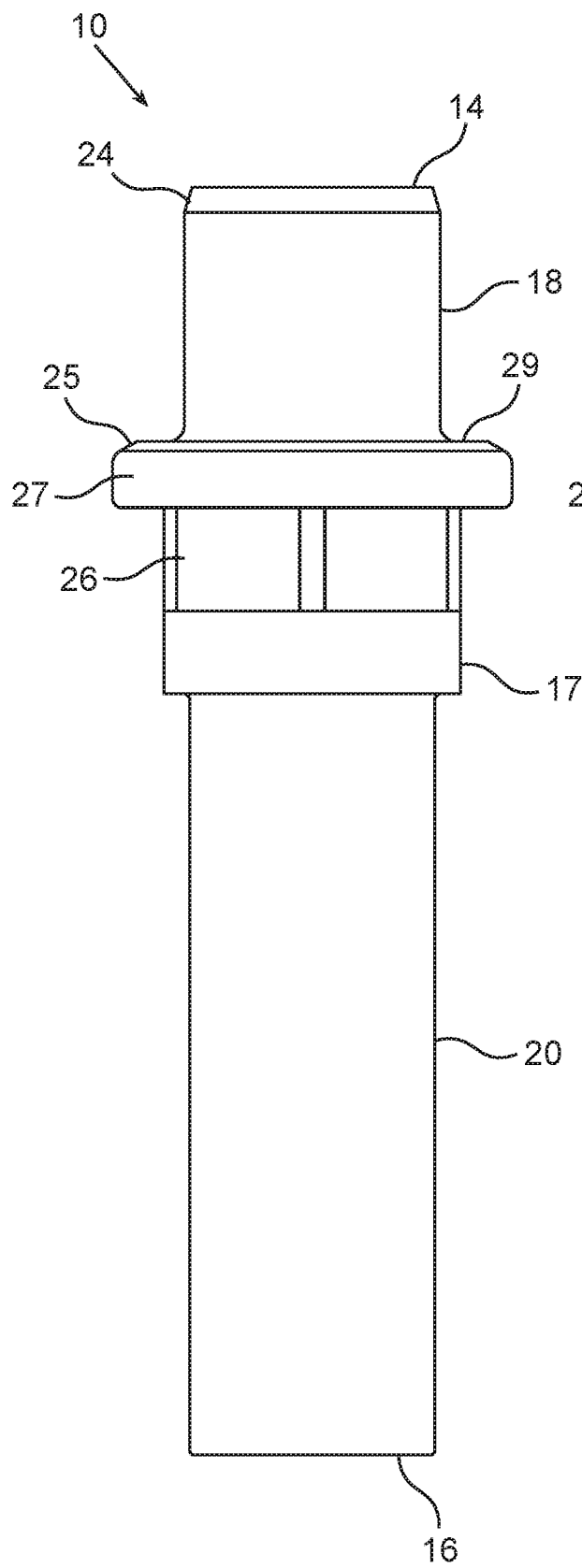


FIG. 3

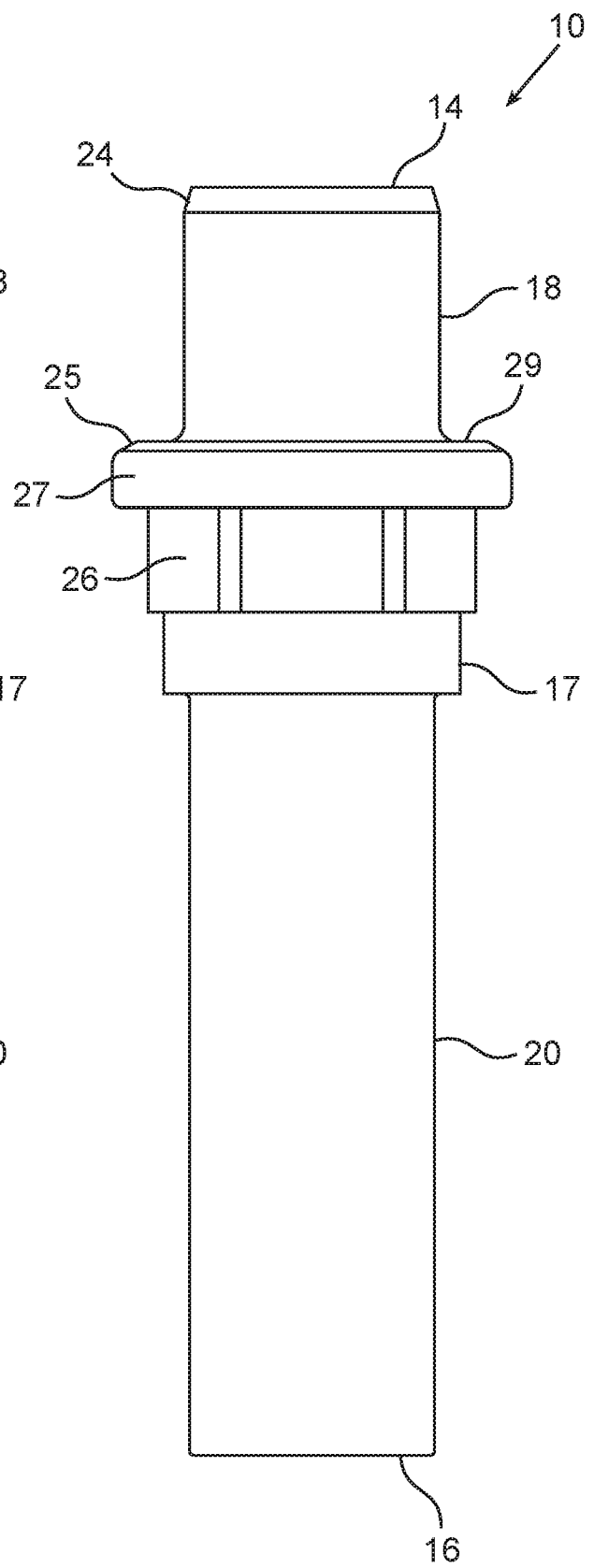


FIG. 4

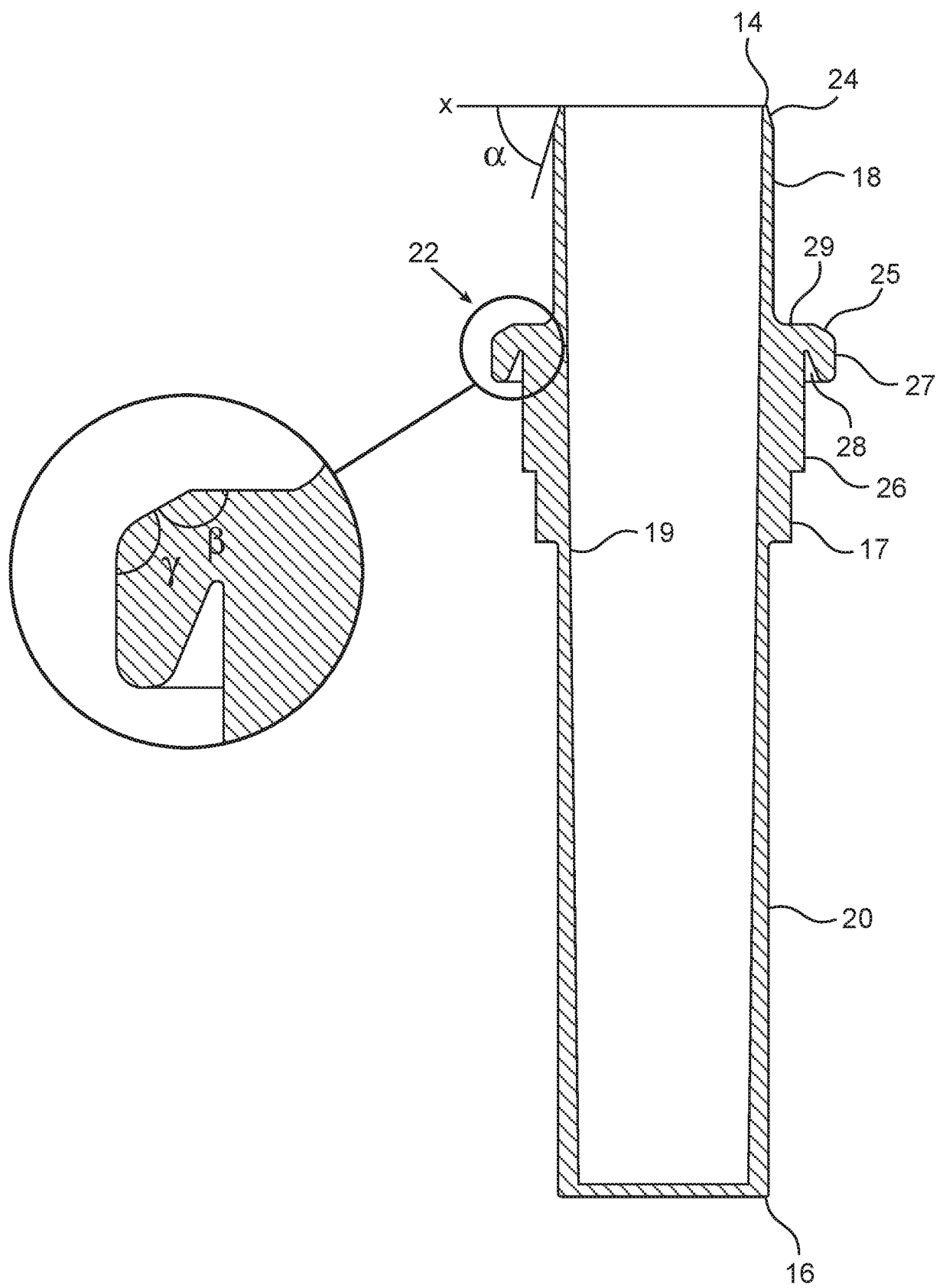


FIG. 5

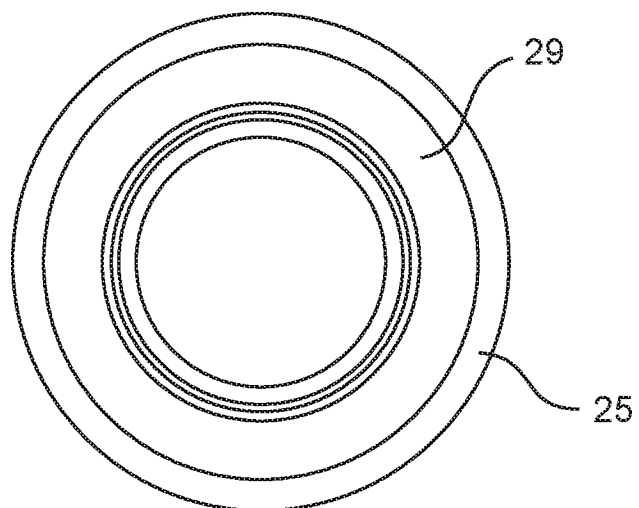


FIG. 6

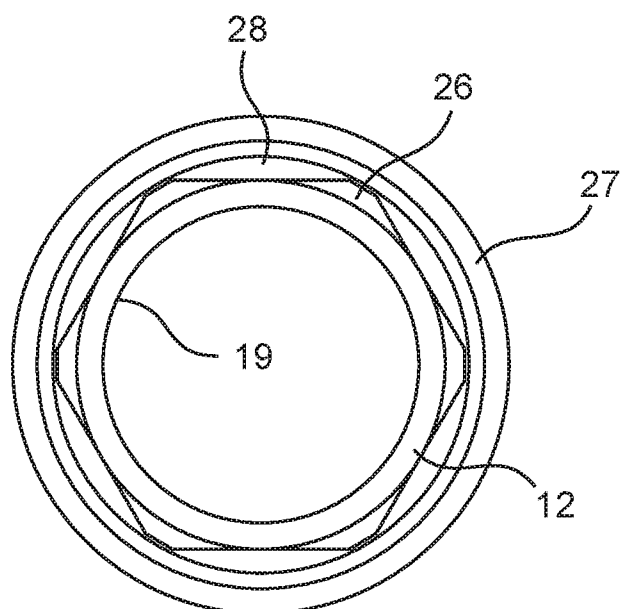


FIG. 7

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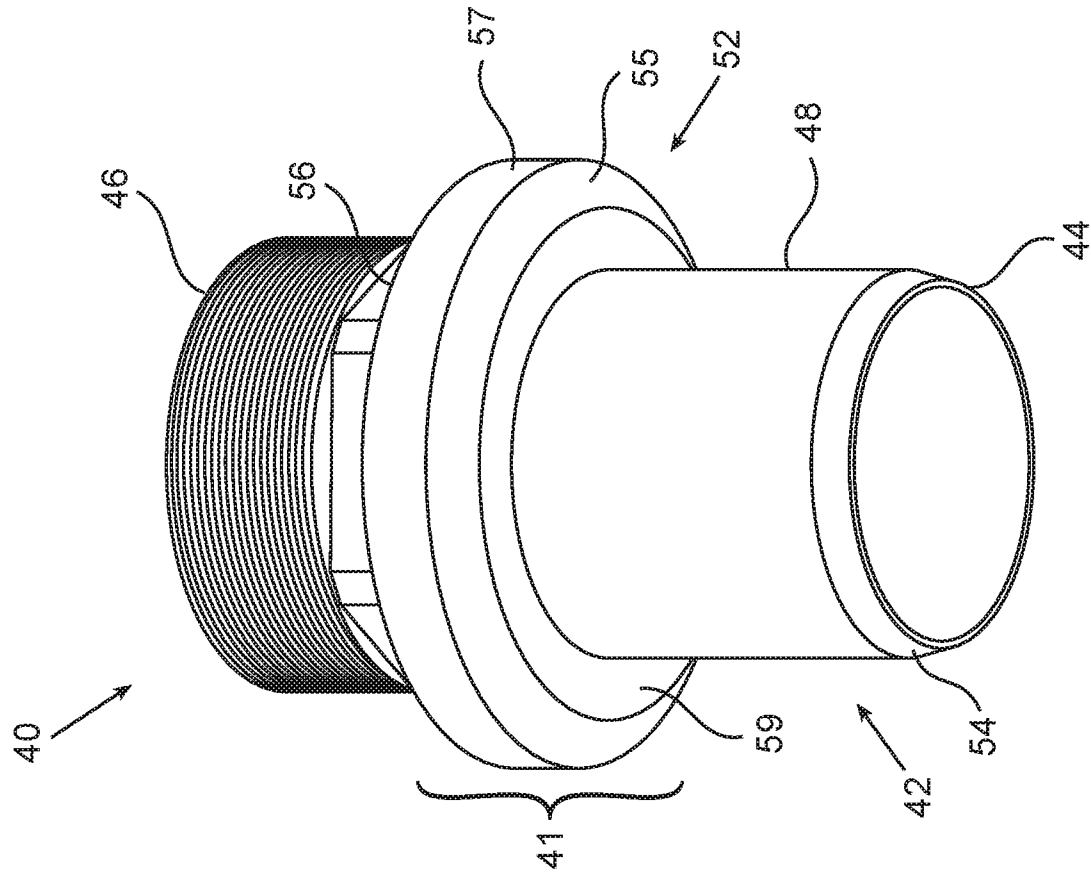


FIG. 9

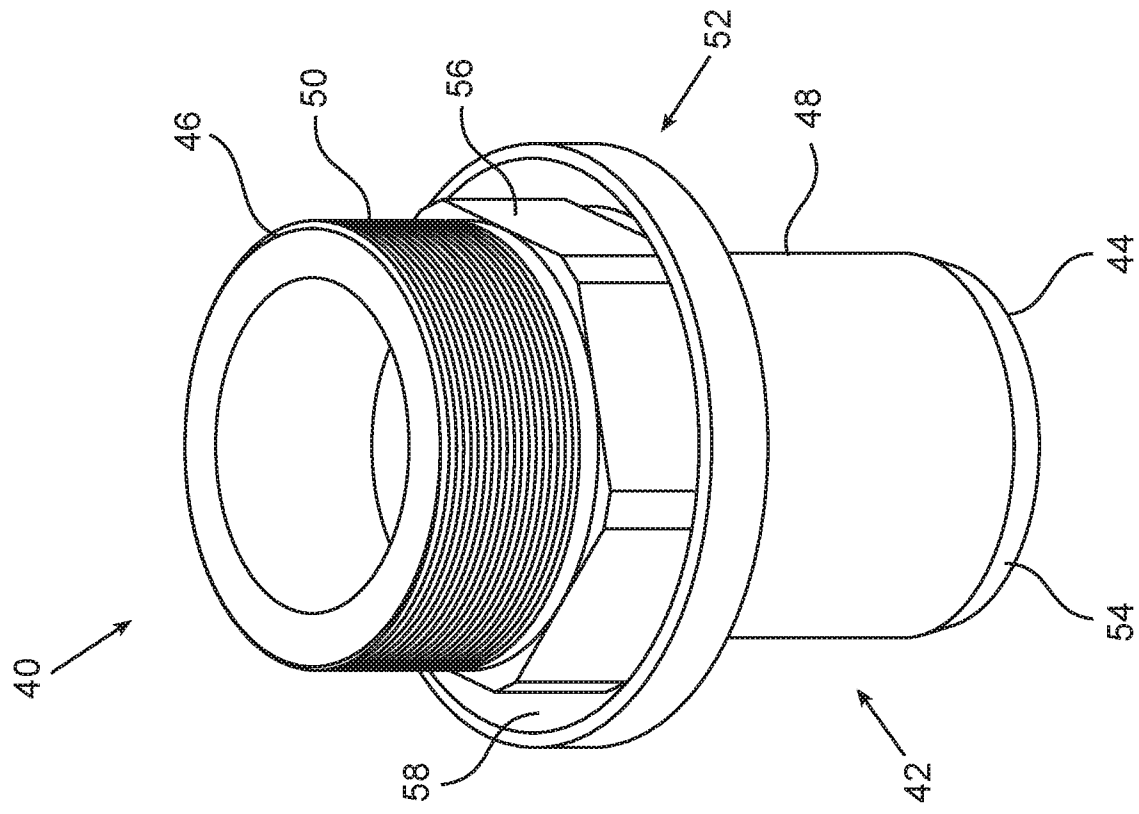
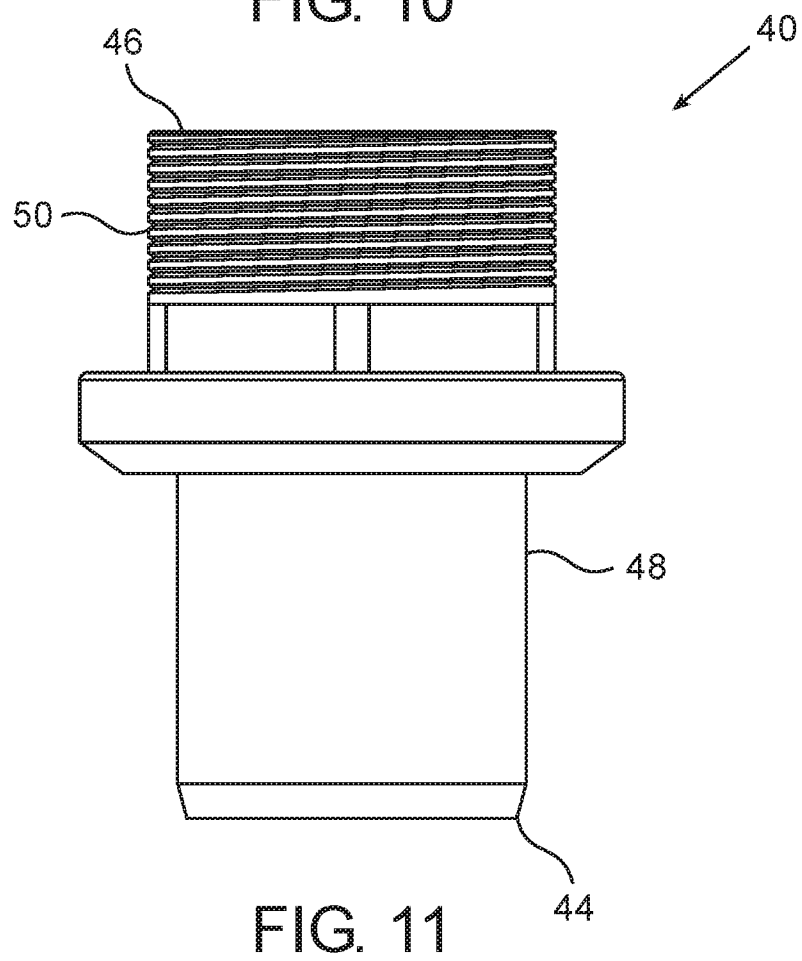
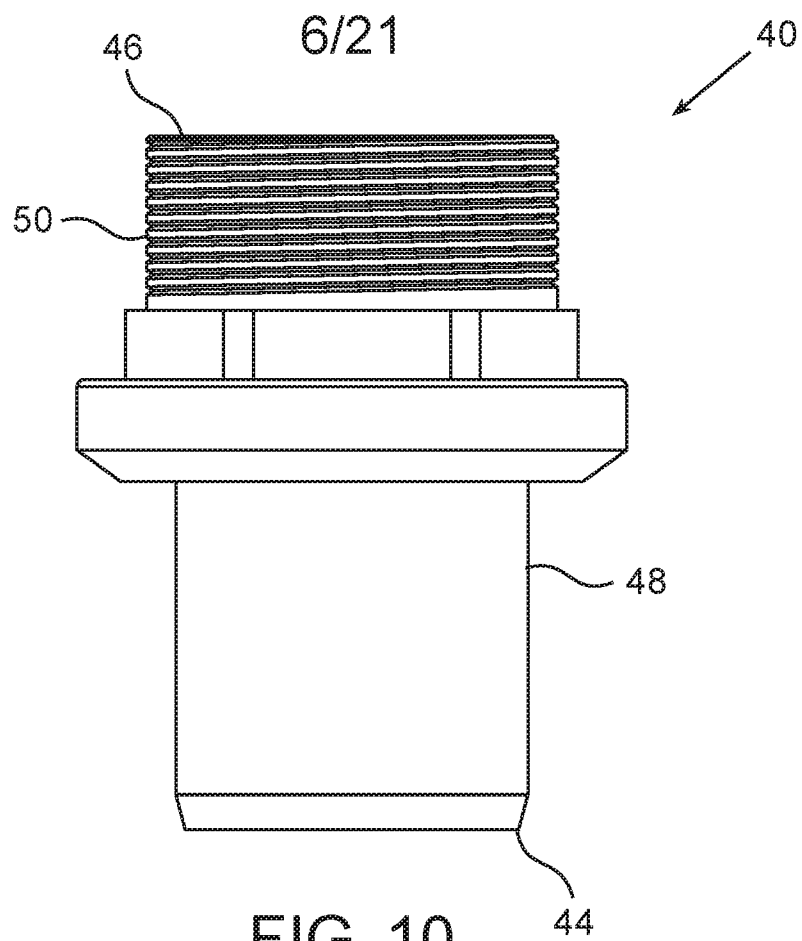


