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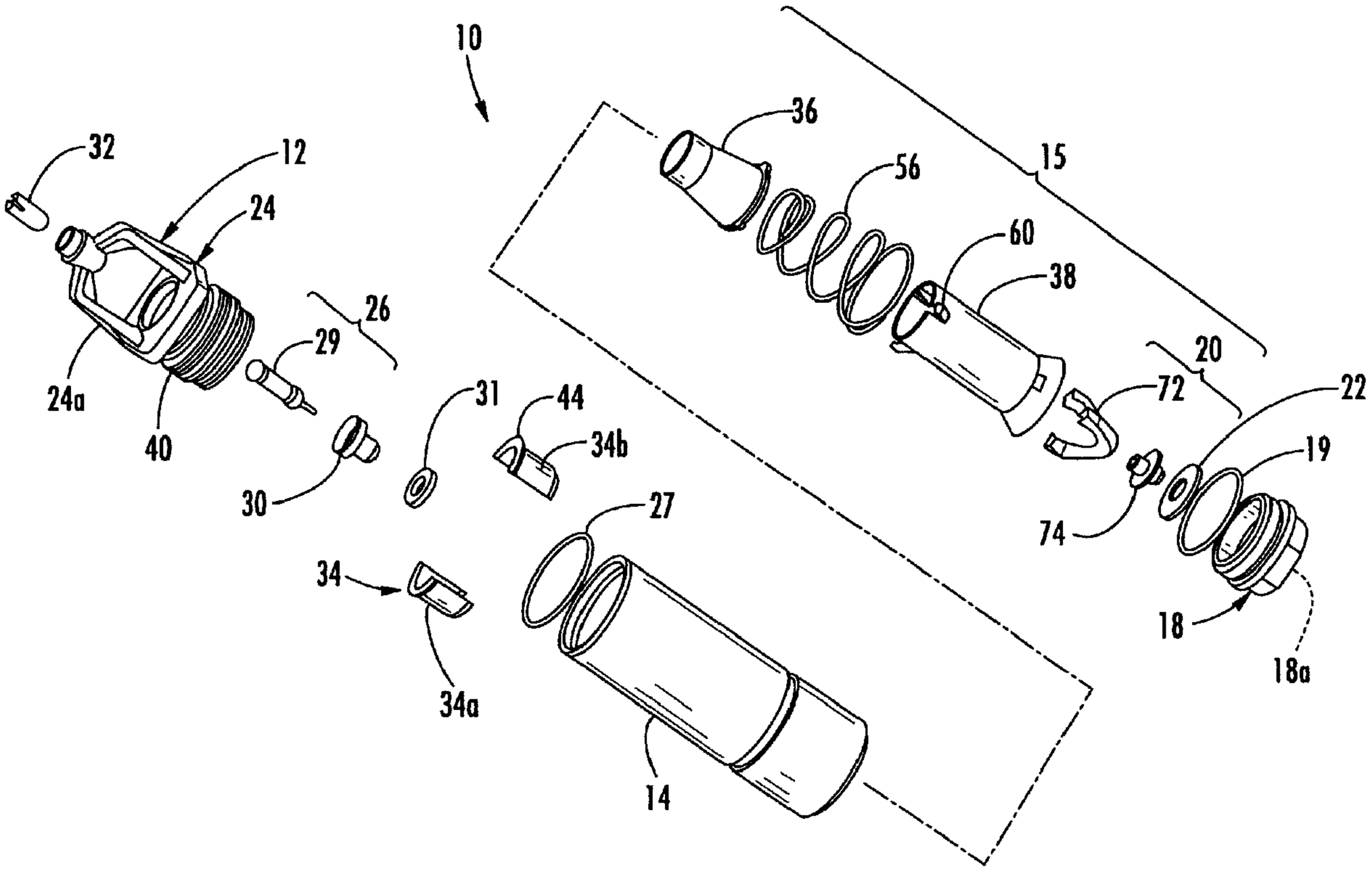