FIG. 8



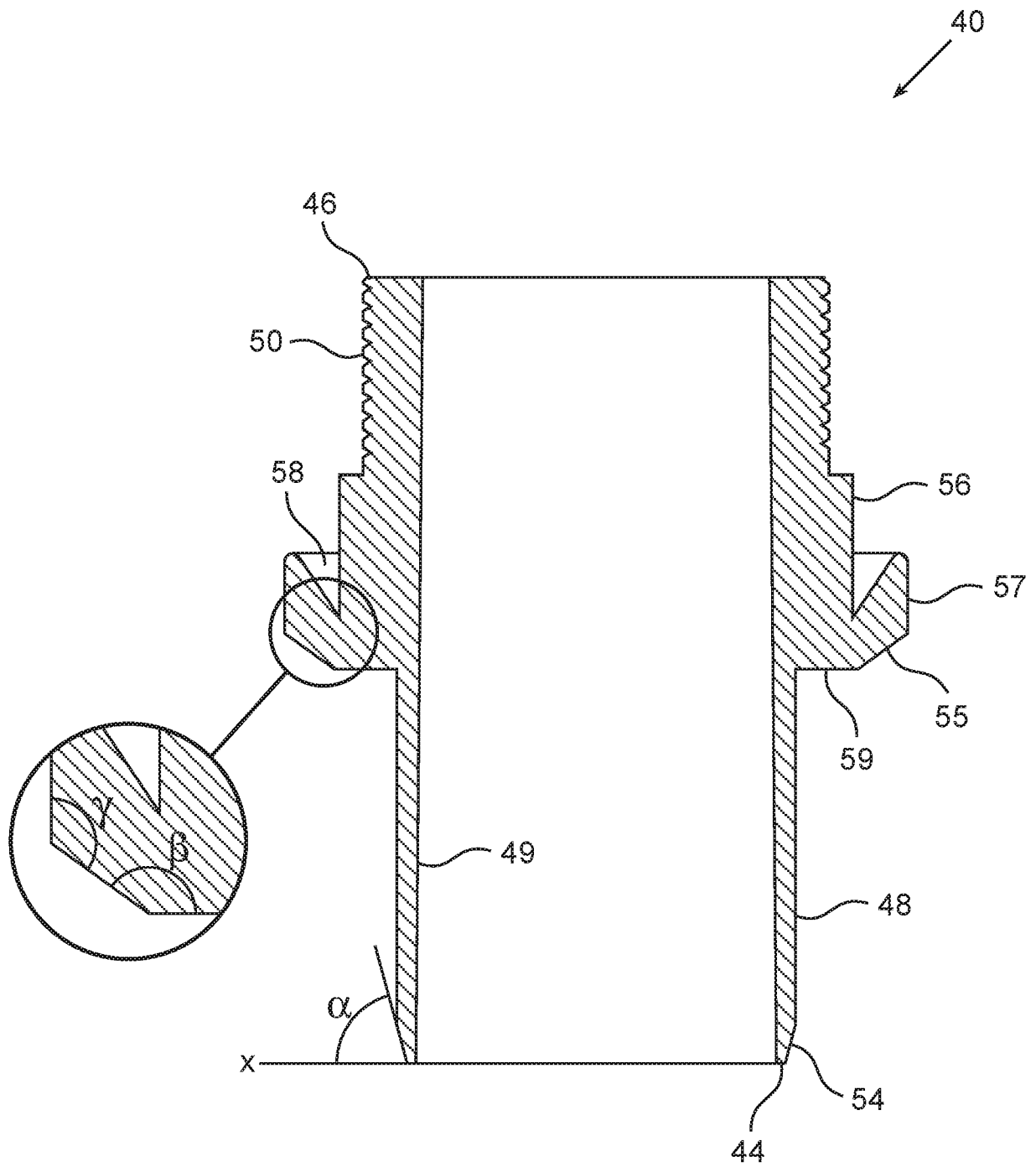


FIG. 12

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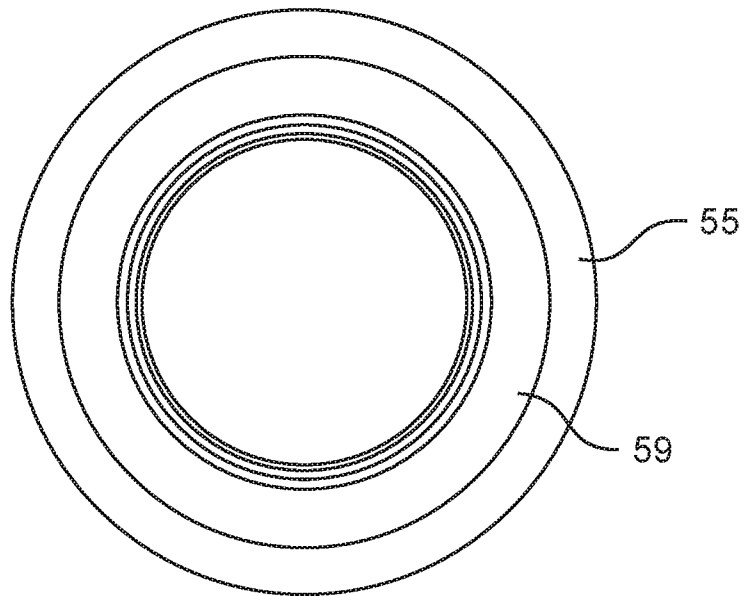


FIG. 13

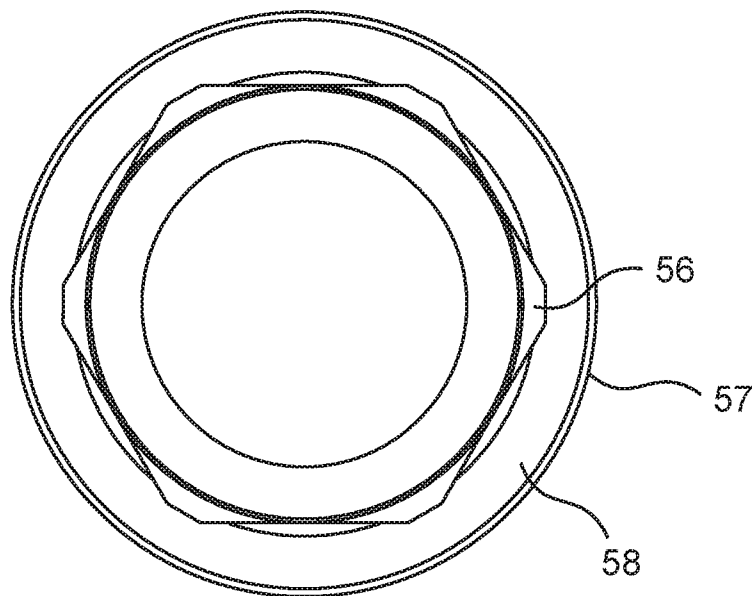


FIG. 14

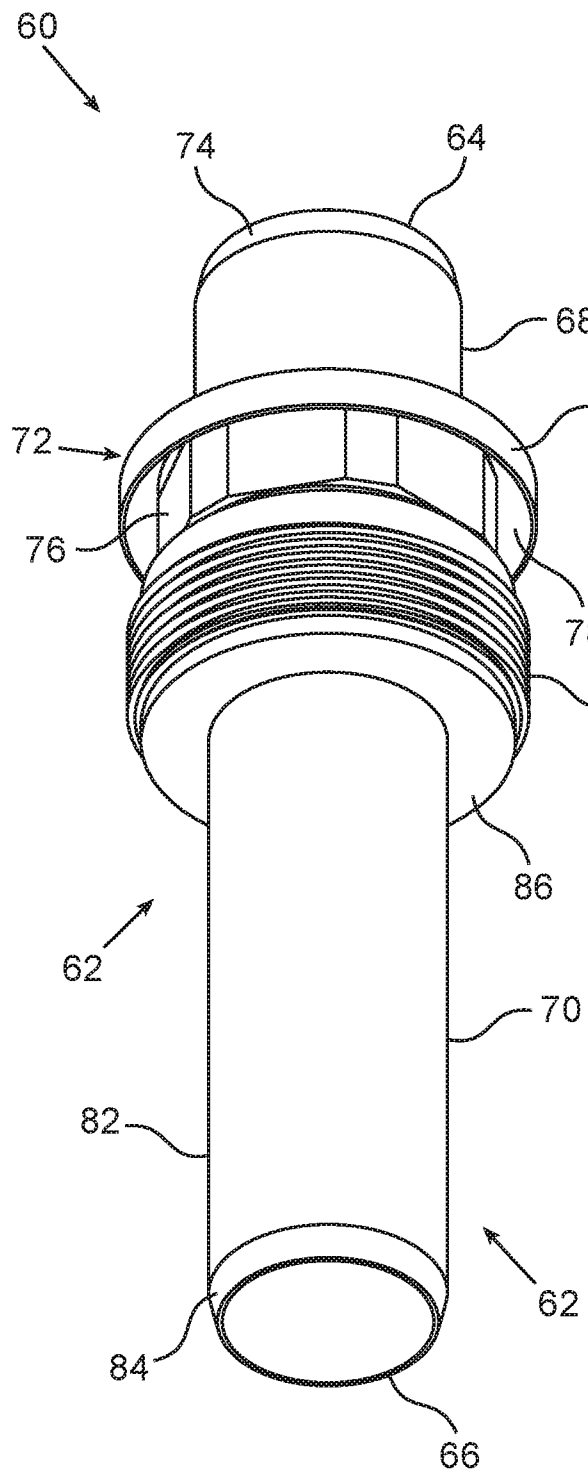


FIG. 15

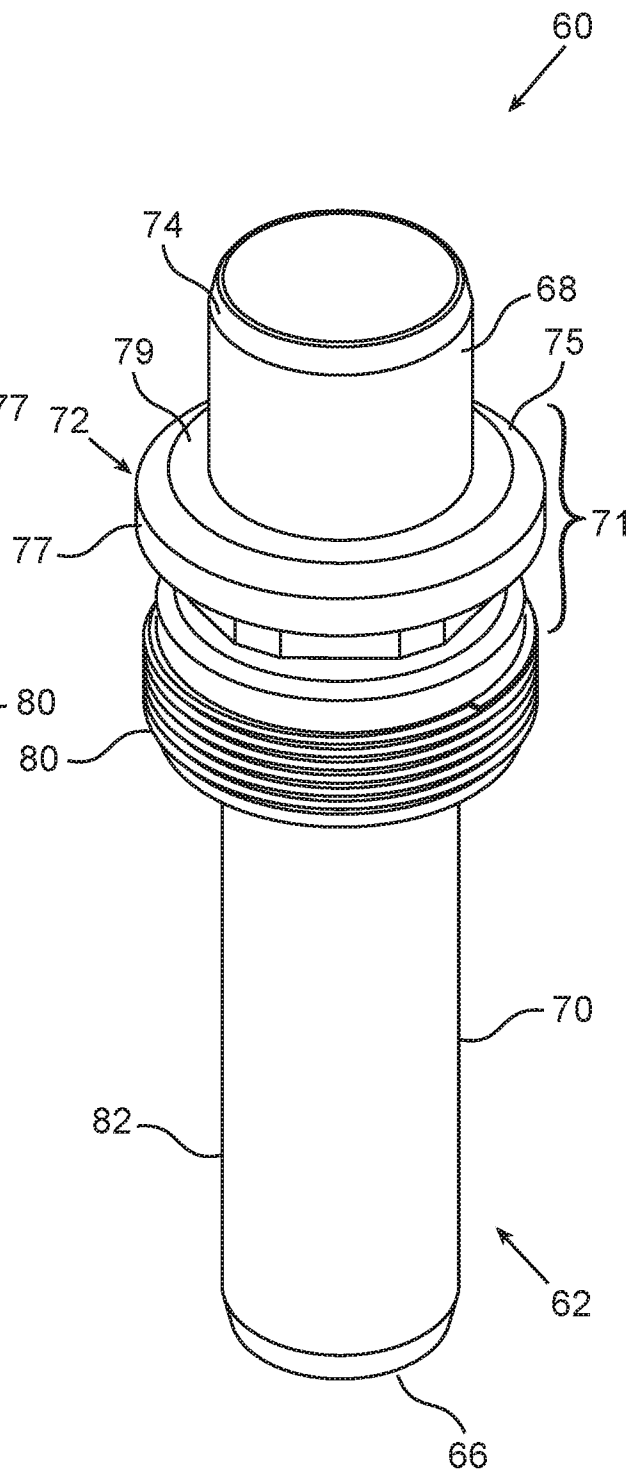


FIG. 16

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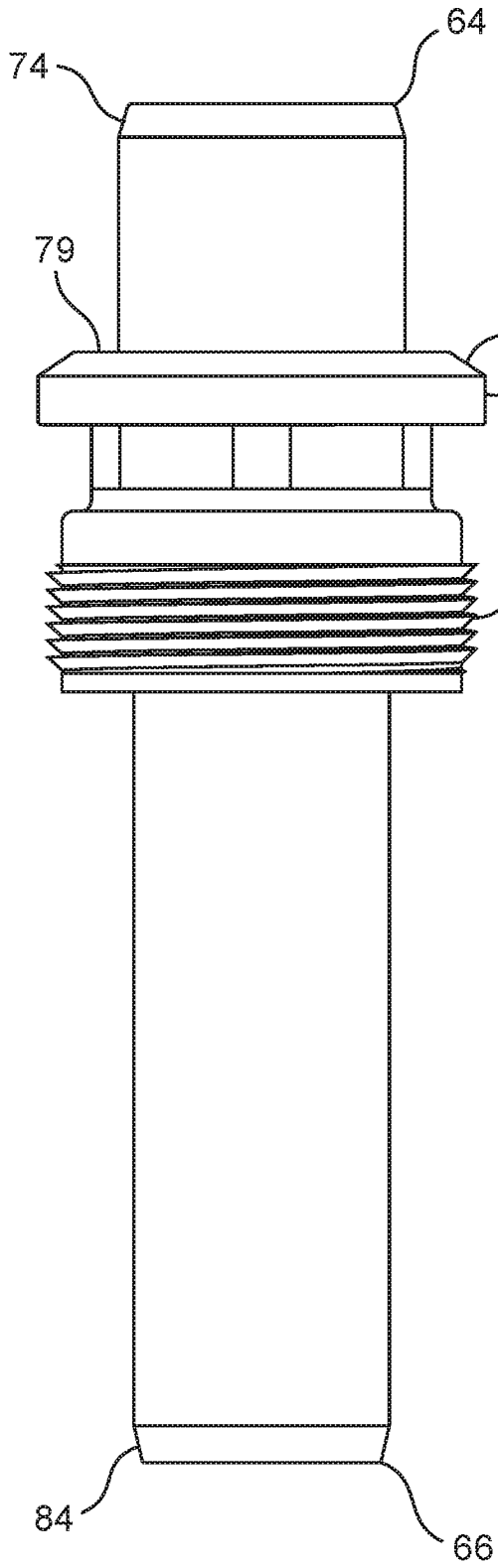


FIG. 17

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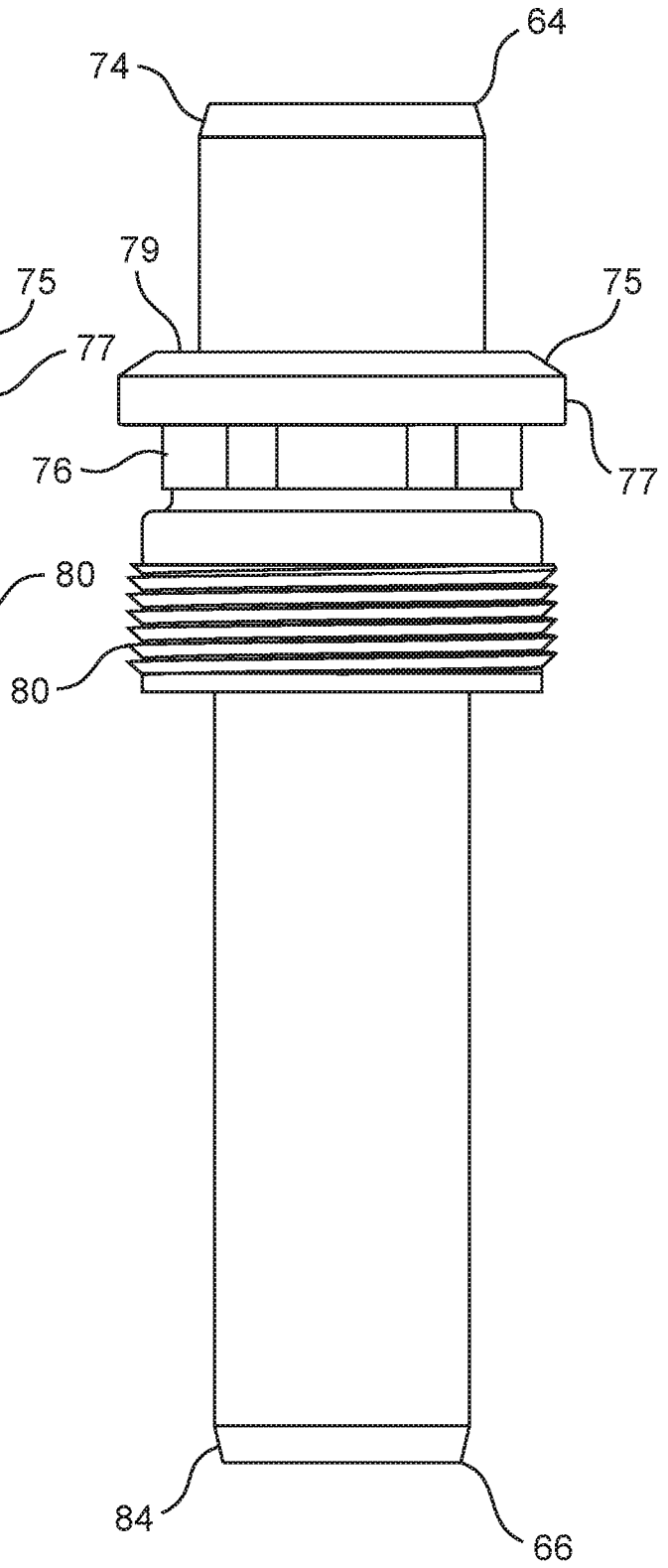


FIG. 18

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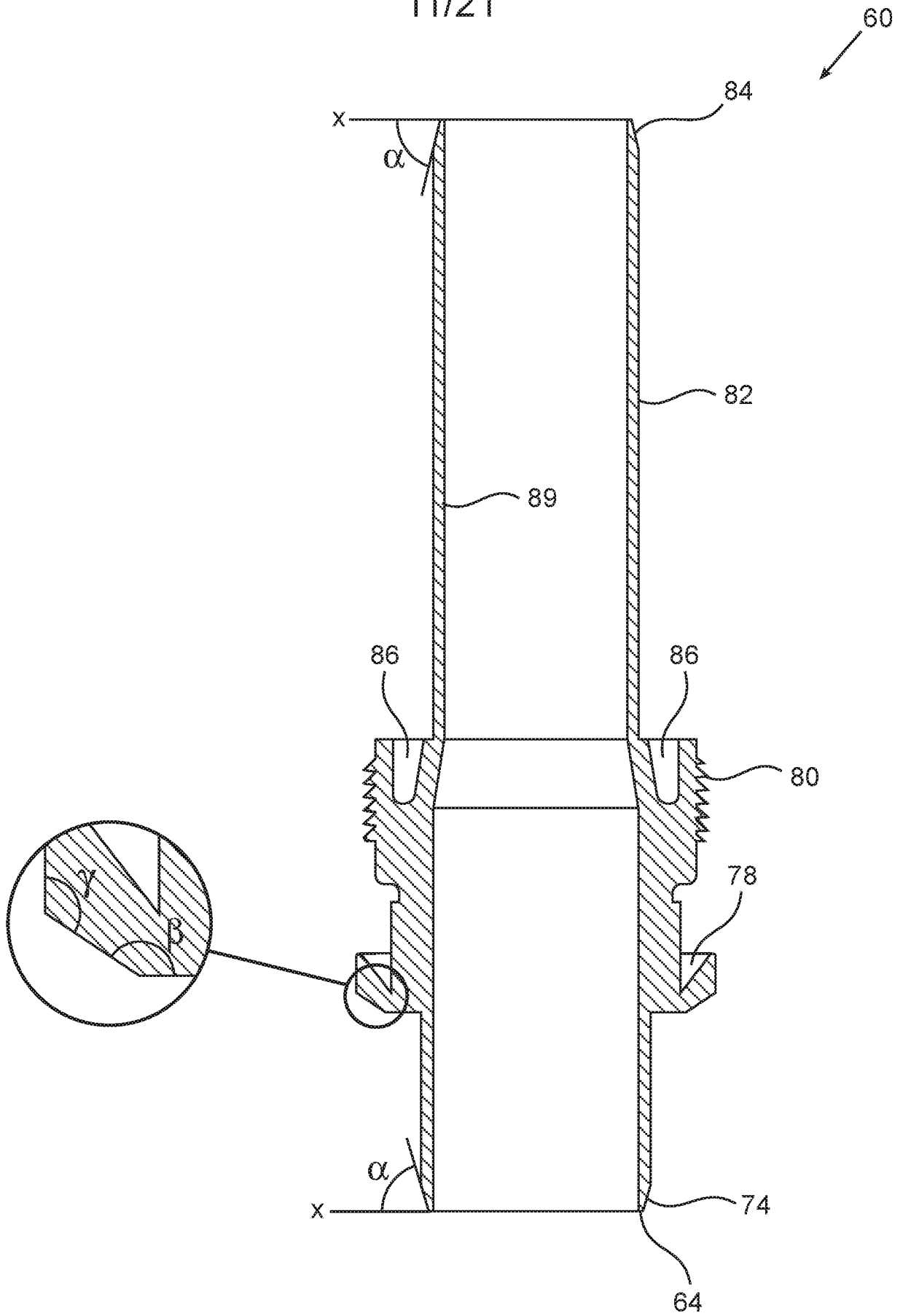


FIG. 19

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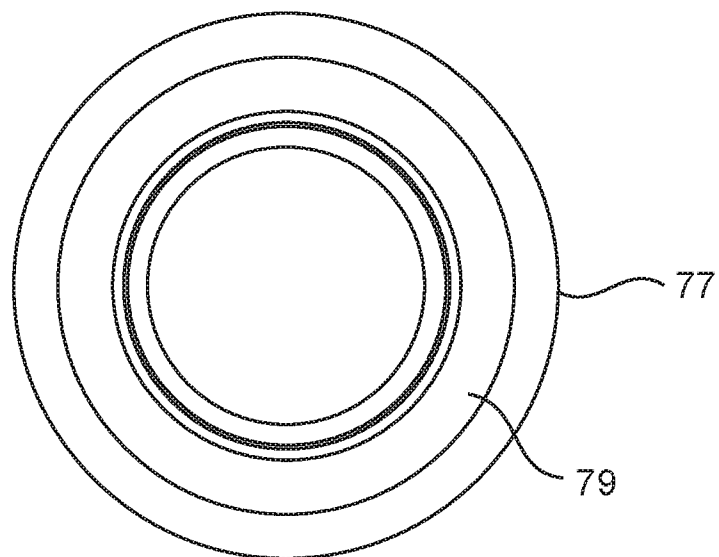