(57) Abrégé/Abstract:
A dry sprinkler assembly comprises a housing having an inlet end, an outlet end, a fluid flow passage extending from the inlet end to the outlet end, and a central longitudinal axis along the fluid flow passage. The inlet end is adapted for mounting to a fluid supply pipe and has an inlet port axially aligned with the central longitudinal axis of the housing for fluid communication with the fluid supply pipe. A sprinkler head assembly has a sprinkler head and a trigger assembly, the sprinkler head being in fluid communication with the fluid flow passage and having an outlet opening. The trigger assembly substantially closes the outlet opening and releases the closure during a fire condition. An actuator assembly has a sealing subassembly sealing the inlet port. The actuator assembly is operatively coupled to the trigger assembly such that the sealing subassembly releases the sealing of the inlet port in response to

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(57) Abrégé(suite)/Abstract(continued):
the trigger assembly releasing the closure at the outlet opening. The sealing subassembly moves in a linear path substantially parallel with the central longitudinal axis when releasing the sealing of the inlet port, and wherein the actuator assembly comprises a plurality of collinear tubular members, each of the tubular members having a passage, the passages forming the fluid flow passage. A first of the tubular members comprises a first outwardly flared conical section extending radially outward from a cylindrical body section of the first of the tubular members, a second of the tubular members being adjacent to and aligned with the first of the tubular members and including a diameter reducing conical section disposed adjacent to and aligned with the cylindrical body section of the first of the tubular members.

# ABSTRACT

A dry sprinkler assembly comprises a housing having an inlet end, an outlet end, a fluid flow passage extending from the inlet end to the outlet end, and a central longitudinal axis along the fluid flow passage. The inlet end is adapted for mounting to a fluid supply pipe and has an inlet port axially aligned with the central longitudinal axis of the housing for fluid communication with the fluid supply pipe. A sprinkler head assembly has a sprinkler head and a trigger assembly, the sprinkler head being in fluid communication with the fluid flow passage and having an outlet opening. The trigger assembly substantially closes the outlet opening and releases the closure during a fire condition. An actuator assembly has a sealing subassembly sealing the inlet port. The actuator assembly is operatively coupled to the trigger assembly such that the sealing subassembly releases the sealing of the inlet port in response to the trigger assembly releasing the closure at the outlet opening. The sealing subassembly moves in a linear path substantially parallel with the central longitudinal axis when releasing the sealing of the inlet port, and wherein the actuator assembly comprises a plurality of collinear tubular members, each of the tubular members having a passage, the passages forming the fluid flow passage. A first of the tubular members comprises a first outwardly flared conical section extending radially outward from a cylindrical body section of the first of the tubular members, a second of the tubular members being adjacent to and aligned with the first of the tubular members and including a diameter reducing conical section disposed adjacent to and aligned with the cylindrical body section of the first of the tubular members.

# DRY SPRINKER ASSEMBLY

## TECHNICAL FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to a sprinkler and, more particularly, to a dry sprinkler that is suitable for use in an area that is exposed to freezing conditions.

## SUMMARY OF THE INVENTION

Accordingly, in one form of the present invention there is provided a dry sprinkler assembly comprising:

a housing having an inlet end, an outlet end, a fluid flow passage extending from the inlet end to the outlet end, and a central longitudinal axis along the fluid flow passage, and the inlet end being adapted for mounting to a fluid supply pipe and having an inlet port axially aligned with the central longitudinal axis of the housing for fluid communication with the fluid supply pipe;

a sprinkler head assembly having a sprinkler head and a trigger assembly, the sprinkler head being in fluid communication with the fluid flow passage and having an outlet opening, and the trigger assembly substantially closing the outlet opening and releasing the closure during a fire condition; and

an actuator assembly, the actuator assembly having a sealing subassembly sealing the inlet port, the actuator assembly being operatively coupled to the trigger assembly such that the sealing subassembly releases the sealing of the inlet port in response to the trigger assembly releasing the closure at the outlet opening, and the sealing subassembly moving in a linear path substantially parallel with the central longitudinal axis when releasing the sealing of the inlet port; and

wherein the actuator assembly comprises a plurality of collinear tubular members, each of the tubular members having a passage, the passages forming the fluid flow passage, a first of the tubular members comprises a first outwardly flared conical section extending radially outward from a cylindrical body section of the first of the tubular members, a second of the tubular members being adjacent to and aligned with the first of the tubular members and including a diameter reducing conical section disposed adjacent to and aligned with the cylindrical body section of the first of the tubular members.

According to another form of the present invention there is provided a dry sprinkler assembly comprising:

a housing having an inlet end, an outlet end, a fluid flow passage extending from the inlet end to the outlet end, and a central longitudinal axis along the fluid flow passage, and the inlet end being adapted for mounting to a fluid supply pipe and having an inlet port axially aligned with the central longitudinal axis of the housing for fluid communication with the fluid supply pipe;

a sprinkler head assembly having a sprinkler head and a trigger assembly, the sprinkler head being in fluid communication with the fluid flow passage and having an outlet opening, and the trigger assembly substantially closing the outlet opening and releasing the closure during a fire condition; and

an actuator assembly, the actuator assembly having a sealing subassembly sealing the inlet port, the actuator assembly being operatively coupled to the trigger assembly such that the sealing subassembly releases the sealing of the inlet port in response to the trigger assembly releasing the closure at the outlet opening, and the sealing subassembly moving in a linear path substantially parallel with the central longitudinal axis when releasing the sealing of the inlet port;

wherein the actuator assembly comprises a plurality of collinear tubular members, each of the tubular members having a passage, the passages forming the fluid flow passage, a first of the tubular members comprises a first outwardly flared conical section extending radially outward from a cylindrical body section of the first of the tubular members, a second of the tubular members being adjacent to and aligned with the first of the tubular members and including a diameter reducing conical section disposed adjacent to and aligned with the cylindrical body section of the first of the tubular members; and

wherein a spring support assembly is adjacent the outwardly flared conical section of the first of the tubular members.

According to yet another form of the present invention there is provided a dry sprinkler assembly comprising:

a housing having an inlet end, an outlet end, a fluid flow passage extending from the inlet end to the outlet end, and a central longitudinal axis along the fluid flow passage, and the inlet end being adapted for mounting to a fluid supply pipe and having an inlet port for fluid communication with the fluid supply pipe;

a sprinkler head assembly having a sprinkler head and a trigger assembly, the sprinkler head being in fluid communication with the fluid flow passage and having an outlet opening, and the trigger assembly substantially closing the outlet opening and releasing the closure during a fire condition; and

an actuator assembly, the actuator assembly having a sealing subassembly sealing the inlet port, the actuator assembly being operatively coupled to the trigger assembly such that the sealing subassembly releases the sealing of the inlet port in response to the trigger assembly releasing the closure at the outlet opening, and the sealing subassembly moving in a linear path substantially parallel with the central longitudinal axis when releasing the sealing of the inlet port;

wherein the actuator assembly comprises a plurality of collinear tubular members, each of the tubular members having a passage, the passages forming the fluid flow passage, a first of the tubular members comprises an outwardly flared conical section, a second of the tubular members being adjacent to and aligned with the first of the tubular members, wherein the second of the tubular members comprises a diameter reducing conical section, the first of the tubular members being adjacent and aligned with the conical section; and

a spring urging the first of the tubular members into contact with the second of the tubular members.

According to yet another form of the present invention there is provided a dry sprinkler assembly comprising:

a housing having an inlet end, an outlet end, a fluid flow passage extending from the inlet end to the outlet end, and a central longitudinal axis along the fluid flow passage, and the inlet end being adapted for mounting to a fluid supply pipe and having an inlet port for fluid communication with the fluid supply pipe;

a sprinkler head assembly having a sprinkler head and a trigger assembly, the sprinkler head being in fluid communication with the fluid flow passage and having an outlet opening, and the trigger assembly substantially closing the outlet opening and releasing the closure during a fire condition; and

an actuator assembly, the actuator assembly having a sealing subassembly sealing the inlet port, the actuator assembly being operatively coupled to the trigger assembly such that the sealing subassembly releases the sealing of the inlet port in response to the trigger assembly releasing the closure at the outlet opening, and the sealing subassembly moving in a linear path substantially parallel with the central longitudinal axis when releasing the sealing of the inlet port;

wherein the actuator assembly comprises a plurality of collinear tubular members, each of the tubular members having a passage, the passages forming the fluid flow

passage, a first of the tubular members comprises an outwardly flared conical section, a second of the tubular members being adjacent to and aligned with the first of the tubular members, wherein the second of the tubular members comprises a diameter reducing conical section, the first of the tubular members being adjacent and aligned with the conical section; and

wherein a third of the tubular members is adjacent the second of the tubular members, wherein the third of the tubular members contacts the trigger assembly.