FIG. 20

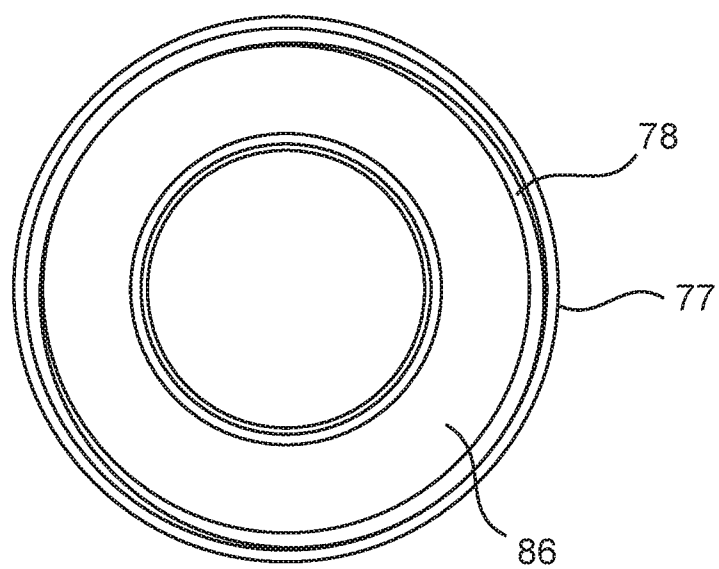


FIG. 21

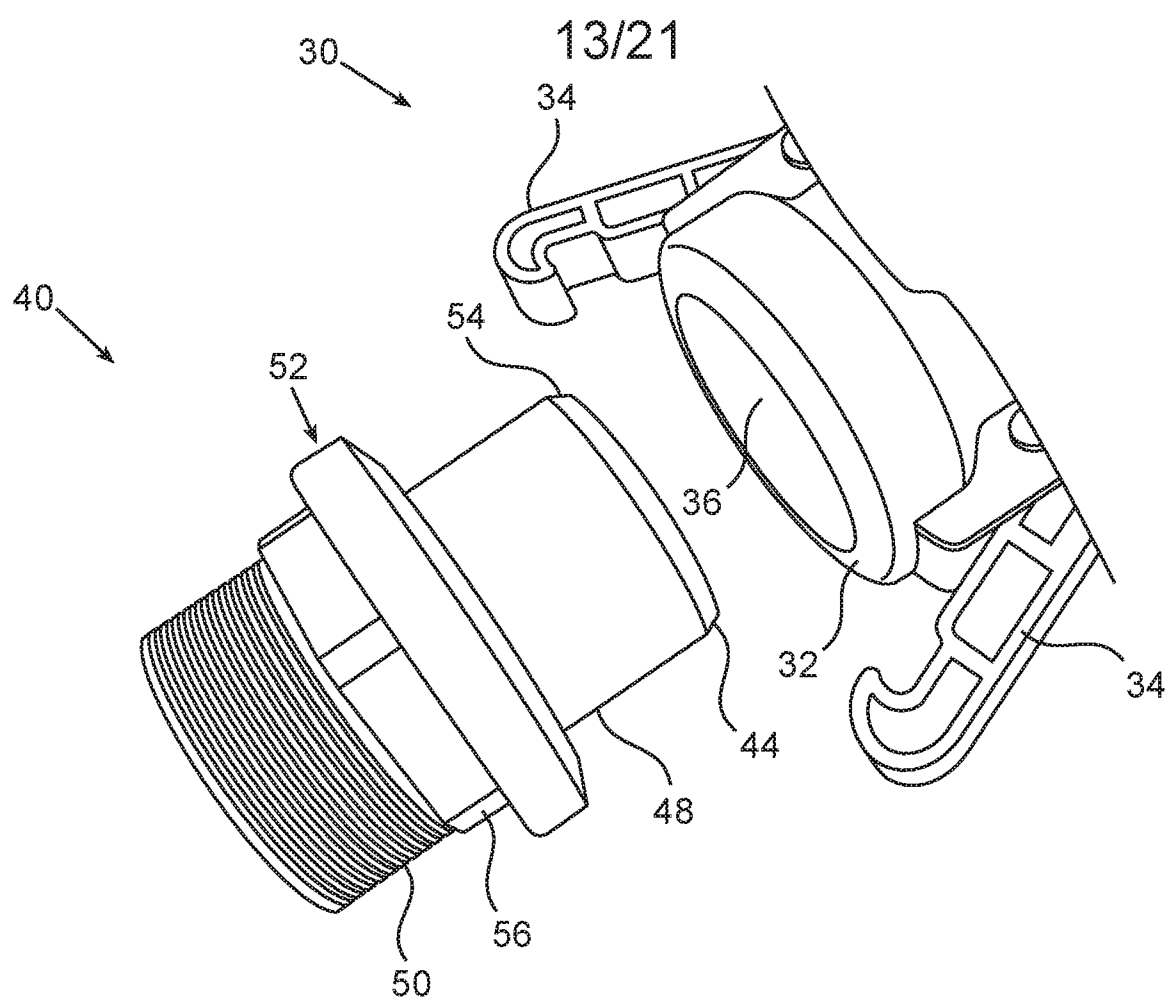


FIG. 22A

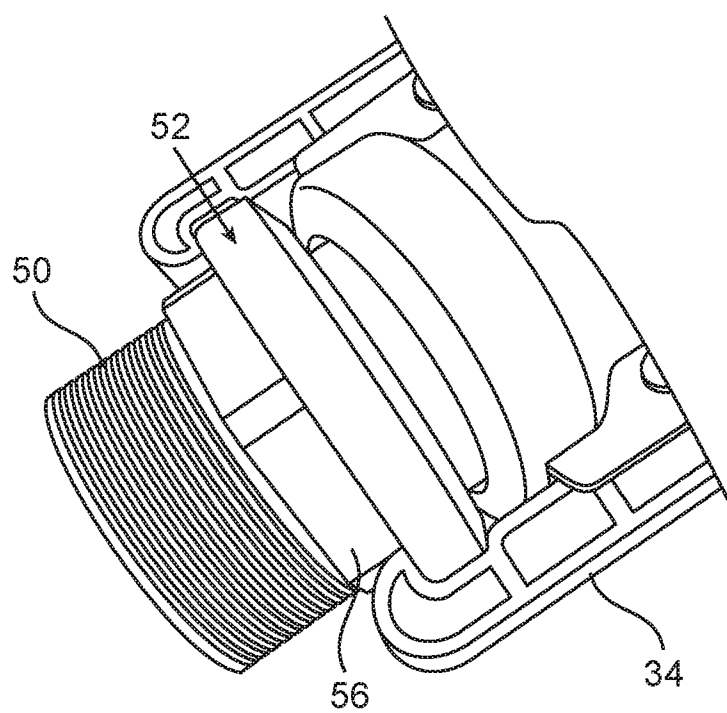


FIG. 22B

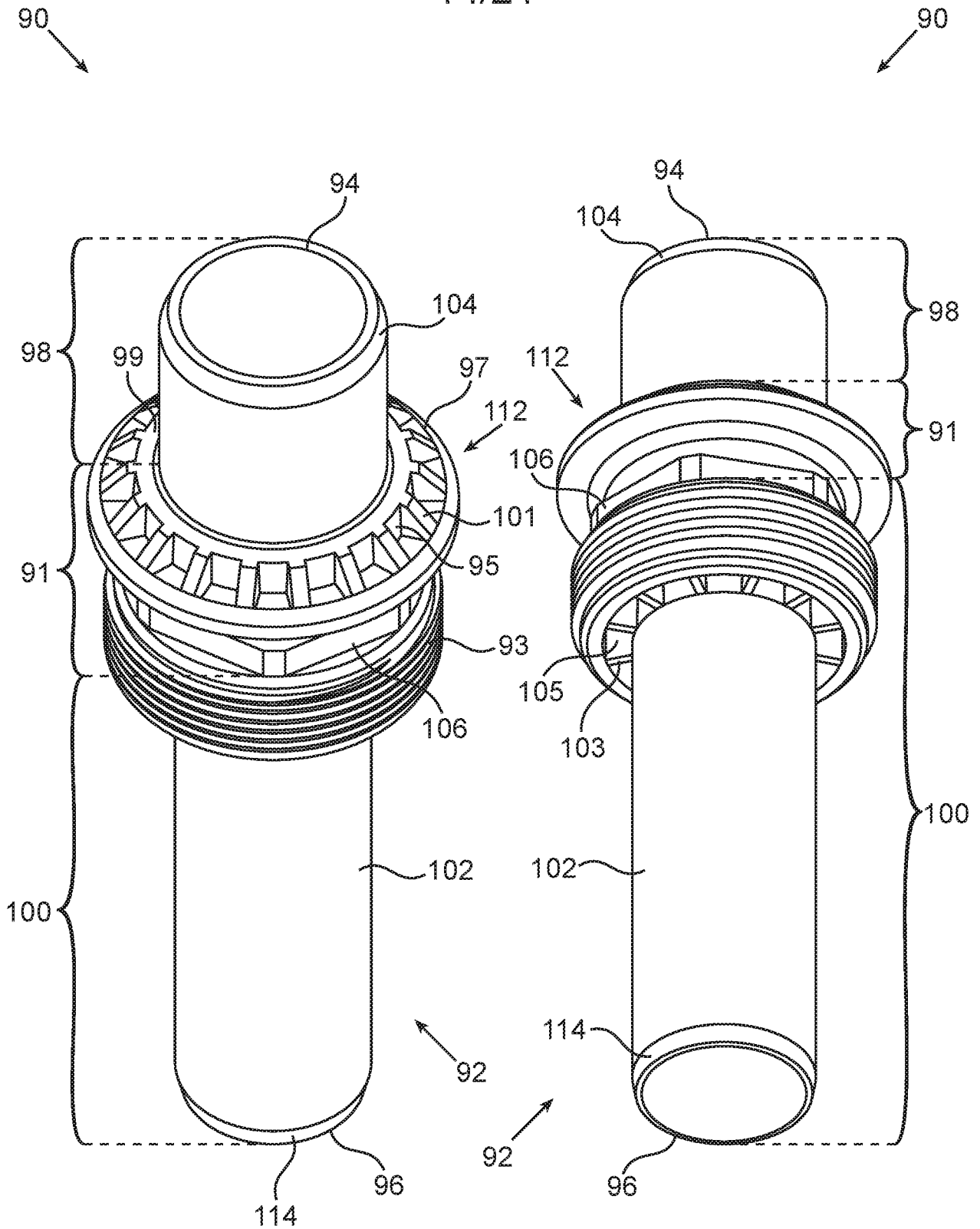


FIG. 23

FIG. 24

90 ↙

↘ 90

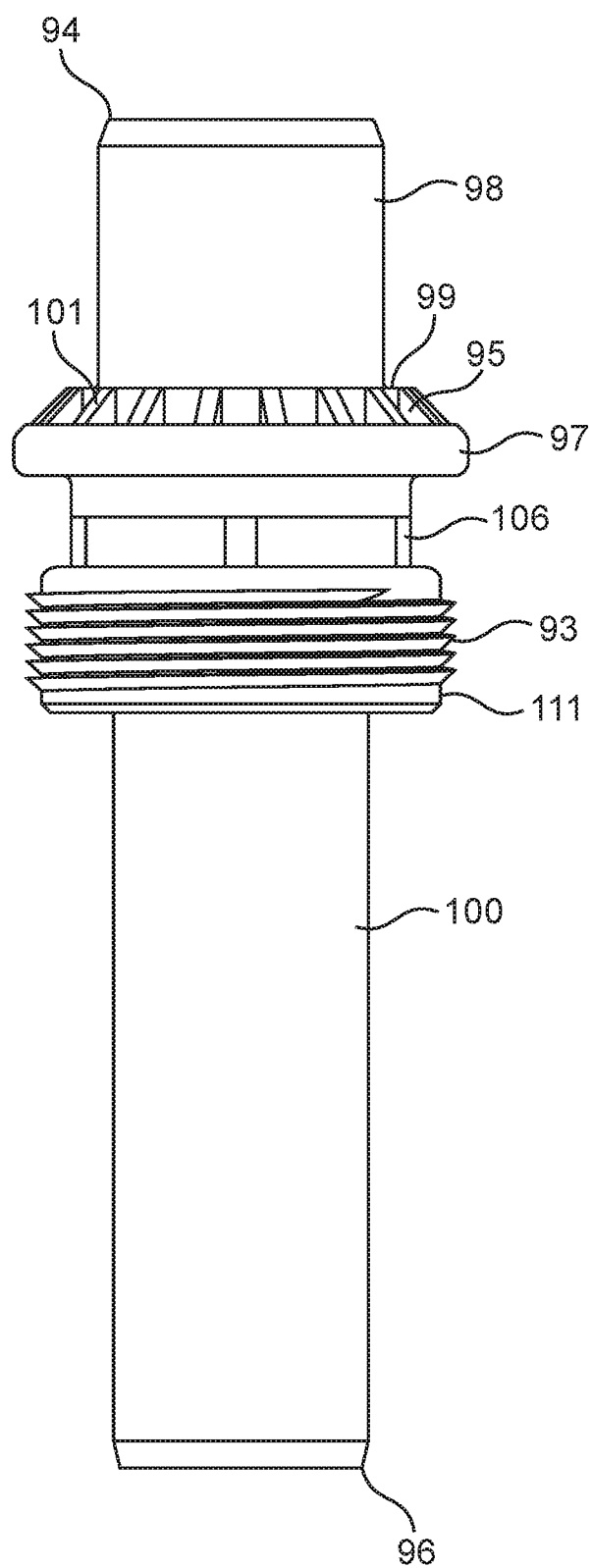


FIG. 25

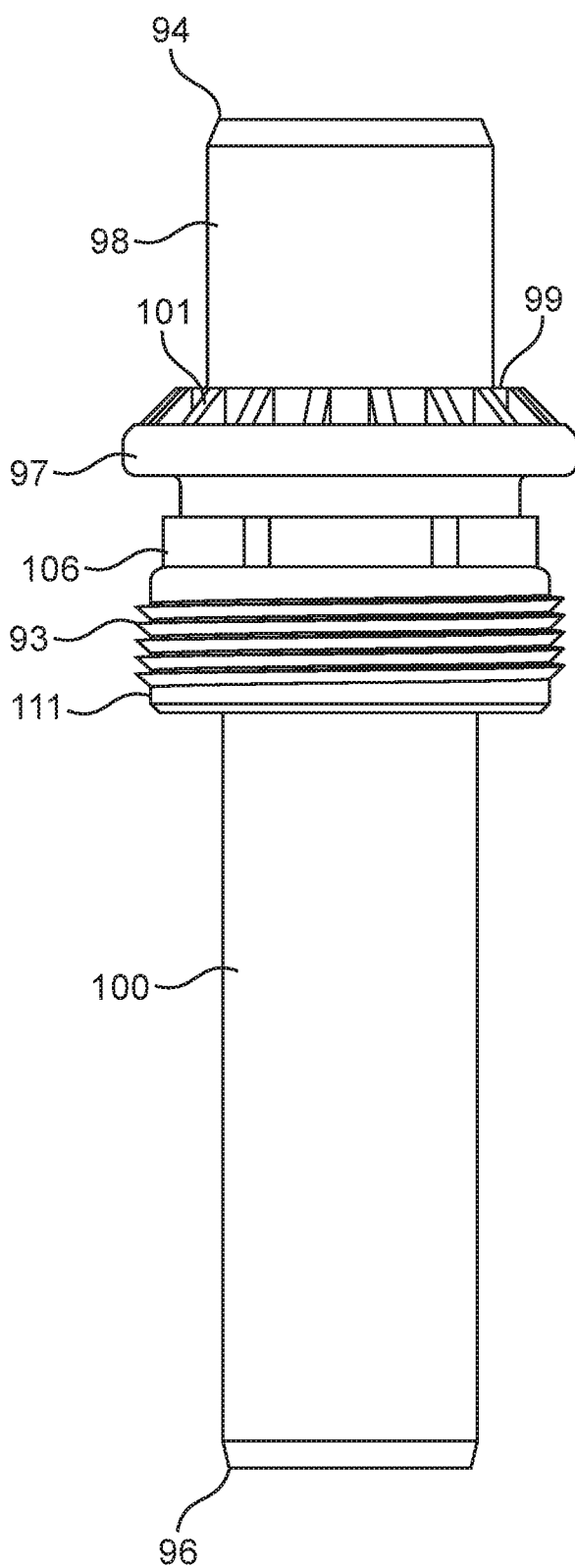


FIG. 26

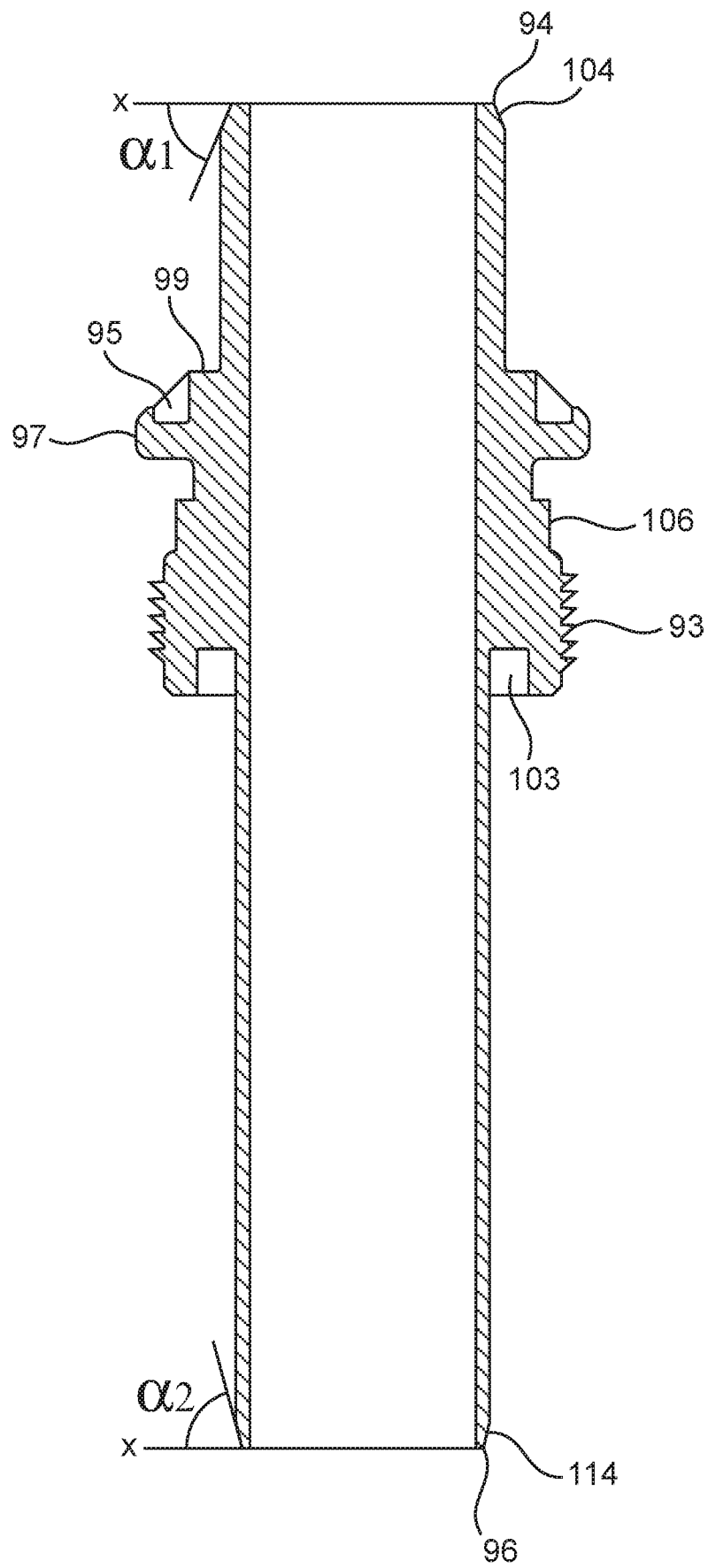


FIG. 27

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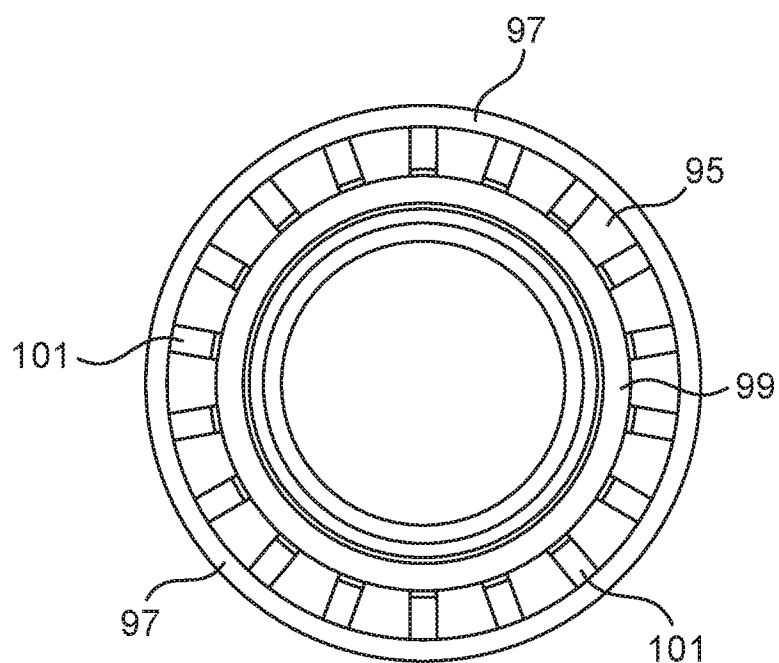