According to still yet another form of the present invention there is provided a dry sprinkler assembly comprising:

a housing having an inlet end, an outlet end, a fluid flow passage extending from the inlet end to the outlet end, and a central longitudinal axis along the fluid flow passage, and the inlet end being adapted for mounting to a fluid supply pipe and having an inlet port for fluid communication with the fluid supply pipe;

a sprinkler head assembly having a sprinkler head and a trigger assembly, the sprinkler head being in fluid communication with the fluid flow passage and having an outlet opening, and the trigger assembly substantially closing the outlet opening and releasing the closure during a fire condition; and

an actuator assembly, the actuator assembly having a sealing subassembly sealing the inlet port, the actuator assembly being operatively coupled to the trigger assembly such that the sealing subassembly releases the sealing of the inlet port in response to the trigger assembly releasing the closure at the outlet opening, and the sealing subassembly moving in a linear path substantially parallel with the central longitudinal axis when releasing the sealing of the inlet port wherein the flow of fire suppressant through the inlet port and into the fluid flow passage is substantially unimpeded; and

wherein the sealing subassembly comprises:

a plate and a plate support, the plate support supporting the plate, and the plate sealing the inlet port;

a first tubular member attached to the plate support at a first end;

a second tubular member adjacent to a second end of the first tubular member, the second tubular member including a diameter reducing conical section; and

a tubular seat member adjacent to the second tubular member and disposed in the outlet opening of the sprinkler head assembly.

Accordingly, the present invention provides a sprinkler assembly that is suitable for use in an area that is exposed to freezing conditions and further that incorporates an actuator that reduces the impedance to the flow of fluid through the sprinkler assembly over conventional dry sprinklers so that the sprinkler assembly exhibits a stable K-factor.

These and other objects, advantages, purposes, and features of the invention will become more apparent from the study of the following description taken in conjunction with the drawings.

## DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of a dry sprinkler assembly of the present invention;

FIG. 2 is a cross-section view of the sprinkler assembly of FIG. 1;

FIG. 3 is an enlarged elevation view of the sprinkler head of the sprinkler assembly of FIG. 1;

FIG. 4 is a cross-section view taken along line IV-IV of FIG. 3;

FIG. 5 is a top plan view of the sprinkler head of FIG. 3;

FIG. 6 is a cross section view taken along line VI-VI of FIG. 3;

FIG. 7 is an enlarged side view of the orifice member of the sprinkler assembly of FIG. 1;

FIG. 8 is a bottom plan view of the orifice member of FIG. 7;

FIG. 9 is a cross-section view taken along line IX-IX of FIG. 7;

FIG. 10 is a bottom plan view of one of the seat members of the sprinkler assembly of FIG. 1;

FIG. 11 is a side elevation view of the seat member of FIG. 10;

FIG. 12 is a top plan view of the seat member of FIG. 10;

FIG. 13 is an enlarged cross-section view of a tube of the sprinkler assembly of FIG. 1;

FIG. 14 is an end view of the tube of a second sprinkler assembly of FIG. 1;

FIG. 15 is a cross-section view of the tube of FIG. 14;

FIG. 16 is an opposed end view of the tube of FIG. 14;

FIG. 17 is an enlarged perspective view of a support of the sprinkler assembly of FIG. 1;

FIG. 18 is a side view of the support of FIG. 17;

FIG. 19 is a top plan view of the support of FIG. 17;

FIG. 20 is a perspective view of the support of FIG. 17 with a spring base and spring mounted to the support;

FIG. 21 is a side elevation view of the spring support assembly of FIG. 20;

FIG. 22 is a top plan view of the spring support assembly of FIG. 20;

FIG. 23 is a cross-section view taken along line XXIII-XXIII of FIG. 22;

FIG. 24 is a top plan view of the spring base of FIGS. 20-23;

FIG. 25 is a cross-section view taken along line XXV-XXV of FIG. 24;

FIG. 26 is a bottom plan view of the spring base of FIG. 24;

FIG. 27 is a bottom plan view of an inlet member of the spring assembly of FIG. 1;

FIG. 28 is a cross-section view of the inlet member of FIG. 27;

FIG. 29 is a side elevation view of another embodiment of the support spring support assembly of the present invention;

FIG. 30 is a top plan view of the spring support assembly of FIG. 29;

FIG. 31 is a cross-section view taken along line XXXI-XXXI of FIG. 30;