FIG. 28

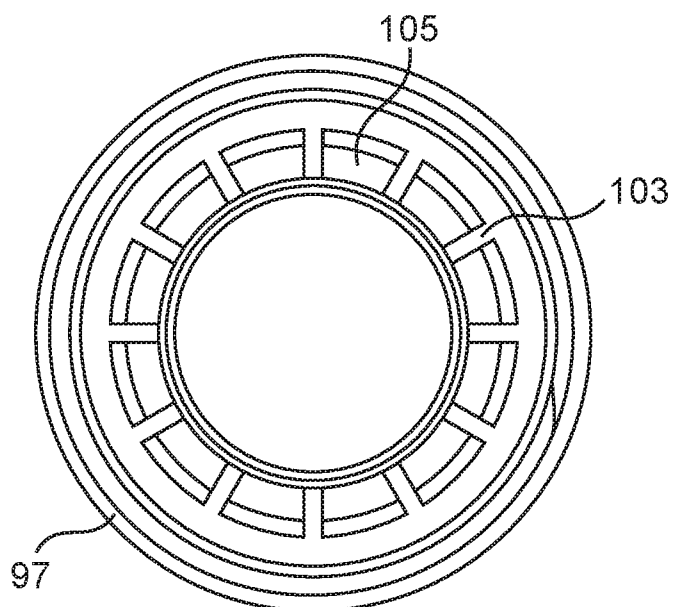


FIG. 29

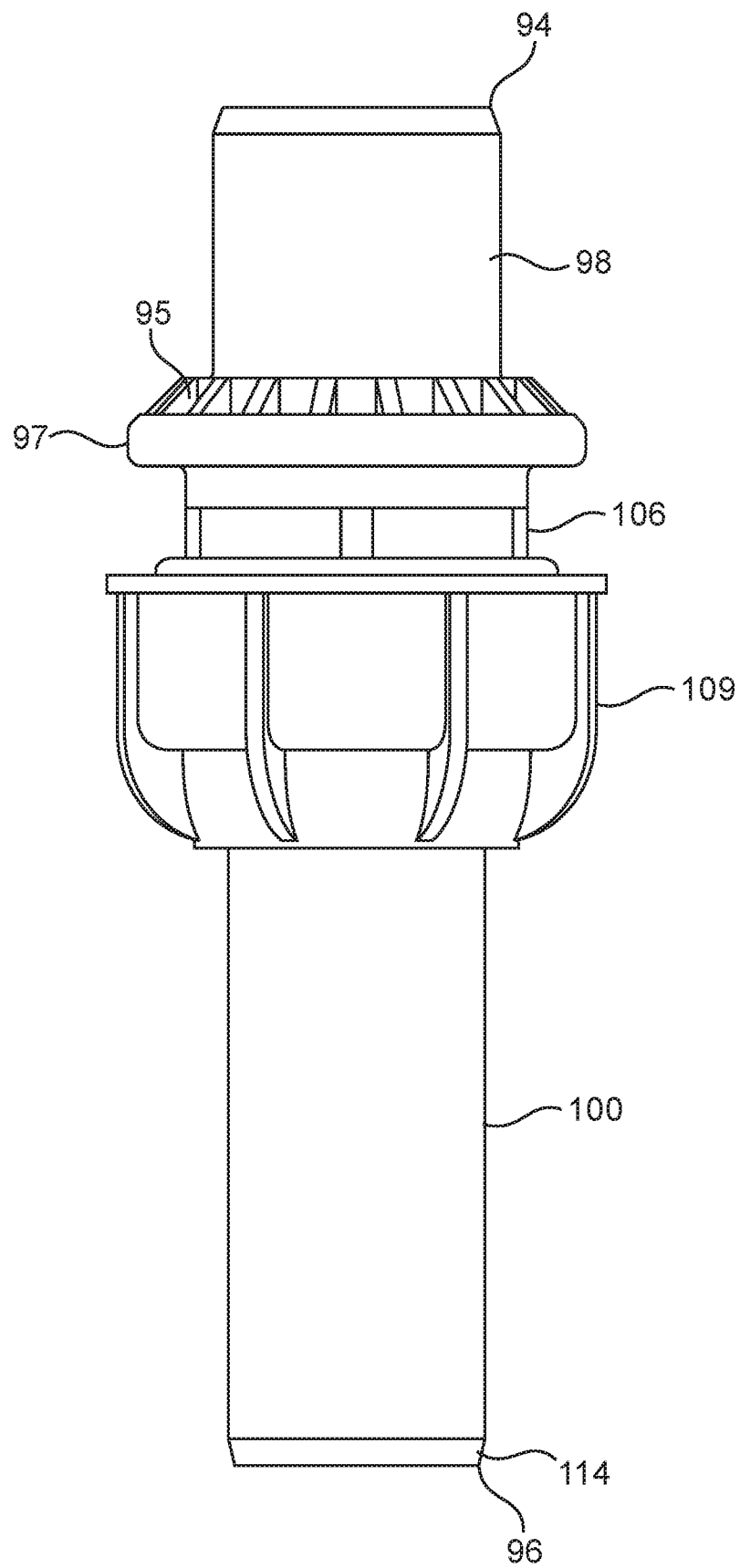


FIG. 30

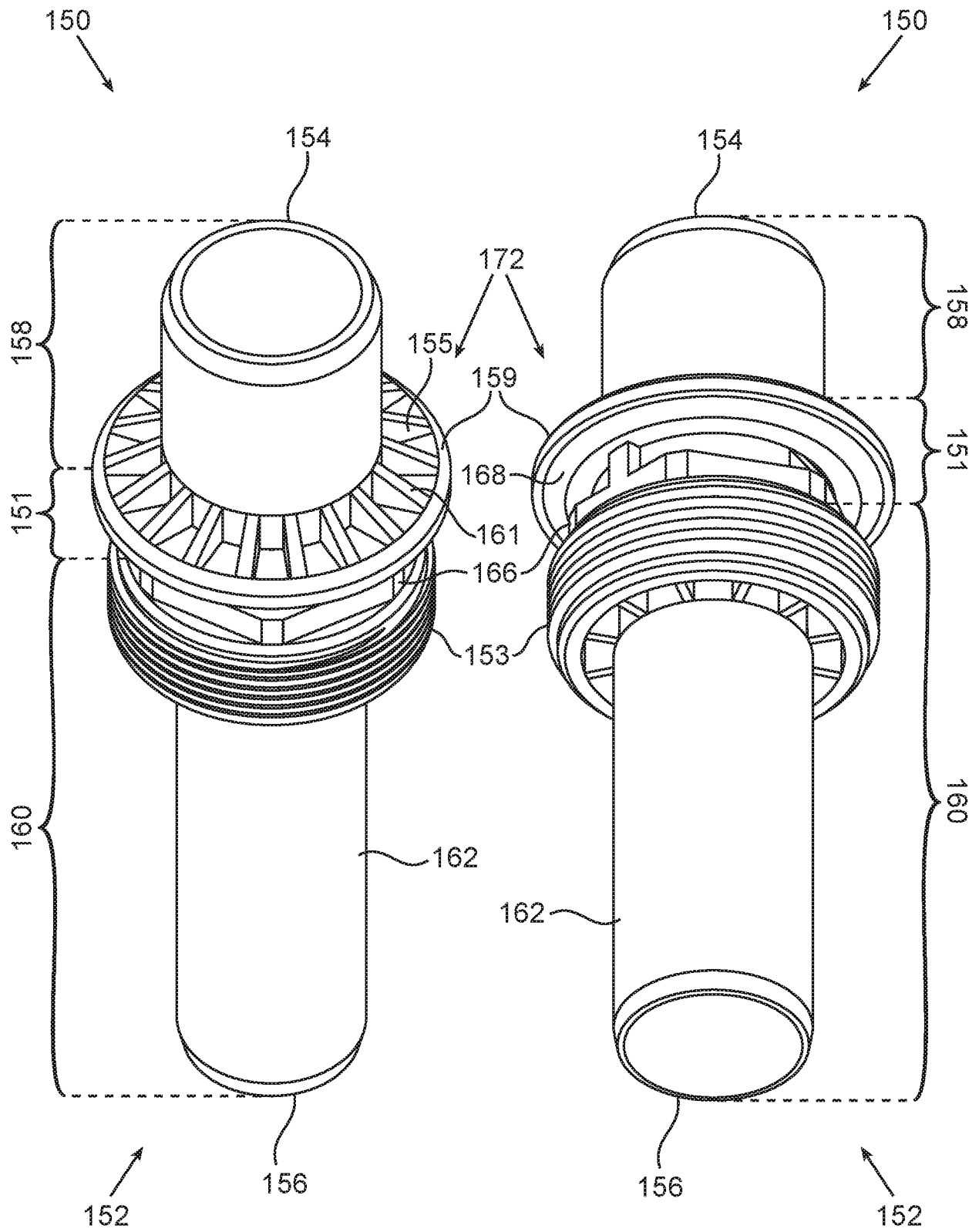


FIG. 31

FIG. 32

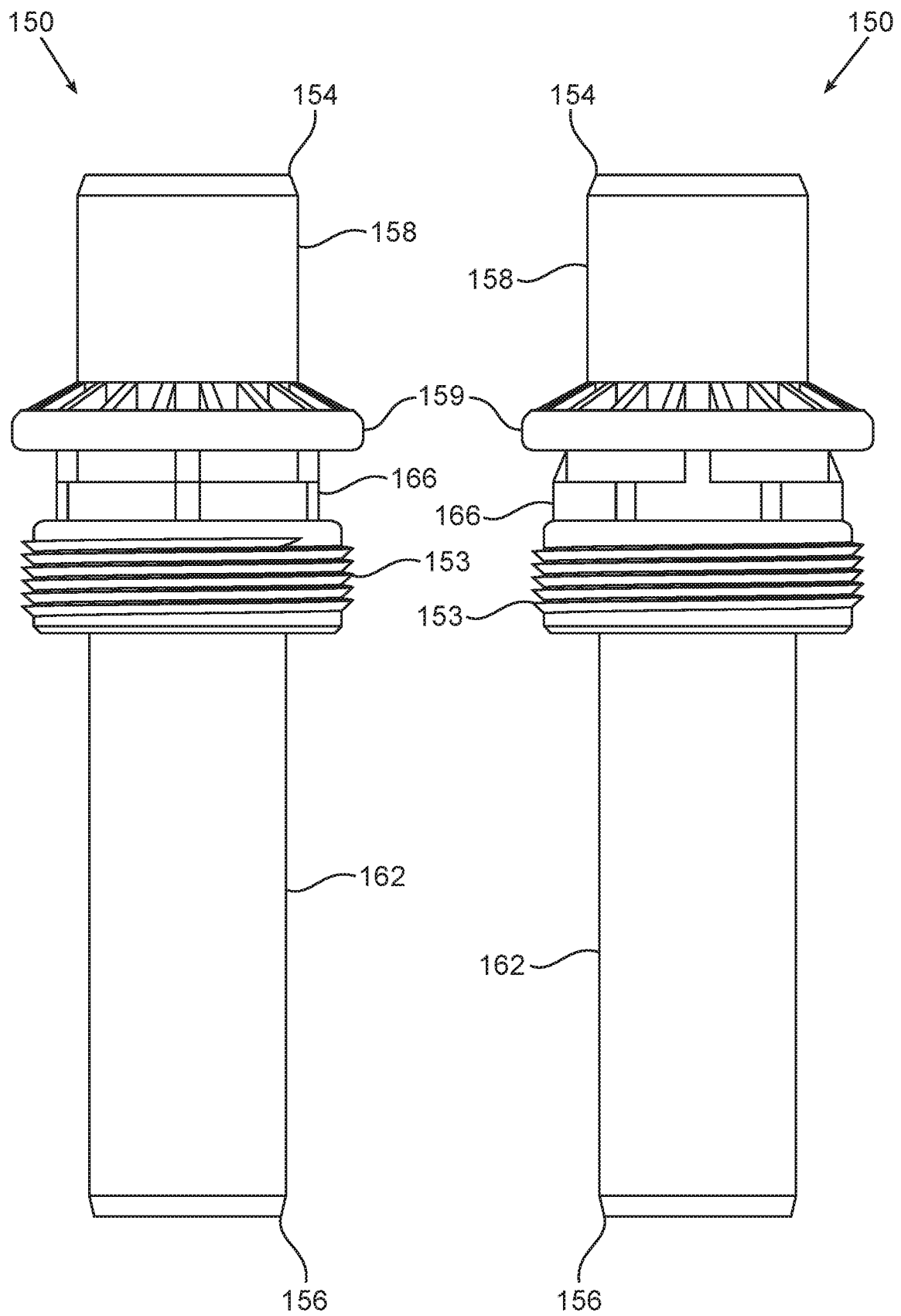


FIG. 33

FIG. 34

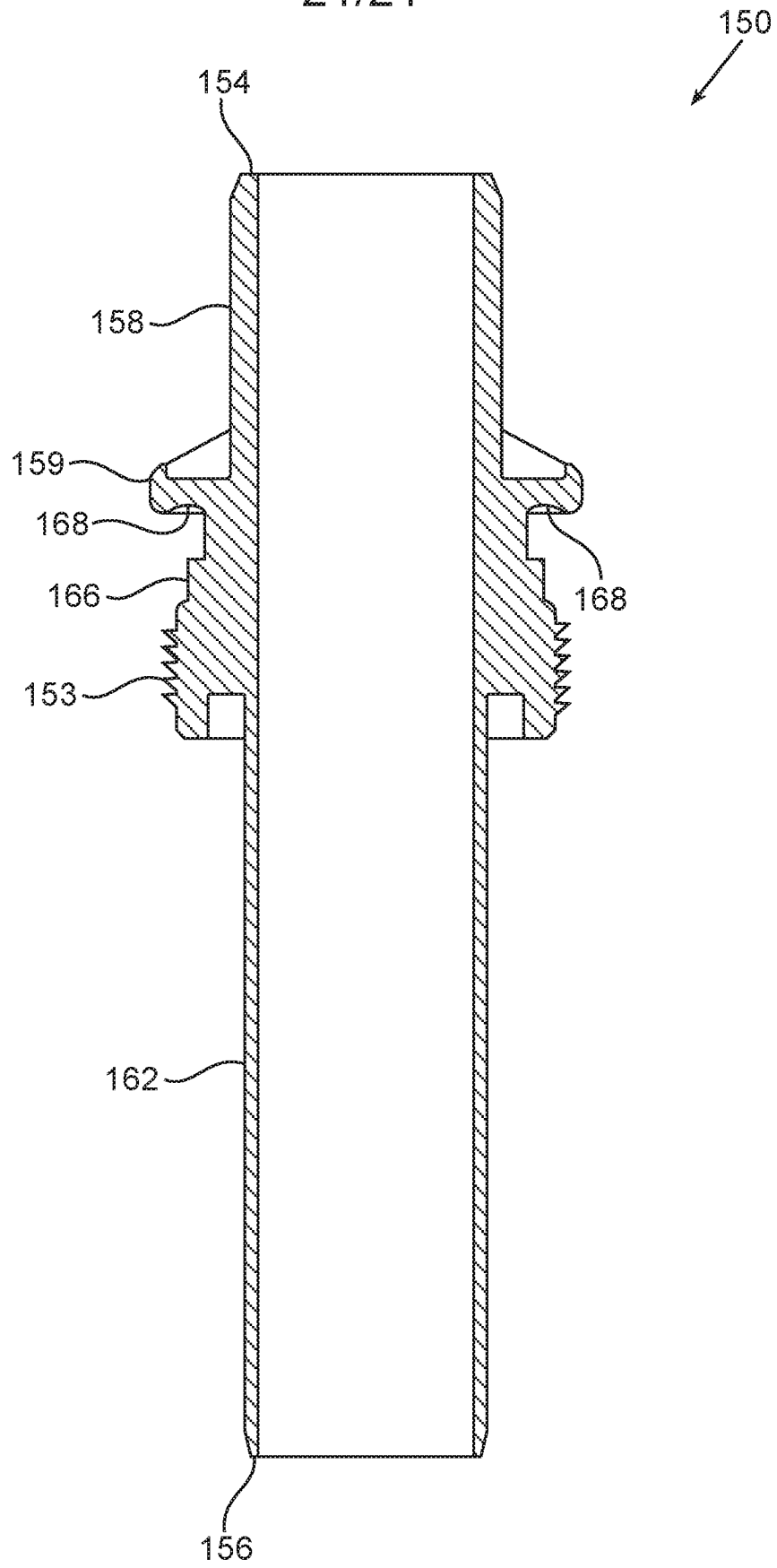


FIG. 35

CLAIMS

1. A connector for connecting irrigation device(s), the connector comprises a hollowed tube extending between a first connector end and a second connector end,
5 wherein said connector ends are open allowing passage therethrough of fluid, the tube comprises

a first tubular portion extending from said first connector end, said first tubular portion is shaped and sized to allow for an engagement with a first irrigation device by an axial insertion thereof into said first irrigation device;

10 a second portion extending from said second connector end, said second portion comprises a tubular member shaped and sized to allow for an engagement with a second irrigation device by an axial insertion of said tubular member into said second irrigation device, said second portion further comprises a cylindrical external thread configured to engage with a securing member by screwing said securing member over said thread,
15 allowing a secured engagement between the second portion and the second irrigation device; and

an intermediate portion disposed between said first portion and said second portion, said intermediate portion comprises a stop member allowing to secure said engagement with said first irrigation device by gripping means connected to or provided separately from
20 said first irrigation device and configured to hold said stop member, thereby securing said engagement.

2. The connector according to claim 1, wherein said engagement between said connector and said irrigation devices resists a fluid pressure of at least about 2.5 atm.

25 3. The connector according to claim 1 or 2, wherein the first irrigation device has a tubular portion having an inner diameter that can receive said first portion in a tight match.

4. The connector according to any one of claims 1-3, wherein the second irrigation
30 device has a tubular portion having an inner diameter that can receive said second portion in a tight match.

5. The connector according to claim 3 or 4, wherein the inner diameter of said tubular portion of the irrigation device(s) is larger than the outer diameter of the first and/or second portion(s).

6. The connector according to any one of claims 1-5, wherein said first and/or second portions having an elongated tube-like shape.

7. The connector according to any one of claims 1-6, wherein said first and/or second portions(s) configured to engage with said irrigation device(s) by an axial push motion of said first and/or second portion(s) into said irrigation device(s).

8. The connector according to any one of claims 1-7, wherein said first and/or said second connector end(s) include(s) a slope declining towards said first and/or second end(s), thereby allowing a safe engagement with said irrigation device(s).

9. The connector according to claim 8, wherein said slope defines an angle of less than about 70° between said slope and a horizontal axis of said connector.

10. The connector according to any one of claims 1 - 9, wherein said stop member comprises an annular flange protruding circumferentially from an outer surface of the tube and disposed perpendicular to said tube from an external surface thereof.

11. The connector according to claim 10, wherein said annular flange is bent to define a circumferential rim which extends towards said second connector end.

12. The connector according to claim 11, wherein said circumferential rim and said annular flange define an angle therebetween of about 90°.

13. The connector according to any one of claims 1-12, wherein said intermediate portion further comprises a hexagonal ring portion surrounding a periphery of said tube and extending from said stop member towards said second portion.

5 14. The connector according to any one of claims 1-13, wherein said stop member defines an annular recess which faces said second portion, allowing stable gripping of the stop member via the recess.

10 15. The connector according to anyone of claims 1-14, wherein said stop member protrudes from an outer periphery of the hollowed tube and configured to restrict said engagement with said first irrigation device to said first portion.

15 16. The connector according to claim 15, wherein the first portion has a length of at least about 30 mm, allowing a stable connection between the first portion and the first device due to a length of engagement of at least about 30 mm therebetween.

17. The connector according to any one of claims 1-16, wherein said tubular member of said second portion is elongated and wherein the engagement with the second device is via the elongated tubular member.

20 18. The connector according to claim 17, wherein the elongated tubular member has a length of at least about 30 mm, allowing a stable connection between the second portion and the second device due to a length of engagement of at least about 30 mm therebetween.

25 19. The connector according to claim 17 or 18, wherein said elongated tubular member has a length of at least about 50 mm.

30 20. The connector according to anyone of claims 1-19, wherein said thread protrudes from an outer periphery of the hollowed tube restricting said engagement with said second irrigation device to said elongated tubular member.

21. The connector according to any one of claims 1-20, wherein an internal surface of said connector is smooth and non-threaded.
22. The connector according to any one of claims 1-21, which is manufactured as an
5 integral single piece of material.
23. The connector according to any one of claims 1-22, which is manufactured from a polymeric material.
- 10 24. The connector according to claim 23, wherein said polymeric material is polypropylene.
25. The connector according to any one of claims 1-24, wherein said engagement with said first and/or second irrigation device(s) allows a hermetically sealed and secured
15 connection between the connector and said first and/or second irrigation device(s).
26. The connector according to any one of claims 1-25, wherein said engagement is stable allowing a fluid passageway resisting a pressure of up to about 8 atm.
- 20 27. The connector according to any one of claims 1-26, wherein the inner diameter of the hollowed tube is constant along the entirety of said tube.
28. The connector according to any one of claims 1-27, wherein said first and/or second portion(s) having a smooth cylindrical outer surface for engaging within said first and/or
25 second irrigation device(s).
29. The connector according to any one of claims 1-28, wherein an inner diameter of the tube is continuously reduced towards said second end.

30. The connector according to any one of claims 1-29, wherein the first connector end, the first portion, the intermediate portion, the second portion and the second connector end are arranged in a series in an axial alignment.

5 31. The connector according to any one of claims 1-30, wherein the length ratio between first portion and second portion is about 1:1 to about 1:10.

32. The connector according to any one of claims 1-31, wherein the length ratio between first portion and second portion is about 1:1 to about 1:5.

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33. The connector according to any one of claims 1-32, wherein the length ratio between first portion and second portion is about 1:1 to about 1:3.

15 34. The connector according to anyone of claims 1-33, wherein said stop member includes radial slots provided to secure and/or release an engagement with an irrigation device by an auxiliary tool capable of rotating said connector via said slots.

35. A connector for connecting irrigation devices, the connector comprising a hollowed tube extending between a first connector end and a second connector end, wherein said first and second connector ends are open, allowing passage therethrough of fluid, wherein the tube comprises

20 a first tubular portion extending from said first connector end and configured to allow for an engagement with a first irrigation device by insertion of at least a portion thereof into the first irrigation device;

25 a second portion extending from said second connector end, said second portion comprises an external cylindrical thread, and a non-threaded elongated tubular member; said second portion is shaped and sized to allow for a secured engagement with a second irrigation device by an axial insertion of said non-threaded tubular member into a tubular portion of said second irrigation device and by screwing a securing member over said
30 thread; and

an intermediate portion disposed between said first portion and said second portion, said intermediate portion comprises an annular flange protruding circumferentially from an outer surface of the tube, said annular flange allowing to secure said engagement with said first irrigation device by gripping means, such to allow stable gripping of said first
5 portion via said annular flange, thereby providing a secured engagement with said first irrigation device.

36. A pipe assembly for allowing a secured and stable engagement between irrigation devices, the pipe assembly comprises a connector according to anyone of claims 1-35, a
10 first irrigation device and a second irrigation device.

37. The pipe assembly according to claim 36, wherein the first irrigation device is a pipe and the second irrigation device is a sprinkler or a sprinkler's stabilizer.

15 38. A method for secured and stable connection of irrigation devices or a pipe-line, the method comprising

providing a connector having a first tube portion, a second tube portion and an intermediate portion;

inserting the first tube portion into a tubular portion of a first irrigation device;
20 inserting by an axial insertion the second tube portion into a tubular portion of a second irrigation device;

securing the engagement between the first tube portion and the first irrigation device by gripping an annular flange of the intermediate portion via gripping arms of the first irrigation device; and

25 securing the engagement between the second tube portion and the second irrigation device by screwing a securing member over a thread of the second portion, thereby stably connecting the connector to the irrigation devices.

39. The method of claim 38, wherein the step of inserting the second portion into a tubular portion of a second irrigation device occurs prior to the step of inserting the first
30 portion into a first irrigation device.

40. The method of claim 38 or 39, wherein the step of inserting includes axially pushing the tube portion of the connector into a tubular portion of the irrigation device.
- 5 41. The method of any one of claims 38-40, comprising inserting above about 30 mm of the first portion and/or second portions of the connector into the first and/or second irrigation devices.
41. The method of claim 38, wherein the securing member is a nut.

PIPE CONNECTORS AND USES THEREOF

FIELD OF THE INVENTION

The present invention relates, in some embodiments thereof, to connectors allowing
5 a secure and sealed engagement of pipes, inter alia, irrigation pipes. In one or more
embodiments, the invention provides a connector for connecting irrigation device(s), the
connector comprising, a hollowed tube extending between a first connector end and a
second connector end, wherein at least the first connector end is open allowing passage
therethrough of a fluid, a first portion extending from the first connector end, the external
10 surface thereof is configured to allow for a sealed engagement with a tubular portion of a
first irrigation device; a second portion extending from the second connector end; and an
intermediate portion positioned between the first portion and the second portion, the
intermediate portion comprises a stop member configured to allow for a secure and sealed
engagement with the first device.

BACKGROUND OF THE INVENTION

The agriculture market and needs are constantly changing. Recent challenges are
associated with the requirement to increase agriculture yields while decreasing
consumption of natural resources and minimizing environmental damages. The water
20 shortage prevailing in many countries as well as global warming and shortage in other
resources yielded new attempts to provide innovative irrigation technologies that would be
cost effective and efficient.

There is a need in novel agriculture irrigation devices and systems that would be
user friendly, and allow an efficient, and cost-effective irrigation.

SUMMARY OF THE INVENTION

The present invention pertains to connectors that allow a secure, efficient and stable
engagement with pipes, inter alia, irrigation pipes or devices. The connectors afford stable
connection between pipes allowing resistance to pressure of up to 10 atmospheres (atm).
30 The connectors of the invention include a first portion, a second portion and an intermediate
portion. The first portion is configured to engage with a tubular portion of an irrigation

device in a manner that the first portion is inserted within the tubular portion and a sealed connection is formed. Due to a relatively elongated first portion, having a length of above about 30 mm, the connection formed between the connector and a first irrigation device is stable resisting pressures as high as 8 atmospheres (atm), and more during irrigation. The intermediate portion includes a stop member that can be held by gripping arms of the irrigation device, thereby allowing a secure engagement with the irrigation device. In one or more embodiments, the second portion allows for an engagement with a second irrigation device, providing a connector that connects between two irrigation devices (e.g., pipes, sprinklers, etc.). In one or more embodiments, the second portion has a closed end, providing a pipe end.

The herein disclosed connectors thus allow to connect pipes or devices that include pipes or opened tubular portions in an efficient and secure manner.

In a first aspect, the present invention provides a connector for connecting irrigation device(s), the connector comprising a hollowed tube extending between a first connector end and a second connector end, wherein said connector ends are open allowing passage therethrough of fluid, the tube comprises

a first coupler extending from the first connector end, the first coupler is shaped and sized to allow for an engagement with a first irrigation device by insertion of at least a portion thereof into the first irrigation device;

a second coupler extending from the second connector end, the second coupler is shaped and sized to allow for an engagement with a second irrigation device by insertion of at least a portion thereof into the second irrigation device; and

an intermediate portion disposed between the first coupler and the second coupler, the intermediate portion comprises a stop member configured to secure the engagement with said first irrigation device by gripping means connected to or provided by the first irrigation device and allowing gripping of the stop member, thereby securing the engagement.

In one or more embodiments, the first irrigation device has a tubular portion having an inner diameter that can receive the first coupler in a tight match. In one or more embodiments, the second irrigation device has a tubular portion having an inner diameter that can receive the second coupler in a tight match. In one or more embodiments, the inner

diameter of the tubular portion is substantially similar to, or slightly larger than the outer diameter of the first and/or second coupler. In one or more embodiments, the first and/or second couplers having an elongated tube-like shape.

In a further aspect, the present invention provides a connector for connecting
5 irrigation device(s), the connector comprising:

a hollowed tube extending between a first connector end and a second connector end, wherein at least the first connector end is open allowing passage therethrough of fluid,

a first portion extending from the first connector end, the first portion is shaped and sized to allow for an engagement with a tubular portion of a first irrigation device in a
10 sealed manner;

a second portion extending from the second connector end; and

an intermediate portion disposed between the first portion and the second portion, the intermediate portion comprises a stop member configured to secure the engagement with the first irrigation device.

15 In a further aspect, the present invention provides a connector for connecting irrigation device(s), the connector comprising:

a hollowed tube extending between a first connector end and a second connector end, wherein the connector ends are open, allowing passage therethrough of fluid, the tube comprises

20 a first portion extending from the first connector end, the first portion is shaped and sized to allow for an engagement with a tubular portion of a first irrigation device by insertion thereof into the tubular portion;

a second portion extending from the second connector end, the second portion is shaped and sized to allow for an engagement with a tubular portion of a second irrigation
25 device by insertion thereof into the tubular portion; and

an intermediate portion disposed between the first portion and the second portion, the intermediate portion comprises an annular flange protruding circumferentially from an outer surface of the tube and configured to secure the engagement with the first irrigation device by gripping means provided by or separately from the first irrigation device and
30 allowing gripping of the annular flange, thereby allowing the secured engagement.

In one or more embodiments, the first and the second connector ends are open.

In one or more embodiments, the tubular portion of the first irrigation device has an inner diameter that can receive the first portion of the connector.

In one or more embodiments, the inner diameter of the tubular portion is substantially similar to the outer diameter of the first portion.

5 In one or more embodiments, the inner diameter of the tubular portion is slightly larger than the outer diameter of the first portion.

In one or more embodiments, the first portion is configured to engage with the first irrigation device by an axial pushing motion and by inserting the first portion within the tubular portion of the first irrigation device.

10 In one or more embodiments, the first connector end includes a first slope declining towards the end, thereby allowing safe engagement with the tubular portion of the first irrigation device.

In one or more embodiments, the first slope defines an angle of less than about 70° between the slope and a horizontal axis of the connector.

15 In one or more embodiments, the stop member comprises an annular flange perpendicular to the tube from an external surface thereof.

In one or more embodiments, the stop member comprises an annular flange protruding circumferentially from an outer surface of the tube.

20 In one or more embodiments, the annular flange is bent to define a circumferential rim which extends towards the second connector end.

In one or more embodiments, the circumferential rim and the annular flange define an angle therebetween of about 90° .

In one or more embodiments, the circumferential rim extends towards the second connector end by about 5 mm to about 15 mm.

25 In one or more embodiments, the annular flange bends to meet the circumferential rim via a regression slope.

In one or more embodiments, the annular flange and the regression slope define an angle of at least about 90° and up to about 170° .

30 In one or more embodiments, the regression slope and the circumferential rim define an angle of at least about 90° and up to about 170° .

In one or more embodiments, the connector further comprising a hexagonal ring portion surrounding a periphery of the tube and extending from the stop member.

In one or more embodiments, the hexagonal ring portion is configured for allowing disassembly of the connector from the engagement by a wrench.

5 In one or more embodiments, the hexagonal ring portion and the stop member define an annular recess which faces the second portion.

In one or more embodiments, the first irrigation device includes gripping means allowing gripping of the stop member, thereby allowing the secured engagement.

10 In one or more embodiments, the stop member is configured to restrict the engagement with the first irrigation device to the first portion.

In one or more embodiments, the second portion is configured to allow for an engagement with a second irrigation device comprising a hollowed tubular portion.

15 In one or more embodiments, the second connector end includes a second slope declining towards the end, the declined slope allowing the engagement with the second irrigation device in a safe manner.

In one or more embodiments, the second slope defines an angle of less than about 85° between the slope and a horizontal axis of the connector.

20 In one or more embodiments, the second portion comprises a cylindrically threaded portion positioned on the exterior periphery of at least part of the second portion, the threaded portion allowing for an engagement with a complementary threaded portion present on or provided separately from the second irrigation.

25 In one or more embodiments, the second portion consists of a cylindrically threaded portion positioned on the exterior periphery of at least a portion of the second portion, the threaded portion allowing for an engagement with a complementary threaded portion present on or provided separately from the second irrigation.

In one or more embodiments, the second portion includes an elongated tubular member extending from the intermediate portion towards the second connector end, and wherein the elongated tubular member is non-threaded.

30 In one or more embodiments, the threaded portion extends from the intermediate portion and the elongated tubular member extends therefrom the threaded portion.

In one or more embodiments, the second end of the second portion is closed.

In one or more embodiments, the internal surface of the connector is smooth and non-threaded.

In one or more embodiments, the connector is manufactured as a single piece of material.

5 In one or more embodiments, the connector is manufactured from a polymeric material. In one or more embodiments, the polymeric material is polypropylene. In one or more embodiments, the engagement with the first irrigation device allows a hermetically sealed and secured connection between the connector and the first irrigation device.

10 In one or more embodiments, the engagement is stable allowing fluid passageway resisting a pressure of up to 10 atm.

In one or more embodiments, the engagement with the second irrigation device allows a hermetically sealed and secured connection between the connector and the second irrigation device. In one or more embodiments, the engagement with the second irrigation device is stable allowing fluid passageway resisting a pressure of up to 10 atm.

15 In one or more embodiments, the inner diameter of the tube is constant along the entirety the tube.

In one or more embodiments, the first portion is having a smooth cylindrical outer surface for engaging within the first irrigation device. In one or more embodiments, the second portion or a portion thereof is having a smooth cylindrical outer surface for
20 engaging within the second irrigation device.

In one or more embodiments, the inner diameter is continuously reduced towards the second end.

In one or more embodiments, the first connector end, the first portion, the intermediate portion, the second portion and the second connector end are arranged in
25 series in an axial alignment. In one or more embodiments, the first and second portions are provided for engagement with a respective first and second irrigation devices.

In one or more embodiments, the length ratio between first portion and second portion is about 1:1 to about 1:10.

30 In one or more embodiments, the length ratio between first portion and second portion is about 1:1 to about 1:5.

In one or more embodiments, the length ratio between first portion and second portion is about 1:1 to about 1:3.

In one or more embodiments, the second end of the second portion is closed allowing the connector to end an irrigation line.

5 In one or more embodiments, the stop member includes radial slots provided to secure and/or release an engagement with an irrigation device by an auxiliary tool capable of rotating the connector via the slots.

In yet another aspect, the present invention provides a connector for connecting tubular device(s), the connector comprising:

10 a hollowed tube extending between a first connector end and a second connector end, wherein at least the first connector end is open,

 a first portion extending from the first connector end, the external surface thereof is configured to allow for an engagement with a tubular portion of a first device in a sealed manner;

15 a second portion extending from the second connector end; and
an intermediate portion disposed between the first portion and the second portion, the intermediate portion comprises a stop member configured to secure the engagement with the first device.

20 In yet another aspect the invention provides a connector for connecting irrigation devices, the connector comprising:

 a hollowed tube extending between a first connector end and a second connector end, wherein the first and second connector ends are open, allowing passage therethrough of fluid,

25 a first portion extending from the first connector end, the external surface of the first portion is configured to allow for an engagement with a tubular portion of a first irrigation device;

30 a second portion extending from the second connector end, the second portion comprises a cylindrical thread positioned on the exterior periphery of at least part of the second portion and a non-threaded elongated tubular member extending from the thread and ending with the second connector end; the second portion is shaped and sized to allow for an engagement with a tubular portion of a second irrigation device via the non-threaded

elongated tubular member and to secure the engagement via the thread following screwing thereof into a complementary thread present on or provided separately from the second irrigation device; and

an intermediate portion disposed between the first portion and the second portion,
5 the intermediate portion comprises an annular flange protruding circumferentially from an outer surface of the tube, the annular flange configured to secure the engagement with the first irrigation device by gripping means provided by the first irrigation device such to allow stable gripping of the first portion via the annular flange, providing a secure engagement with the first irrigation device.

10 In yet another aspect the invention provides a connector for terminating an irrigation pipeline, the connector comprising:

a hollowed tube extending between a first connector end and a second connector end, wherein at least the first connector end is open allowing passage of fluid therethrough, wherein the tube comprises

15 a first tubular portion extending from the first connector end and having a length of above about 30 mm, the first portion is shaped and sized to allow for an engagement with a tubular portion of a first irrigation device in a sealed manner;

a second tubular portion extending from the second connector end; and

an intermediate portion disposed between the first portion and the second portion,
20 the intermediate portion comprises an annular flange protruding circumferentially from an outer surface of the tube and defining a recess facing the second portion, the annular flange configured to secure the engagement with the first irrigation device by gripping means, such to allow stable gripping of the annular flange via the recess, thereby providing the secured engagement.

25 In yet another aspect the invention provides a connector for terminating an irrigation pipeline, the connector comprising:

a hollowed tube extending between a first connector end and a second connector end, wherein the first connector end is open and the second connector end is closed allowing the irrigation pipeline termination;

a first elongated tubular portion extending from the first connector end and having a length of above about 30 mm, the first portion is shaped and sized to allow for an engagement with a tubular portion of a first irrigation device in a sealed manner;

a second elongated tubular portion extending from the second connector end; and
5 an intermediate portion disposed between the first portion and the second portion, the intermediate portion comprises an annular flange protruding circumferentially from an outer surface of the tube and defining a recess facing the second portion, the annular flange configured to secure the engagement with the first irrigation device by gripping means provided by or separately from the first irrigation device such to allow stable gripping of
10 the annular flange via the recess, thereby providing the secured engagement.

In yet another aspect the invention provides a method for secure and stable connection of irrigation devices, the method comprising

providing a connector having a first tube portion, a second tube portion and an intermediate portion;

15 inserting the first tube portion into a first irrigation device; and
inserting the second tube portion into a second irrigation device; thereby stably connecting the connector to the irrigation devices.

In yet another aspect the invention provides a method of secure and stable connection of irrigation devices, the method comprising

20 providing a connector having a first portion, a second portion and an intermediate portion; wherein the first portion includes a tubular member and wherein the second portion includes a cylindrical thread positioned on the exterior periphery of at least part of the second portion, and a non-threaded elongated tubular member extending from the thread;

inserting the first portion into a tubular portion of a first irrigation device;
25 securing the connection of the first portion and first irrigation device by gripping an annular flange of the first portion via gripping arms;

inserting the second portion into a tubular portion of a second irrigation device;
securing the connection of the second portion and second irrigation device by
screwing a nut over the thread;

30 thereby stably connecting the connector to the irrigation devices.

In one or more embodiments, the step of inserting the second portion into a tubular portion of a second irrigation device occurs prior to the step of inserting the first portion into a first irrigation device.

5 In one or more embodiments, the step of inserting includes axially pushing the tubular portion of the connector into a tubular portion of the irrigation device.

In one or more embodiments, the method comprising inserting above about 30 mm of the first portion of the connector into the first irrigation device. In one or more embodiments, the method comprising inserting above about 30 mm of the second portion of the connector into the second irrigation device.

10 In one or more embodiments, the method further comprising securing the engagement between the first tube portion and the first irrigation device by gripping an annular flange of the first portion via gripping arms.

In one or more embodiments, the second tube portion includes a cylindrical thread positioned on the exterior periphery of at least part of the second portion and wherein the
15 method further comprises securing and strengthening the connection of the connector to the second irrigation device by screwing a securing member over the thread. In one or more embodiments, the securing member is a nut.

In one or more embodiments, the method further comprising strengthening the connection of the connector to the second irrigation device by a screw driver.

20 Unless otherwise defined, all technical or/and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the invention pertains. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of embodiments of the invention, exemplary methods or/and materials are described below. In case of conflict, the patent
25 specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and are not intended to be necessarily limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

Some embodiments of the invention are herein described, by way of example only,
30 with reference to the accompanying drawings. With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes

of illustrative discussion of embodiments of the invention. In this regard, the description taken with the drawings makes apparent to those skilled in the art how embodiments of the invention may be practiced.

In the drawings:

5 FIG. 1 is a perspective view of an exemplary tubular connector that includes a first portion extending from a first opened end and a second portion extending from a second closed end, according to some embodiments of the invention;

 FIG. 2 is yet another perspective view of an exemplary connector that includes a first portion extending from a first opened end and a second portion extending from a second closed end, according to some embodiments of the invention;

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 FIG. 3 is a side view of an exemplary connector that includes a first portion extending from a first opened end and a second portion extending from a second closed end, according to some embodiments of the invention;

 FIG. 4 is yet another side view of an exemplary connector that includes a first portion extending from a first opened end and a second portion extending from a second closed end, according to some embodiments of the invention;

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 FIG. 5 is a cross section view of an exemplary connector that includes a first portion extending from a first opened end and a second portion extending from a second closed end, according to some embodiments of the invention;

20 FIG. 6 is a top view of an exemplary connector that includes a first portion extending from a first opened end and a second portion extending from a second closed end, according to some embodiments of the invention;

 FIG. 7 is a bottom view of an exemplary connector that includes a first portion extending from a first opened end and a second portion extending from a second closed end, according to some embodiments of the invention;

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 FIG. 8 is a perspective view of an exemplary connector that includes a first portion extending from a first opened end and a second threaded portion extending from a second opened end, according to some embodiments of the invention;

 FIG. 9 is yet another perspective view of an exemplary connector that includes a first portion extending from a first opened end and a second threaded portion extending from a second opened end, according to some embodiments of the invention;

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FIG. 10 is a side view of an exemplary connector that includes a first portion extending from a first opened end and a second threaded portion extending from a second opened end, according to some embodiments of the invention;

5 FIG. 11 is yet another side view of an exemplary connector that includes a first portion extending from a first opened end and a second threaded portion extending from a second opened end, according to some embodiments of the invention;

FIG. 12 is a cross section view of an exemplary connector that includes a first portion extending from a first opened end and a second threaded portion extending from a second opened end, according to some embodiments of the invention;

10 FIG. 13 is a top view of an exemplary connector that includes a first portion extending from a first opened end and a second threaded portion extending from a second opened end, according to some embodiments of the invention;

FIG. 14 is a bottom view of an exemplary connector that includes a first portion extending from a first opened end and a second threaded portion extending from a second opened end, according to some embodiments of the invention;

FIG. 15 is a perspective view of an exemplary connector that includes a first portion extending from a first opened end and a second partially threaded portion extending from a second opened end, according to some embodiments of the invention;

20 FIG. 16 is a yet another perspective view of an exemplary connector that includes a first portion extending from a first opened end and a second partially threaded portion extending from a second opened end, according to some embodiments of the invention;

FIG. 17 is a side view of an exemplary connector that includes a first portion extending from a first opened end and a second partially threaded portion extending from a second opened end, according to some embodiments of the invention;

25 FIG. 18 is yet another side view of an exemplary connector that includes a first portion extending from a first opened end and a second partially threaded portion extending from a second opened end, according to some embodiments of the invention;

FIG. 19 is a cross section view of an exemplary connector that includes a first portion extending from a first opened end and a second partially threaded portion extending from a second opened end, according to some embodiments of the invention;

FIG. 20 is a top view of an exemplary connector that includes a first portion extending from a first opened end and a second partially threaded portion extending from a second opened end, according to some embodiments of the invention;

FIG. 21 is a bottom view of an exemplary connector that includes a first portion
5 extending from a first opened end and a second partially threaded portion extending from a second opened end, according to some embodiments of the invention;

FIGs. 22A – 22B show steps of an engagement between an exemplary connector that includes at least a first opened end and an irrigation device that includes a tubular hollowed portion, according to some embodiments of the invention;

10 FIG. 23 is a perspective view of an exemplary connector that includes a first and a second portions and radial slots for securing an engagement with an irrigation device, according to some embodiments of the invention;

FIG. 24 is yet a further perspective view of an exemplary connector that includes a first and a second portions and radial slots, according to some embodiments of the
15 invention;

FIG. 25 is a side view of the connector of FIGs. 23-24, according to some embodiments of the invention;

FIG. 26 is yet another side view of the connector of FIGs. 23-24, according to some embodiments of the invention;

20 FIG. 27 is a cross section view of the connector of FIGs. 23-26, according to some embodiments of the invention;

FIG. 28 is a top view of the connector of FIGs. 23-27, according to some embodiments of the invention;

FIG. 29 is a bottom view of the connector of FIGs. 23-28, according to some
25 embodiments of the invention;

FIG. 30 shows an engagement of the connector of FIGs. 23-29 with a pipe nut, according to some embodiments of the invention;

FIG. 31 is a top perspective view of yet a further exemplary connector for connecting irrigation devices, according to some embodiments of the invention;

30 FIG. 32 is a bottom perspective view of the connector of FIG. 31, according to some embodiments of the invention;

FIG. 33 is a side view of the connector of FIGs. 31-32, according to some embodiments of the invention;

FIG. 34 is yet another side view of the connector of FIGs. 31-32, according to some embodiments of the invention;

5 FIG. 35 is a cross section view of the connector of FIGs. 31-34, according to some embodiments of the invention.

It should be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements are exaggerated relative to each other for clarity. Further, where
10 considered appropriate, reference numerals have been repeated among the figures to indicate corresponding elements.

DETAILED DESCRIPTION OF THE INVENTION

It is understood that the invention is not limited to the particular methodology,
15 protocols, and reagents, etc., described herein, as these may vary as the skilled artisan will recognize. It is also to be understood that the terminology used herein is used for the purpose of describing particular embodiments only and is not intended to limit the scope of the invention. The following exemplary embodiments may be described in the context of exemplary connectors for ease of description and understanding. However, the invention
20 is not limited to the specifically described apparatus, devices and methods, and may be adapted to various applications without departing from the overall scope of the invention. All ranges disclosed herein include the endpoints. The use of the term “or” shall be construed to mean “and/or” unless the specific context indicates otherwise.

The present invention pertains to smart irrigation connectors allowing user friendly,
25 substantially sealed and stable connection between units of irrigation tools. The connectors of the invention are inventive and allow a novel connection of irrigation devices. In some embodiments, the connectors include tube-like coupling members or portions that can be introduced within pipes or tubular portions of irrigation devices. Such unique and novel connection affords stability and resistance to high fluid flow pressures.

30 An aspect of the invention pertains to connectors that include a first coupler configured to allow insertion or coupling thereof within a first device, and a second coupler

that affords connection with a second irrigation device. Another aspect of the invention pertains to connectors that include a first coupler configured to allow insertion or coupling thereof within a first device, and a second element or portion that presents a pipe end. In one or more embodiments, the first coupler includes a hollowed tube. In one or more
5 embodiments, the second coupler includes a hollowed tube. In one or more embodiments, the first and second couplers include a hollowed tube. In one or more embodiments, the hollowed tube is elongated having a length of 30 mm or more. In one or more embodiments, the connectors include a first hollowed tubular portion configured to allow insertion or coupling thereof within a first device, being a pipe or other irrigation device having a
10 hollowed tubular portion, and a second portion that affords connection with a second irrigation device or that presents a pipe end. The second portion of the connectors may include a thread and/or a tubular member (optionally elongated tubular member). The connectors further include an intermediate portion comprising a stop member that inter alia serves as the holding member of gripping arms provided by the first irrigation device. The
15 intermediate portion allows the secure, and/or sealed and/or stable engagement with the first irrigation device. In an embodiment of the invention, the stop member securely engages the first portion of the connector to the first device such that the engagement is resistant to forces exerted by the pressured fluid. In one or more embodiments, the connectors resist a pressure of up to 10 atm.

20 Yet another aspect of the invention pertains to pipe assembly or pipe line that includes a connector as herein disclosed and one or more irrigation devices. Optionally, the irrigation device(s)/pipe assembly include(s) one or more of a securing member, such as, clamps or gripping arms that can hold the connector or a portion thereof, and/or a nut that can strengthen and secure a connection with the connector via a thread.

25 Thus, the herein disclosed invention pertains to connectors for connecting irrigation device(s), the connectors comprising:

 a hollowed tube extending between a first connector end and a second connector end, wherein at least the first connector end is open allowing passage therethrough of fluid,

 a first portion extending from the first connector end, the external surface thereof
30 is configured to allow for an engagement with a tubular portion of a first device;

 a second portion extending from the second connector end; and

an intermediate portion positioned between the first and second portions, the intermediate portion comprising a stop member, wherein the stop member is configured to allow for a secure engagement with the first device.

As used herein the term "first portion" is interchangeable with the terms "first coupling member", "first coupler" and/or "first stabilizer". The first portion is configured to allow an engagement with a first device, optionally an irrigation device. In one or more embodiments, the first portion has a tube-like or tubular structure that can be introduced into a tubular portion of the first device. In one or more embodiments, the first portion is elongated, i.e., it includes a length of at least about 30 mm, allowing a stable connection between the first portion and the first device due to an elongated length of engagement, even under high fluid flow pressures. In one or more embodiments, the first portion configured to be inserted to a first device under great friction or tight-fit connection, allowing a sealed engagement.

As used herein the term "second portion" is interchangeable with the terms "second coupling member", "second coupler" and/or "second stabilizer". In one or more embodiments, the second portion is configured to allow an engagement with a second device, optionally an irrigation device. In one or more embodiments, the second portion includes a tube-like or tubular structure that can be introduced into a tubular portion of the second device. In one or more embodiments, the second portion is elongated, i.e., it includes a length of at least about 30 mm, allowing a stable connection between the second portion and the second device, even under high fluid flow pressures. In one or more embodiments, the second portion configured to be inserted to a second device under great friction or tight-fit connection, allowing a sealed engagement. In one or more embodiments, the second portion includes a closed end, allowing termination of a pipeline. In one or more embodiments, the second portion induces an outer thread for securing a connection with the second device by screwing a securing member (e.g., a nut) over the thread. In one or more embodiments, the second portion includes an elongated tubular member extending from the thread, allowing insertion of the tubular member into a second device and further securing a connection with the second device by screwing a nut over the thread.

As used herein the term "first device" includes any element, unit, or article with which the first portion of the herein disclosed connectors may be engaged. In one or more embodiments, the first device includes a hollowed and/or a tubular and/or an open-ended portion. In one or more embodiments, the first device is configured to allow an engagement
5 with the first connector portion by an insertion of the latter within the tubular portion of the first device. Optionally, the first device is configured to allow an engagement with the first connector portion by an insertion of the tubular portion of the first device into a first portion of the connector. In one or more embodiments, the first device is a device used for agriculture purposes, such as an irrigation device. Optionally, the first device includes a
10 securing member, such as gripping arms capable of holding the connector, or a portion thereof.

In one or more embodiments, the engagement or insertion of first portion of the herein disclosed connectors allows a substantially sealed/tight connection with no or minimal leakage of fluids. In one or more embodiments, the engagement allows a
15 connection that is more stable and resistant to higher pressure forces than current used technologies. In one or more embodiments, the engagement between first portion and first device is stable allowing fluid passageway resisting a pressure of up to about 10 atm. In one or more embodiments, the engagement between first portion and first device allows pressure resistance of up to 9 atm. For example, up to 8 atm, up to 7 atm, up to 6 atm, up
20 to 5 atm, or up to 4 atm. In one or more embodiments, the engagement between first portion and first device is stable allowing fluid passageway resisting a pressure of at least about 1 atm. In one or more embodiments, the engagement between first portion and first device allows pressure resistance of at least about 2.5 atm. For example, at least about 1 atm, at least about 1.5 atm, at least about 2 atm, at least about 2.5 atm, at least about 3 atm, at least
25 about 4 atm, at least about 5 atm, at least about 6 atm, at least about 7 atm, at least about 8 atm, at least about 9, or at least about 10 atm. In one or more embodiments, pressure resistance was measured using a manometer having 2.5 inch with a 0.25-inch screwing.

As used herein the term "second device" includes any element, unit, or article with which the second portion of the herein disclosed connectors may be engaged. The second
30 device may be engaged with second portion of the herein disclosed connectors by any suitable means or engagement mechanisms. For example, the engagement with the second

device may be made by screwing, and/or by inserting a tubular element of the second portion within a tubular second device and/or a tubular portion of the second device. In one or more embodiments, the second device includes a hollowed and/or a tubular and/or an open-ended portion. Optionally, the second device is configured to allow an engagement
5 with the second connector portion by an insertion of the tubular portion of the second device into a second portion of the connector. Optionally, the second device includes a securing member, such as gripping arms, or a nut that can be threaded over a thread of the connector, allowing a secure connection between the connector and the second device.

In one or more embodiments, the engagement or insertion of second portion of the
10 herein disclosed connectors allows a substantially sealed connection with no or minimal leakage of fluids. In one or more embodiments, the engagement allows a connection that is more stable and resistant to higher pressure forces than current used technologies. In one or more embodiments, the engagement between second portion and second device is stable allowing fluid passageway resisting a pressure of up to 10 atm. In one or more
15 embodiments, the engagement between second portion and second device allows pressure resistance of up to 9 atm. For example, up to 8 atm, up to 7 atm, up to 6 atm, up to 5 atm, or up to 4 atm. In one or more embodiments, the second device is a device used for agriculture purposes, for example, an irrigation device.