FIG. 32 is a perspective view of the support of the spring support assembly of FIGS. 29-31;

FIG. 33 is a cross-section view of the support of FIG. 32;

FIG. 34 is an enlarged top plan view of the spring base of the spring support assembly of FIGS. 29-31;

FIG. 35 is a cross-section view taken along line XXXV-XXXV of FIG. 34;

FIG. 36 is a perspective view of yet another embodiment of the spring support assembly of the present invention;

FIG. 37 is a side elevation view of the spring support assembly of FIG. 36;

and

FIG. 38 is a cross-section view taken along line XXXVIII-XXXVIII of FIG. 37.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2, the numeral 10 generally designates a dry sprinkler assembly of the present invention. As will be more fully described below, dry sprinkler assembly 10 incorporates an actuator assembly 15 that controls the flow of fire suppressant into the sprinkler assembly from a fire suppressant supply pipe (not shown) while reducing the draw-backs associated with prior art dry sprinklers in which the internal

actuating mechanisms may often interfere with and impede the flow of water suppressant to the sprinkler head and maintaining the K-factor of the sprinkler assembly stable.

Dry sprinkler assembly 10 includes a sprinkler head assembly 12, a housing 14, and an inlet member 18, which threads into the end of housing 14. Housing 14 also includes threads on its outer surface for threading into the supply pipe, which couples assembly 10 to the fire suppression supply pipe. Housing 14 comprises a tubular member, preferably a round metal tubular member, and includes an inlet end 14a and an outlet end 14b. Inlet member 18 is mounted to inlet end 14a of housing 14 to provide a seat 90, which then forms the seal with the supply pipe, as will be more fully described below. Inlet member 18 comprises a metal annular member with a threaded end for securing inlet member 18 into inlet end 14a of housing 14 and an annular base, which inserts into the fire suppressant supply pipe. The threaded end of inlet member 18 is preferably secured in the inlet end 14a of housing 14 with an adhesive, such as an epoxy. Furthermore, an o-ring seal 19 is preferably positioned between inlet member 18 and housing 14.

Positioned in housing 14 is actuator assembly 15, which controls the flow of fire suppressant into housing 14 and through sprinkler head assembly 12. Actuator assembly 15 is mounted to outlet end 14b of housing 14, as will be more fully described below. Sprinkler head assembly 12 includes a sprinkler head 24 and a trigger assembly 26. Sprinkler head 24, which is preferably formed from brass, threads into the outlet end of housing 14 and is preferably secured therein with an adhesive, such as an epoxy. Furthermore, a spacer 27, such as a metal, preferably stainless steel, spacer, is positioned between sprinkler head 24 and housing 14.

Trigger assembly 26 comprises a heat sensitive trigger assembly that opens the outlet opening 28 of sprinkler head 24 in response to detecting a temperature associated with a fire condition. Though it should be understood that trigger assembly 26 may comprise another type of trigger assembly. Furthermore, trigger assembly 26 is coupled to actuator assembly 15 in a manner such that when trigger assembly 26 is actuated—or in other words exposed to a temperature associated with a fire condition—actuator assembly 15 opens the inlet opening 18a of inlet member 18 to allow water to flow into and from sprinkler assembly 10.

In the illustrated embodiment, trigger assembly 26 includes a glass bulb 29 and a holder 30. Holder 30 is also preferably metal, such as leaded bronze. Glass bulb 29 is a conventional thermally sensitive bulb that breaks upon exposure to a temperature associated

with a fire. Bulb 29 is supported between frame 24a of sprinkler head 24 and holder 30, which is positioned in outlet opening 28, by a compression screw 32, which preferably comprises a threaded brass rod. Screw 32 urges bulb 29 into holder 30, and, hence, urges holder 30 in opening 28. Positioned between holder 30 and outlet opening 28 is a washer 31, such as stainless steel washer, whose thickness can be varied to accommodate the various tolerances of the component parts of sprinkler assembly 10.

As best seen in FIG. 2, actuator assembly 15 supports washer 31 in base 40 of sprinkler head 24 and extends between washer 31 and inlet member 18 to seal inlet opening 18a of inlet member 18 so that housing 14 is free of fire suppressant fluid, and instead is filled with air, until such time that the sprinkler assembly is exposed to a temperature associated with a fire condition. Furthermore, actuator assembly 15 and its various members, described below, move in a generally linear path along or parallel to the central longitudinal axis 10a (FIG. 2) of sprinkler assembly 10 away from inlet opening 18a when trigger assembly 26 is actuated so that inlet opening 18a is no longer sealed and, further, so that the flow of fire suppressant can flow into sprinkler assembly 10 and out from sprinkler head assembly 12 substantially unimpeded by the actuator assembly to thereby stabilize the K-factor of the sprinkler assembly.

As best seen in FIG. 2, actuator assembly 15 includes a plurality of members that are generally aligned along axis 10a between washer 31 and inlet member 18 and, further, which define a fluid flow passage 15a for the fire protection fluid through housing 14. As best seen in FIGS. 1 and 2, actuator assembly 15 including a seat 34, which supports washer 31, an orifice member 36, and an inner tubular member 38. Seat 34 is formed from two half-cylindrical members 34a and 34b, preferably metal members, such as copper members, which are positioned in the base 40 of sprinkler head 24. Members 34a and 34b are juxtaposed with their upper ends positioned in outlet opening 28 and positioned to support washer 31 (FIG. 2) in opening 28.

The upper end of orifice member 36 is similarly positioned in base 40 of sprinkler head 24 and, further, abuts the lower ends of members 34a and 34b. The lower ends of members 34a and 34b have a groove or shoulder formed or provided therein to form a seat for the upper end of orifice member 36. In this manner, orifice member 36 and seat 34 are laterally coupled. Orifice member 36 similar comprises a metal member, such as a copper member.

Tubular member 38, which is positioned in member 14 and abuts a lower end of orifice member 36, is engaged by a spring support assembly 20. Tubular member 38 preferably comprises a round metal tubular member with a flared or tapered end, described below. As previously noted, seat 34, orifice member 36, and tubular member 38 are generally collinear and, further, are stacked between spring support assembly 20 and holder 30 with each having a transverse passage 34c, 36a, and 38a, respectively, to form fluid flow passageway 15a from inlet member 18 to sprinkler head 24 for fire suppressant fluid to flow from the fire protection system through tubular member 14 and through sprinkler head 24 to be dispersed by deflector 16.

As previously noted, seat 34 is formed from two members and, in the illustrated embodiment, is formed from two half-cylindrical members 34a and 34b, which are substantially mirror images of each other and are arranged in a juxtaposed position in base 40 of sprinkler head 24. When placed in their juxtaposed or adjacent relationship, such as shown in FIG. 2, the upper ends of members 34a and 34b form an upper annular recess or seat 42 for washer 31 and an annular rim 44. When positioned in base 40, the outer perimeter of annular rim 44 rests against the annular seat 46 formed in base 40 of sprinkler head 24. Members 34a and 34b are held in position against annular seat 46 by washer 31 and trigger assembly 26. In this manner, seat 34 together with trigger assembly 26, and washer 31 substantially close outlet opening 28.

As previously noted, mounted at the opposed ends of members 34a and 34b is orifice member 36, which includes a first right-cylindrical section 50 and a conical section 52. Section 50 is seated in a lower annular recess or seat 53 formed on lower ends of members 34a and 34b. Lower end of conical section 52 includes a flange 54 against which tubular member 38 is seated.

Tubular member 38 is urged toward orifice member 36 by a spring 56, such as a coil spring, such as a stainless steel coil spring, which extends around tubular member 38 and which is seated on one end in an annular groove 58 formed in the inner surface of tubular member 14 and seated on its opposed end against a plurality of outwardly extending tabs 60 formed in cylindrical wall 62 of tubular member 38. Tabs 60 are aligned with tabs 54a of flange 54, so that when tube 38 is urged toward orifice member 36, tabs 60 contact tabs 54a for added stability.

As previously noted, members 34, 36, and 38 are coaxial and provide a fluid flow passageway for fire suppressant fluid to flow from inlet member 18 to sprinkler head 24.

Spring support assembly 20 is mounted to a lower end of tubular member 38 and is mounted to tubular member 38 from an opposed end from orifice member 36 so that spring support assembly 20 positions a spring seal 22 against and seals the inlet opening 18a of inlet 18. Spring plate 22 preferably comprises a metal spring plate formed from a nickel alloy and, further, is coated with a Teflon tape at least on its lower side, and preferably on both its sides, to reduce friction between plate 22 and inlet member 18. Lower end 38b of tubular member 38 includes an outwardly flared or conical portion 68 that includes a plurality of openings 70 for engaging or being engaged by spring support assembly 20, as will be described below.