The herein disclosed connectors advantageously afford water saving, increased
20 efficiency and usage simplicity.

In one or more embodiments, the herein disclosed connectors are manufactured as a single piece of material. The material used for manufacturing the connectors of the invention may be variable. In one or more embodiments, the material used to manufacture the connectors comprise a polymeric material. Various types of polymeric materials are
25 suitable, for example, the polymeric material may be polypropylene.

In one or more embodiments, the inner diameter of the herein disclosed connectors may be substantially constant along the entire length thereof. In an embodiment of the invention, the inner diameter may be variable presenting a reduced diameter towards first connector end or towards second connector end. The diameter in accordance with this
30 embodiment, is continuously reduced along the length of the connectors towards first connector end or towards second connector end. The diameter in accordance with this

embodiment, may be reduced along the length of the connectors towards first connector end or towards second connector end by up to about 30%. For example, up to about 25% or up to about 20%, up to about 15%, or up to about 10%. The inner diameter may thus present a conical shape with a cut-off end being first connector end or second connector
5 end. In an exemplary embodiment, the inner diameter is reduced towards second end. In an exemplary embodiment, the inner diameter may be about 30 mm to about 90 mm. For example, about 40 mm to about 80 mm, about 40 mm to about 70 mm, about 40 mm to about 60 mm, or about 30 mm to about 60 mm. In one exemplary embodiment, the inner diameter may be about 48 mm, or about 50 mm, or about 55 mm.

10 In one or more embodiments, the outer diameter of first portion is substantially similar, or similar to the outer diameter of second portion. In one or more embodiments, the outer diameter of the herein disclosed connectors may be substantially constant along the entire length thereof. In an embodiment of the invention, the outer diameter may be variable presenting a reduced diameter towards first connector end or towards second
15 connector end. The diameter in accordance with this embodiment, is continuously reduced along the length of the connectors towards first connector end or towards second connector end.

In an exemplary embodiment, the outer diameter may be about 30 mm to about 100 mm. For example, about 40 mm to about 90 mm, about 40 mm to about 80 mm, about 40
20 mm to about 70 mm, about 40 mm to about 60 mm, or about 30 mm to about 60 mm. In an exemplary embodiment, the outer diameter of the tube may be about 50 mm, or about 55 mm.

In an embodiment of the invention, first portion may have a length of about 30 mm to about 70 mm. For example, about 30 mm to about 60 mm, about 40 mm to about 55
25 mm, or about 45 mm to about 55 mm. In an embodiment of the invention, first portion has a length of about 50 mm. In an embodiment of the invention, first portion has a length of at least, or above about 30 mm. In an embodiment of the invention, first portion has a length of at least, or above about 35 mm, or at least, or above about 40, or at least, or above about 45 mm, or at least, or above about 50 mm.

In one or more embodiment, first portion of the herein disclosed connectors includes a first slope which declines towards first connector end. First slope allows the coupling of the first portion and engagement thereof with a first irrigation device.

5 In one or more embodiment, second portion of the herein disclosed connectors includes a second slope which declines towards second connector end. Second slope allows the coupling of the second portion and engagement thereof with a second irrigation device.

The enabled engagement or coupling is thus safe preventing possible damages for the inner portion of the irrigation device(s). In one or more embodiments, the safe engagement means that no damage is caused to the irrigation device with which the herein
10 disclosed connector is engaged with. For example, in cases where the irrigation device(s) include(s) seals (such as an O-ring) at the internal surface thereof, the slope prevents possible damages, such as dislocations and ruptures to the seals.

In one or more embodiments, the declined first and/or second slopes define(s) an angle of less than about 85° between the slope and a horizontal axis of the connector. For
15 example, the angle is less than about 80°. For example, the angle is between about 20° and about 80°, between about 30° and about 70°, between about 30° and about 50°, or between about 40° and about 60°.

In one or more embodiments, the slope has a length of about 3 mm to about 10. For example, about 4 mm to about 8 mm, or about 5 mm to about 7 mm.

20 In one or more embodiments, the herein disclosed connectors include an intermediate portion positioned between first portion and second portion. In one or more embodiments, the intermediate portion that includes a stop member. In one or more embodiment, the stop member is configured to allow for a secure engagement with the first irrigation device via gripping arms. In one or more embodiments, the stop member is
25 configured to restrict the engagement with the first irrigation device to the first portion.

The herein disclosed connectors thus allow an engagement between pipelines, pipeline tools, or pipes or portions thereof by insertion of the first and/or second portion(s) of the connectors to the pipelines, pipeline tools, or pipes and/or portions thereof. The obtained engagement between the herein disclosed connectors and pipelines/pipeline
30 tools/pipes and/or portions thereof may be secured by securing members, such as gripping arms and/or a nut.

Referring now to the drawings, FIGs. 1-2 which are perspective views, FIGs. 3-4 which are side views, FIG. 5 which is a cross section view and FIGs. 6 and 7 which are top and bottom views, respectively, present an exemplary connector 10 of the invention.

5 The connector 10 includes a hollowed longitudinal tube 12 extending between a first connector end 14 and a second connector end 16. First connector end 14 is open allowing passage therethrough of irrigation water or any other type of liquid. Second connector end 16 is closed allowing the connector to be used as an irrigation end of line or line-end, or pipe end.

Connector 10 is thus usable for capping or ending or terminating an irrigation line.
10 Connector 10 includes a first portion 18, a second portion 20 and an intermediate portion 21. First portion 18 extending between first connector end 14 and intermediate portion 21 and configured for an engagement with a tubular portion of an irrigation device in a sealed manner, and a second portion 20 extending between second connector end 16 and intermediate portion 21 and configured to allow end of flow of the irrigation line. Second
15 portion 20 is further optionally configured to allow drainage of irrigation water and/or drainage of waste of irrigation water. Such an arrangement and configuration of the connector 10 allows an improved flow of the irrigation system and prevention of blockages within the irrigation pipes. Further, the particular configuration of the connector provides stability of the entire pipe system.

20 In one or more embodiments, second portion 20 is non-threaded. In one or more embodiments, second portion 20 is shaped as an elongated tubular member which includes a closed connector second end 16.

The external surface of first portion 18 is configured to allow for an engagement with a first irrigation device, which may be, for example, a sprinkler or a connector thereof
25 or a pipe or any of the alike. The external surface of first portion 18 is configured to allow for an engagement with a first irrigation device by an axial push motion, allowing a friction match or tight fit connection between first portion and first irrigation device. Connector 10 further includes an intermediate portion 21 positioned between first portion 18 and second portion 20 that includes a stop member 22. As will be explained in greater detail below,
30 stop member 22 is configured to allow for a secure engagement with the irrigation device.

In one or more embodiments, second portion 20 may, but not necessarily, further include a collar 17 surrounding tube 12 from an external surface thereof.

First portion 18 includes slope 24 starting from a position adjacent first connector end 14 and which declines towards first end 14. Slope 24 allows the insertion of the first portion 18 and engagement thereof with a first irrigation device. The insertion via slope 24 is smooth and prevents possible damages for the inner portion of first irrigation device. For example, in cases where first irrigation device includes seals/gaskets (such as an O-ring) at the internal surface thereof, the slope 24 prevents damages, such as dislocations and ruptures to the seals/gaskets.

Slope 24 defines an angle α of up to about 85° between slope 24 and a horizontal axis X of connector 10 (shown in FIG. 5). In one or more embodiments, slope 24 defines an angle α of up to about 70° between slope 24 and a horizontal axis X of connector 10. For example, angle α is about 20° to about 70° , about 30° to about 60° , or about 40° to about 55° .

Stop member 22 includes an outer annular flange 29 which is perpendicular to tube 12 from an external surface thereof. Annular flange 29 is bent to define a circumferential rim 27 which extends towards second connector end 16. Circumferential rim 27 extends toward second connector end 16 to define an angle of about 90° between annular flange 29 and circumferential rim 27. Circumferential rim 27 continuously bends from annular flange 29, via regression slope 25. Circumferential rim 27 extends towards second connector end 16 by about 5 mm to about 15 mm. For example, circumferential rim 27 extends towards second connector end 16 by about 8 mm or about 10 mm.

Intermediate portion 21 further comprises a hexagonal ring portion 26 surrounding a periphery of tube 12 from an external surface thereof and extending from stop member 22.

Hexagonal ring portion 26 is configured for allowing disassembly of connector 10 from an engagement with an irrigation device. For example, the disassembly may be conducted by a wrench, or by any suitable tool.

Stop member 22 and hexagonal ring portion 26 may define an annular recess 28, such that hexagonal ring portion extends from annular recess 28 (shown in FIGs. 2, 5 and 7).

In one or more embodiments, second portion 20 may have a length of about 100 mm to about 200 mm. For example, about 120 mm to about 180 mm, about 140 mm to about 160 mm, or about 145 mm to about 155 mm. In an exemplary embodiment of the invention, second portion has a length of about 150 mm. In an exemplary embodiment, second portion has a length of about 166 mm. In an exemplary embodiment, second portion is elongated. In an exemplary embodiment, second portion has a length of above about or at least about 40 mm, or 50 mm, or above about or at least about 55 mm, or above about or at least about 60 mm, or above about or at least about 65 mm, or above about or at least about 70 mm, or above about or at least about 75 mm, or above about or at least about 80 mm, or above about or at least about 90 mm, or above about or at least about 100 mm. In one or more embodiments, the length ratio between first portion and second portion is about 1:10 to about 10:1. For example, about 1:5 to about 5:1, about 1:1 to about 1:10, about 1:1 to about 1:5, about 1:1 to about 1:4, or about 1:1 to about 1:3. In an exemplary embodiment, the length ratio between the first portion and the second portion is about 1:3. In an exemplary embodiment, the length ratio between the first portion and the second portion is about 1:3.3. In an exemplary embodiment, the ratio between the first portion and the second portion is at least about 1:2.5, or at least about 1:3. In one or more embodiment, the outer diameter of stop member 22 is about 50 mm to about 100 mm. For example, about 70 mm to about 90 mm, or about 80 mm.

Reference is now made to FIG. 5 which shows a cross section of the herein disclosed connector 10. The internal surface 19 of connector 10 is smooth and non-threaded. Annular recess 28 is defined between stop member 22 and hexagonal ring portion 26. An α angle of up to about 80° is present between slope 24 and horizontal axis X of connector 10. An angle β is present between annular flange 29 and regression slope 25. Angle β may be more than about 90° and up to about 170° . An angle γ is present between regression slope 25 and circumferential rim 27. Angle γ may be more than about 90° and up to about 170° .

Reference is now made to FIGs. 8 -9 which are perspective views, FIGs. 10-11 which are side views, FIG. 12 which is a cross section view and FIGs. 13 -14 which are top view and bottom view, respectively, presenting a further exemplary connector 40 of the invention.

The connector 40 includes a hollowed longitudinal tube 42 extending between a first connector end 44 and a second connector end 46. First connector end 44 and second connector end 46 are open allowing passage therethrough of irrigation water or any other type of liquid. Connector 40 includes a first portion 48 which extends from first connector end 44 and configured for an engagement with a first irrigation device and a second portion 50 extending from second connector end 46 and which is cylindrically threaded on the exterior periphery of tube 42 and configured to allow an engagement with a complementary threaded portion present on or apart from a second irrigation device in mating engagement therewith. Tube 42 being hollowed continuously extending between the first connector end 44 and a second connector end 46.

The external surface of first portion 48 is configured to allow for an engagement with a first irrigation device, which may be, for example, a sprinkler or a connector, or a base thereof, or a pipe or any of the alike.

Connector 40 further includes an intermediate portion 41 positioned between first portion 48 and second portion 50. Intermediate portion 41 comprising a stop member 52. As will be explained in greater detail below, stop member 52 is configured to allow for a secure engagement with first irrigation device, in a stable and sealed manner. The engagement/connection between connector 40 and a first and a second irrigation devices is facilitated by the insertion of first portion 48 into a tubular portion of a first irrigation device and insertion of a tubular portion of a second irrigation device into second portion 50. The connection with first irrigation device can be secured by a securing member, e.g., clamps, provided by or separately from first irrigation device, which can hold intermediate portion 41. The connection with second irrigation device can be secured by a securing member, e.g., a nut, provided by or separately from second irrigation device, which can be threaded onto the outer thread of second portion 50.

First portion 48 includes a slope 54 which declines towards first end 44. Declined slope 54 allows the insertion of the first portion 48 and engagement thereof in a sealed manner with a first irrigation device. Declined slope 54 defines an angle of up to about 80° between slope 54 and a horizontal axis X of connector 40.

Stop member 52 includes an annular flange 59 which is perpendicular to tube 42 from an external surface thereof. Annular flange 59 is bent to define a circumferential rim

57 which extends towards second connector end 46. Circumferential rim 57 extends towards second connector end 46 to define an angle of about 90° between annular flange 59 and circumferential rim 57. Annular flange 59 extends continuously to meet circumferential rim 57 via regression slope 55. Circumferential rim 57 extends towards second connector end 46 by about 8 mm. Circumferential rim 57 is substantially parallel to tube 42. An α angle of up to about 80° is present between slope 55 and a horizontal axis X of connector 40. An angle β is present between annular flange 59 and regression slope 55. Angle β may be more than about 90° and up to about 170° . An angle γ is present between regression slope 55 and circumferential rim 57. Angle γ may be more than about 90° and up to about 170° .

Intermediate portion 41 further comprises a hexagonal ring portion 56 surrounding a periphery of tube 42 from an external surface thereof and extending from stop member 52.

Hexagonal ring portion 56 is configured for allowing disassembly of connector 40 from an engagement with an irrigation device. For example, the disassembly may be conducted by a wrench, or by any suitable tool.

Stop member 52 and hexagonal ring portion 56 may optionally define annular recess 58, such that hexagonal ring portion 56 extends from annular recess 58 (shown in FIG. 12).

In one or more embodiments, the inner diameter of tube 42 may be substantially constant along the entire length thereof. In an embodiment of the invention, the inner diameter may be variable presenting a reduced diameter towards first end 44 or towards second end 46. In an exemplary embodiment, the outer diameter may be substantially constant along the entire length thereof. In an embodiment of the invention, the outer diameter may be variable presenting a reduced diameter towards first end 44 or towards second end 46.

In one or more embodiments, first and/or second portion may have a length of about 10 mm to about 90 mm. For example, 10 mm to about 80 mm, 10 mm to about 70 mm, about 10 mm to about 50 mm, about 10 mm to about 40 mm, or about 15 mm to about 35 mm, or about 30 mm to about 80 mm, or about 35 mm to about 80 mm, 30 mm to about 70 mm about, 30 mm to about 50 mm, or about 30 mm to about 40 mm. In an embodiment of

the invention, first portion has a length of above about 30 mm, or above about 35 mm, or above about 40 mm. In an embodiment of the invention, first portion has a length of about 50 mm. In an embodiment of the invention, second portion has a length of about 25 mm. In one or more embodiments, the length ratio between first portion and second portion is about 1:10 to about 10:1. For example, about 1:5 to about 5:1, about 10:1 to about 1:1, about 5:1 to about 1:1, about 4:1 to about 1:1, or about 3:1 to about 1:1. In an exemplary embodiment, the length ratio between the first portion and the second portion is about 2:1. In one or more embodiment, the outer diameter of stop member 52 is about 50 mm to about 100 mm. For example, about 70 mm to about 90 mm, or about 80 mm.

Reference is now made to FIG. 12 which shows a cross section of the herein disclosed connector 40. The internal surface 49 of connector 40 is smooth and non-threaded.

Reference is now made to FIGs. 15 -16 which are perspective views, FIGs. 17-18 which are side views, FIG. 19 which is a cut view, FIG. 20 which is a top view and FIG. 21 which is a bottom view presenting a further exemplary connector 60.

The connector 60 includes a hollowed longitudinal tube 62 extending between a first connector end 64 and a second connector end 66. First connector end 64 and second connector end 66 are open allowing passage therethrough of irrigation water or any other type of liquid.

Connector 60 includes a first portion 68 which extends from first connector end 64 and configured for an engagement with a first irrigation device in a friction match and a second portion 70 extending from second connector end 66 and which is configured to allow an engagement with a second irrigation device in mating engagement therewith. Tube 62 being hollowed continuously extending between the first connector end 64 and a second connector end 66.

The external surface of first portion 68 is configured to allow for an engagement with a first irrigation device, which may be, for example, a sprinkler or a connector thereof or a pipe or any of the alike.

Second portion 70 is partially threaded and includes a cylindrically threaded portion 80 on the exterior periphery of tube 62 configured to allow a secure engagement with a complementary threaded portion present on a second irrigation device, or on a part thereof,

or on a subsequent tool that assists in the engagement to the second irrigation device, in mating engagement therewith. Second portion 70 further includes an elongated tubular member 82 which provides stability and affords resistance to greater pressure. In one or more embodiments, elongated tubular member 82 is an extension of tube 62 and part thereof. Elongated tubular member 82 may be inserted within a tubular portion of the second irrigation device in a sealed engagement. Cylindrically threaded portion 80 may secure the engagement of elongated tubular member 82 with the second device. Second portion 70 may thus allow for an engagement in a sealed and secure manner with a second irrigation device which may be a pipe or a part thereof.

Connector 60 further includes an intermediate portion 71 positioned between first portion 68 and second portion 70 that includes a stop member 72. Stop member 72 is similar to stop member 22 of connector 10 and stop member 52 of connector 40 and configured to allow for a secure engagement with first irrigation device. Stop member 72 protrudes from an outer periphery of the hollowed tube and is configured to restrict an engagement with a first irrigation device to first portion 68.

First portion 68 includes a first slope 74 which declines towards first end 64. Declined first slope 74 allows the insertion of the first portion 68 and engagement thereof with a first irrigation device. Declined first slope 74 defines a first angle α of up to about 85° between first slope 74 and a horizontal axis X of connector 60. Second portion 70 includes a second slope 84 which declines towards second end 66. Declined second slope 84 allows the insertion of the second portion 70 and engagement thereof with a second irrigation device. Declined second slope 84 defines a second angle α of up to about 85° between second slope 74 and a horizontal axis X of connector 60.

Stop member 72 includes an annular flange 79 which is perpendicular to tube 62 from an external surface thereof. Annular flange 79 is bent to define a circumferential rim 77 which extends towards second connector end 66. Circumferential rim 77 extends toward second connector end to define an angle of about 90° between annular flange 79 and circumferential rim 77. Annular flange 79 continuously bends to meet circumferential rim 77 via regression slope 75. Circumferential rim 77 extends towards second connector end by about 10 mm.

An angle β is present between annular flange 79 and regression slope 75. Angle β may be more than about 90° and up to about 170°. An angle γ is present between regression slope 75 and circumferential rim 77. Angle γ may be more than about 90° and up to about 170°.

5 Connector 60 may optionally further comprise a hexagonal ring portion 76 surrounding a periphery of tube 62 from an external surface thereof and extending from stop member 72.

 Intermediate portion 71 may or may not further comprise a hexagonal ring portion 76 configured for allowing disassembly of connector 60 from an engagement with an
10 irrigation device. For example, the disassembly may be conducted by a wrench, or by any suitable tool.

 Stop member 72 and hexagonal ring portion 76 may define an annular recess 78, such that hexagonal ring portion extends from annular recess (shown in FIGs. 15, 19, and 21).

15 In an exemplary embodiment, connector 60 is configured to engage with a first irrigation device being, for example, an irrigation device that includes a tubular portion, such as a pipe via insertion of first portion 68 into the tubular portion of first irrigation device. The engagement is stable and sealed. Second portion 70 allows for example, an engagement with a pipe such that elongated tubular member 82 may be engaged in a sealed
20 manner with the pipe. Cylindrically threaded portion 80 is suitable for strengthening the engagement with the second device or pipe and allows, for example, screwing a nut over the engagement thereby further stabilizing the engagement with the second irrigation device.