Referring to FIGS. 17-26, spring support assembly 20 includes a support base 72 (FIG. 17), a spring base 74 (FIGS. 24-26), and spring plate 22. As best seen in FIGS. 17 and 19, support base 72 includes a plurality of downwardly depending mounting arms 80 (as viewed in FIG. 17), which project radially outward from a central body 82 with a transverse opening 84. Arms 80 have an arcuate cross-section and extend from body 82 at an acute angle to form a plurality of passageways through which the fire suppressant fluid flows into inner tubular member 38. The lower ends of arms 80 have an enlarged C-shaped cross-section, which insert into openings 70 of tubular member 38, and are angled with respect to the upper portions of arms 80 so that their outer surfaces are generally parallel to the central longitudinal 82a of body 82. In this manner, arms 80 couple spring support assembly 20 to tubular member 38.

Mounted in transverse opening 84 is spring base 74. Base 74 is preferably coupled to support base 72 by, for example, staking. As best seen in FIGS. 24-26, spring base 74 includes a central body 86, with an upwardly projecting rounded boss 86a and a rearwardly projecting collar 86b, and an annular flange 88 against which spring plate 22 is positioned and against which spring plate 22 is urged when spring support assembly 20 is mounted in sprinkler assembly 10. When spring support assembly 20 is seated in tubular member 38, the upper ends (as viewed in FIG. 2) of arms 80 extend into openings 70 of tubular member 38 to thereby couple spring support assembly 20 to tubular member 38. Bases 72 and 74 are both preferably metal bases, such as bronze bases.

As best understood from FIGS. 2 and 23, prior to assembly, spring plate 22 assumes a generally concave configuration and, when assembled, a generally planar orientation when spring plate 22 is urged against annular seat 90 (FIG. 28) provided or formed in inlet member 18. Thus, as would be understood, when the downward pressure applied against spring plate 22 is released, spring plate 22 will assume its concave

configuration as shown in FIG. 23 to thereby urge support 72 and tubular member 38 upwardly toward sprinkler head 24, as will be more fully described below.

Referring again to FIGS. 23 and 25, spring base 74 extends into opening 84 of support base 72 and, further, is secured to support by riveting. In addition, spring plate 22 is similarly coupled to spring base 74 by, for example, staking. In this manner, spring support assembly 20 comprises a unitary assembly in which each of the components, namely the support base 72, spring base 74, and spring plate 22 are coupled and, therefore, reduce, if not eliminate, the possibility of the components interfering with the flow of water suppressant to the sprinkler head when the sprinkler head 24 is opened in response to detecting a temperature associated with a fire condition. Furthermore, because each of the actuator assembly components, including the spring support assembly, are interconnected, the actuator assembly moves in a generally linear path along or substantially parallel to the central axis 10a of sprinkler assembly 10 when the downward pressure from trigger assembly 26 is released with spring seal 22 being lifted off inlet opening so that fluid flows into inlet member 18 and between arms 80 into passage 15a. Thus, actuator assembly 15 reduces the interference with the flow of the fire suppressant fluid through the sprinkler assembly to thereby stabilize the K-factor of sprinkler assembly 10.

In operation, when sprinkler assembly 10 is subject to a temperature associated with a fire, trigger assembly 26 will release holder 30 and, therefore, release washer 48 from seat 34. Once seat 34 is no longer urged downward (as viewed in FIG. 2), spring 56, acting upon tubular member 38, will urge tubular member 38 upward and orifice member 36 upward to urge seat 34 outwardly through outlet opening 28. Upon the upward movement of tubular member 38, the force applied to compress spring plate 22 will be released, thus spring plate 22 will assume its concave configuration to also urge tubular member 38 upward (as viewed in FIG. 2). Spring plate 22 will be unseated from annular seat 90 under the pressure of the fire extinguishing fluid from the fire suppressant pipe, which will then allow the fluid from the fire suppression pipe to enter into sprinkler assembly 10 and pass between the respective arms 80 of spring support assembly 20 and, further, to enter passageways 38a, 36a, and 34c of members 38, 36, and 34, respectively, and, further, to exit outlet opening 28 of sprinkler head 24.