 In one or more embodiments, the inner diameter of tube 62 may be substantially
25 constant along the entire length thereof. In an embodiment of the invention, the inner diameter may be variable presenting a reduced diameter towards first end 64 or towards second end 66. The diameter in accordance with this embodiment, is continuously reduced along the length of tube 62 towards first end 64 or towards second end 66. The inner diameter may thus present a conical shape with a cut off end. The inner diameter may
30 present a substantially cylindrical shape. In an exemplary embodiment, the inner diameter is reduced towards second end 66. In an exemplary embodiment, the inner diameter may

be about 40 mm to about 60 mm, or about 40 mm to about 55 mm, or about 40 mm to about 50 mm. In one exemplary embodiment, the inner diameter of tube 62 may be about 44 mm, or about 45.5 mm. In one or more embodiments, the outer diameter of first portion 68 is substantially similar or similar to the outer diameter of second portion 70. In one or more
5 embodiments, the outer diameter of tube 62 may be substantially constant along the entire length thereof. In an embodiment of the invention, the outer diameter may be variable presenting a reduced diameter towards first end 64 or towards second end 66. The diameter in accordance with this embodiment, is continuously reduced along the length of tube 62 towards first end 64 or towards second end 66.

10 In an exemplary embodiment, the outer diameter may be about 30 mm to about 100 mm. For example, about 30 mm to about 90 mm, about 40 mm to about 80 mm, or about 40 mm to about 60 mm. In an exemplary embodiment, the outer diameter of tube 62 may be about 50 mm. In an embodiment of the invention, first portion may have a length of about 20 mm to about 70 mm. For example, about 30 mm to about 60 mm, about 40 mm
15 to about 55 mm, or about 45 mm to about 55 mm. In an embodiment of the invention, first portion has a length of above about 30 mm, or above about 35 mm, or above about 40 mm, or above about 45 mm, or above about 50 mm. In an embodiment of the invention, first portion has a length of about 50 mm. In one or more embodiments, second portion may have a length of about 50 mm to about 200 mm. For example, about 60 mm to about 180
20 mm, about 80 mm to about 170 mm, or about 100 mm to about 160 mm. In an embodiment of the invention, second portion has a length of about 155 mm.

In one or more embodiments, the length ratio between first portion and second portion is about 1:10 to about 10:1. For example, about 1:5 to about 5:1, about 1:1 to about 1:10, about 1:1 to about 1:5, about 1:1 to about 1:4, or about 1:1 to about 1:3. In an
25 exemplary embodiment, the ratio between the first portion and the second portion is about 1:3. In one or more embodiment, the outer diameter of stop member 52 is about 50 mm to about 100 mm. For example, about 70 mm to about 90 mm, or about 80 mm.

Reference is now made to FIG. 19 which shows a cross section of the herein disclosed connector 60. The internal surface 89 of connector 60 is smooth and non-
30 threaded.

Referring now to FIGs. 22A – 22B, the herein disclosed connector 40 is shown when in an engagement with a first irrigation device 30 which may be a sprinkler or a sprinkler's stabilizer. The engagement is shown with respect to connector 40, but the herein disclosed engagement is contemplated with any of the herein disclosed connectors. First irrigation device 30 includes an opened tubular portion 32 having an inner diameter 36 that can receive an outer diameter of first portion 48 of connector 40. First portion 48 is configured to engage with opened tubular portion 32 of first irrigation device 30 by an axial pushing motion and by placing first portion 48 within opened tubular portion 32. The engagement between the connector 40 and first irrigation device 30 is secured and hermetically sealed. The inner diameter 36 of tubular portion is substantially similar to or slightly larger than the outer diameter of the first portion 48. That is, the outer diameter of first portion 48 is substantially similar to, or slightly smaller than the inner diameter 36 of the tubular portion 32. Such diameters allow a tight fit and substantially sealed connection between the first portion 48 of connector 40 and first irrigation device 30. In one or more embodiments, the inner diameter 36 of tubular portion 32 is slightly wider than the outer diameter of the first portion 48. Stop member 52 is configured to secure the engagement between the first portion 48 and the irrigation device, forming a sealed connection between the connector 40 and the irrigation device 30. The engagement with first irrigation device 30 allows a hermetically sealed connection between the connector 40 and first irrigation device 30. The engagement established is stable allowing fluid passageway resisting a pressure of up to 10 atm. In one or more embodiments, first portion 48 is having a smooth cylindrical surface for engaging within a portion of first irrigation device 30. In one or more embodiments, first irrigation device 30 includes gripping means, such as gripping arms 34. Gripping arms 34 may grip stop member 52 from an outer surface thereof. In one or more embodiments, a second irrigation device (not shown) may be engaged with connector 40 via second portion 50 by insertion of second irrigation device into second portion 50. The connection may be secured by screwing a nut over the thread of second portion 50.

The present invention discloses, in some embodiments thereof, a method of mating or engaging one or more tubular devices. The method relates to engaging between the herein disclosed connectors and at least one first irrigation device. The method allows for a stable connection between pipes or other devices that include pipes. The method includes

inserting by an axial pushing motion a first portion of the herein disclosed connectors within a tubular portion of an irrigation device. In one or more embodiments, the method includes inserting by an axial pushing motion a second portion of the herein disclosed connectors within a tubular portion of a second irrigation device. In one or more
5 embodiments, the method includes screwing over the engaged devices a threaded element (such as a nut) that is complementary to the threaded portion of the herein disclosed connectors. In one or more embodiments, the method includes screwing a nut within threaded portion and strengthening the screwing using a screw driver. In one or more embodiments, the method includes engaging a second device that includes a threaded
10 portion.

Reference is now made to FIGs. 23 -24 which are perspective views, FIGs. 25-26 which are side views, FIG. 27 which is a cut view, FIG. 28 which is a top view and FIG. 29 which is a bottom view presenting a further exemplary connector 90.

The connector 90 includes a hollowed longitudinal tube 92 extending between a
15 first connector end 94 and a second connector end 96. First connector end 94 and second connector end 96 are open allowing passage therethrough of irrigation water or any other type of liquid.

Connector 90 includes a first portion 98 which extends from first connector end 94 and configured for an engagement with a first irrigation device and a second portion 100
20 extending from second connector end 96 and configured to allow an engagement with a second irrigation device in mating engagement therewith. Tube 92 being hollowed continuously extending between the first connector end 94 and a second connector end 96.

The external surface of first portion 98 is configured to allow for an engagement with a first irrigation device under great friction, or in a friction match, which may be, for
25 example, a sprinkler or a connector thereof, or a pipe or any of the alike.

Second portion 100 is partially threaded including a cylindrically threaded portion 93 on the exterior periphery of tube 92 configured to allow a secure engagement with a complementary threaded portion present on a second irrigation device, or on a part thereof,
30 or on a subsequent tool that assists in the engagement to the second irrigation device, in mating engagement therewith. Second portion 100 further includes an elongated tubular member 102 extending from threaded portion 93 and which provides stability and affords

resistance to great pressure following engagement with a second irrigation device. In one or more embodiments, elongated tubular member 102 constitutes part of tube 92. Elongated tubular member 102 may be inserted within a tubular portion of the second irrigation device in a sealed engagement. Cylindrically threaded portion 93 protrudes from an outer periphery of the hollowed tube and is configured to restrict an engagement with a second irrigation device to elongated tubular member 102. Cylindrically threaded portion 93 may secure the engagement of elongated tubular member 102 with the second device. Second portion 100 may thus allow for an engagement in a sealed and secure manner with a second irrigation device which may be a pipe or a part thereof. Second portion 100 is configured to allow for an engagement with a second irrigation device under great friction, or in a friction match, which may be, for example, a sprinkler or a connector thereof, or a pipe or any of the alike.

Connector 90 further includes an intermediate portion 91 positioned between first portion 98 and second portion 100. Intermediate portion 91 includes stop member 112 and hexagonal ring portion 106. Stop member 112 is configured to allow for a secure engagement with first irrigation device as demonstrated in FIG. 22. Stop member 112 further defines the boundary of overlap or engagement between connector 90 and a first irrigation device such that said overlap restricted to first portion 98.

First portion 98 includes a first slope 104 which declines towards first end 94. Declined first slope 104 allows the insertion of the first portion 98 and engagement thereof with a first irrigation device. Declined first slope 104 defines a first angle α_1 of up to about 85° between first slope 104 and a horizontal axis X of connector 90. Second portion 100 includes a second slope 114 which declines towards second end 96. Declined second slope 114 allows the insertion of the second portion 100 and engagement thereof with a second irrigation device. Declined second slope 114 defines a second angle α_2 of up to about 85° between second slope 114 and a horizontal axis X of connector 90. In one or more embodiments, angle α_1 and angle α_2 are identical or may be different in magnitude. For, example, angle α_1 may be greater than angle α_2 , or vice versa. Alternatively, angle α_1 may be equal to angle α_2 .

Stop member 112 includes an annular flange 99 which is perpendicular to tube 92 from an external surface thereof and having a circumferential rim 97 that is perpendicular

to tube 92 and includes a diameter being larger than the diameter of annular flange 99. Stop member 112 includes radial walls 101 defining radial slots 95 which allow an engagement with an auxiliary tool such as a screw driver, to thereby strengthen the connection between connector 90 and a second and/or a first irrigation device, and/or a subsequent tool (e.g., a securing member) that assists in such connection as demonstrated in FIG. 30 depicting pipe nut 109 engaged with connector 90 via thread 93 and a complementary thread within pipe nut 109. As used herein the term "auxiliary tool" refers to an external tool used to strengthen and/or allow a connection between the herein disclosed connectors and an irrigation device. In one or more embodiments, the stop member includes about, or at least about 10 slots 95. For example, the stop member includes about, or at least about 12 slots, about, or at least about 14 slots, about, or at least about 16 slots, or about, or at least about 18 slots.

Connector 90 further comprises a hexagonal ring portion 106 surrounding a periphery of tube 92 from an external surface thereof and extending from stop member 112.

Intermediate portion 91 may or may not further comprise a hexagonal ring portion 106 configured for allowing disassembly of connector 90 from an engagement with an irrigation device. For example, the disassembly may be conducted by a wrench, or by any suitable tool.

Stop member 112 and hexagonal ring portion 106 thus form intermediate portion 91 such that second portion 100 includes threaded portion 93 and elongated tubular member 102 wherein threaded portion 93 extends from hexagonal ring portion 106 and elongated tubular member 102 is continuous and extends from threaded portion 93.

In an exemplary embodiment, connector 90 is configured to engage with a first irrigation device being, for example, an irrigation device that includes a tubular portion, such as a pipe via first portion 98. The engagement is substantially stable and sealed and resists a force of at least about 2.5 atm. In an exemplary embodiment, the connector 90 provides connection with a first and a second irrigation devices which are so stable resisting great pressure forces of even up to about 10 atm. Second portion 100 allows for example, an engagement with a second irrigation device, such as a pipe in a manner that elongated tubular member 102 may be engaged in a sealed connection with the pipe. Cylindrically threaded portion 93 is suitable for strengthening the engagement with the second device or

pipe and allows screwing a pipe nut 109 over the engagement thereby further stabilizing and securing the engagement with the second irrigation device.

In one or more embodiments, the length of first portion 98 is at least about 30 mm, above about 35 mm or above about 40mm, or above about 45 mm, or above about 50 mm.

5 In one or more embodiments, the length of elongated tubular member 102 is at least about 80 mm. For example, at least about 90 mm, at least about 100 mm, at least about 110 mm, at least about 120 mm, or at least about 130 mm, or at least about 135 mm. In one or more embodiments, the length of elongated tubular member 102 is about 135 mm.

10 In one or more embodiments, the length of connector 90, from first connector end 94 to second connector end 96 is at least about 200 mm. For example, at least about 220 mm. In one or more embodiments, the length of connector 90, from first connector end 94 to second connector end 96 is about 241 mm.

15 In one or more embodiments, the inner diameter of connector 90 is about 20 mm to about 100 mm, about 20 mm to about 80 mm, or about 30 mm to about 50 mm. In one or more embodiments, the inner diameter of connector 90 is about 41 mm. In one or more embodiments, the diameter of the outer surface of longitudinal tube 92 is about 20 mm to about 100 mm, about 20 mm to about 80 mm, or about 30 mm to about 60 mm. In one or more embodiments, the outer diameter of longitudinal tube 92 is about 50.3 mm.

20 In one or more embodiments, the length ratio between first portion 98 and second portion 100 is about 1:10 to about 10:1. For example, about 1:5 to about 5:1, about 1:1 to about 1:10, about 1:1 to about 1:5, about 1:1 to about 1:4, or about 1:1 to about 1:3. In an exemplary embodiment, the ratio between the first portion 98 and the second portion 100 is about 1:3.

25 In one or more embodiments, the length ratio between first portion 98 and elongated tubular member 102 is about 1:10 to about 10:1. For example, about 1:5 to about 5:1, about 1:1 to about 1:10, about 1:1 to about 1:5, about 1:1 to about 1:4, or about 1:1 to about 1:3. In an exemplary embodiment, the ratio between the first portion 98 and elongated tubular member 102 is about 1:3. In an exemplary embodiment, the ratio between the first portion 98 and elongated tubular member 102 is about 1:2.8.

Threaded portion 93 defines radial slots 105 which are spaced apart from each other by walls 103. The slots 105 disposed within a gap between a wall 111 of threaded portion 93 and an external surface of elongated tubular member 102 or longitudinal tube 92.

Reference is now made to FIG. 30 which shows connector 90 that can be engaged with a second irrigation device (not shown) via insertion of second portion 100 into the irrigation device. A subsequent tool such as pipe nut 109 can be used to assist in such connection by strengthening or fastening the connection via threading pipe nut 109 over threaded portion 93. A screw driver can be placed to fit slots 95 and can be used to strengthen the connection between pipe nut 109 and threaded portion 93 by rotations.

Reference is now made to FIGs. 31 -32 which are perspective views, FIGs. 33-34 which are side views, and FIG. 35 which is a cut view, presenting a further exemplary connector 150.

Similarly to connectors 60 and 90, the connector 150 includes a hollowed longitudinal tube 152 extending between a first connector end 154 and a second connector end 156, wherein both ends are open allowing passage therethrough of irrigation water or any other type of liquid.

Connector 150 includes a first portion 158 which extends from first connector end 154 and configured for an engagement with a first irrigation device and a second portion 160 extending from second connector end 156 and configured to allow an engagement with a second irrigation device in mating engagement therewith.

Second portion 160 is partially threaded including a cylindrically threaded portion 153 on the exterior periphery of tube 152 configured to allow a secure engagement with a complementary threaded portion present on a second irrigation device, or on a part thereof, or on a subsequent tool that assists in the engagement to the second irrigation device, in mating engagement therewith. Second portion 160 further includes a tubular member 162 which may be elongated and which may extend from threaded portion 153. Tubular member 162 may have an external substantially smooth/straight surface allowing insertion thereof into a tube portion of an irrigation device. Tubular member 162 provides stability and affords resistance to great pressure following engagement with a second irrigation device.

Connector 150 further includes an intermediate portion 151 positioned between first portion 158 and second portion 160. Intermediate portion 151 includes stop member 172 and hexagonal ring portion 166. Stop member 172 is configured to allow for a secure engagement with a first irrigation device and further defines the boundary of overlap or engagement between connector 150 and a first irrigation device such that the overlap restricted to first portion 158.

Stop member 172 includes an annular flange 159 which is perpendicular to tube 152 from an external surface thereof. Stop member 172 further includes radial oblique walls 161 declining towards annular flange 159 and defining radial slots 155 which allow to rotate connector 150 using an auxiliary tool such as a screw driver, to thereby strengthen the connection between connector 150 and a second and/or a first irrigation device, and/or a securing member that assists in such connection.

Annular flange 159 protrudes circumferentially from an outer surface of the tube 152 and defines a recess 168 facing the second portion 160 such that annular flange 159 secures the engagement with an irrigation device by gripping means provided by the irrigation device to thereby allow stable gripping of the annular flange via the recess 168 and provide a secured engagement between the connector and the irrigation device. In one or more embodiments, the length ratio between first portion 158 and elongated tubular member 162 is about 1:10 to about 10:1. For example, about 1:5 to about 5:1, about 1:1 to about 1:10, about 1:1 to about 1:5, about 1:1 to about 1:4, about 1:1 to about 1:3, or about 1:1 to about 1:2.

In one or more embodiments, the length of elongated tubular member 162 is at least about 30 mm. For example, at least about 40 mm, at least about 50 mm, at least about 60 mm, at least about 70 mm, at least about 80 mm, at least about 90 mm, at least about 100 mm, at least about 110 mm, at least about 120 mm, or at least about 130 mm, or at least about 135 mm.

Each of the following terms: 'includes', 'including', 'has', 'having', 'comprises', and 'comprising', and, their linguistic / grammatical variants, derivatives, or/and conjugates, as used herein, means 'including, but not limited to', and is to be taken as specifying the stated component(s), feature(s), characteristic(s), parameter(s), integer(s), or step(s), and does not preclude addition of one or more additional component(s), feature(s), characteristic(s),

parameter(s), integer(s), step(s), or groups thereof. Each of these terms is considered equivalent in meaning to the phrase 'consisting essentially of'.

The term "configured to" is interchangeable with the term "adapted to".

Each of the phrases 'consisting of' and 'consists of', as used herein, means 'including
5 and limited to'.

The term 'method', as used herein, refers to steps, procedures, manners, means, or/and techniques, for accomplishing a given task including, but not limited to, those steps, procedures, manners, means, or/and techniques, either known to, or readily developed from known steps, procedures, manners, means, or/and techniques, by practitioners in the
10 relevant field(s) of the disclosed invention.

Throughout this disclosure, a numerical value of a parameter, feature, characteristic, object, or dimension, may be stated or described in terms of a numerical range format. Such a numerical range format, as used herein, illustrates implementation of some exemplary embodiments of the invention, and does not inflexibly limit the scope of
15 the exemplary embodiments of the invention. Accordingly, a stated or described numerical range also refers to, and encompasses, all possible sub-ranges and individual numerical values (where a numerical value may be expressed as a whole, integral, or fractional number) within that stated or described numerical range. For example, a stated or described numerical range 'from 1 to 6' also refers to, and encompasses, all possible sub-ranges, such
20 as 'from 1 to 3', 'from 1 to 4', 'from 1 to 5', 'from 2 to 4', 'from 2 to 6', 'from 3 to 6', etc., and individual numerical values, such as '1', '1.3', '2', '2.8', '3', '3.5', '4', '4.6', '5', '5.2', and '6', within the stated or described numerical range of 'from 1 to 6'. This applies regardless of the numerical breadth, extent, or size, of the stated or described numerical range. Moreover, for stating or describing a numerical range, the phrase 'in a range of between about a first
25 numerical value and about a second numerical value', is considered equivalent to, and meaning the same as, the phrase 'in a range of from about a first numerical value to about a second numerical value', and, thus, the two equivalently meaning phrases may be used interchangeably. For example, for stating or describing the numerical range of room temperature, the phrase 'room temperature refers to a temperature in a range of between
30 about 20 °C and about 25 °C', and is considered equivalent to, and meaning the same as,

the phrase 'room temperature refers to a temperature in a range of from about 20 °C to about 25 °C'.

The term 'about', in some embodiments, refers to ± 30 % of the stated numerical value. In further embodiments, the term refers to ± 20 % of the stated numerical value. In yet further embodiments, the term refers to ± 10 % of the stated numerical value.

It is to be fully understood that certain aspects, characteristics, and features, of the invention, which are, for clarity, illustratively described and presented in the context or format of a plurality of separate embodiments, may also be illustratively described and presented in any suitable combination or sub-combination in the context or format of a single embodiment. Conversely, various aspects, characteristics, and features, of the invention which are illustratively described and presented in combination or sub combination in the context or format of a single embodiment, may also be illustratively described and presented in the context or format of a plurality of separate embodiments.

Although the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications, and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all such alternatives, modifications, and variations that fall within the spirit and broad scope of the appended claims.

All publications, patents, and patent applications mentioned in this specification are herein incorporated in their entirety by reference into the specification, to the same extent as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated herein by reference. In addition, citation or identification of any reference in this application shall not be construed as an admission that such reference is available as prior art to the present invention. To the extent that section headings are used, they should not be construed as necessarily limiting.