Referring to FIGS. 29-33, the numeral 120 designates another embodiment of the spring support assembly of the present invention. Spring support assembly 120 is of similar construction to spring support assembly 20 and includes a support base 172, a spring

base 174, and plate spring 22, similar to the previous embodiment. In the illustrated embodiment, support base 172 includes four support arms 180 which are generally equally spaced around a central axis 120a of spring support assembly 120. In addition, each arm 180 is formed from solid flange and includes an upper portion 180a with a tapered cross-section that extends from central portion 183 outwardly and downwardly, a medial portion 180b that extends downwardly from upper portion 180a with a generally uniform cross-section, and a lower portion 180c that has a reduced thickness to form tabs for inserting into the respective openings of tubular member 38, such that medial portions 180b form seats or stops for tubular member 38.

Referring to FIGS. 34-35, spring base 174 is of similar construction to spring base 74 but includes a conical shaped boss 186a. Similar to the previous embodiment, spring base 174 is coupled to base 172 and spring plate 22 is secured to base 174, for example, by staking.

Referring to FIGS. 36-38, the numeral 220 designates yet another embodiment of the spring support assembly of the present invention, which includes spring plate 22 and a spring support base 272 that incorporates the functions and features of the spring bases and support bases of the previous embodiments into a monolithic, unitary part, which facilitates assembly of the sprinkler assembly.

In the illustrated embodiment, spring support base 272 incorporates four mounting arms similar to the previous embodiment; however, it should be understood that that spring support base 272 may include three arms similar to assembly 20.

As best understood from FIG. 38, spring support base 272 includes a central portion 283 and a plurality of arms 280 that project from central portion 283. Central portion 283 includes an upwardly projecting boss 286 with a conical portion 286a and an annular rim 286b, which provides a mounting surface for spring plate 22, which is coupled to spring support base 272 by staking, similar to the previous embodiments.

As should be understood from the foregoing, the dry sprinkler assembly of the present invention provides an improved assembly with a more stable configuration where its component parts are configured to reduce the likelihood of fluid flow blockage through the sprinkler assembly when the sprinkler assembly has been activated to open.

While several forms of the invention have been shown and described, other forms will now be apparent to those skilled in the art. For example, though the tubular members are illustrated with round tubular cross-sections, the tubular members may assume

other tubular configurations. In addition, the number of tabs provide on tubular member 38 may be increased. Furthermore, other trigger assemblies may be used including a trigger assembly that incorporates a fusible link in lieu of a bulb. Therefore, it will be understood that the embodiments shown in the drawings and described above are merely for illustrative purposes, and are not intended to limit the scope of the invention, which is defined by the claims that follow as interpreted under the principles of patent law, including the doctrine of equivalents.

**What is claimed is:**

1. A dry sprinkler assembly comprising:

a housing having an inlet end, an outlet end, a fluid flow passage extending from said inlet end to said outlet end, and a central longitudinal axis along said fluid flow passage, and said inlet end being adapted for mounting to a fluid supply pipe and having an inlet port axially aligned with said central longitudinal axis of said housing for fluid communication with the fluid supply pipe;

a sprinkler head assembly having a sprinkler head and a trigger assembly, said sprinkler head being in fluid communication with said fluid flow passage and having an outlet opening, and said trigger assembly substantially closing said outlet opening and releasing said closure during a fire condition; and

an actuator assembly, said actuator assembly having a sealing subassembly sealing said inlet port, said actuator assembly being operatively coupled to said trigger assembly such that said sealing subassembly releases said sealing of said inlet port in response to said trigger assembly releasing said closure at said outlet opening, and said sealing subassembly moving in a linear path substantially parallel with said central longitudinal axis when releasing said sealing of said inlet port; and

wherein said actuator assembly comprises a plurality of collinear tubular members, each of said tubular members having a passage, said passages forming said fluid flow passage, a first of said tubular members comprises a first outwardly flared conical section extending radially outward from a cylindrical body section of said first of said tubular members, a second of said tubular members being adjacent to and aligned with said first of said tubular members and including a diameter reducing conical section disposed adjacent to and aligned with said cylindrical body section of said first of said tubular members.

2. The dry sprinkler assembly according to claim 1, further comprising a spring, said spring urging said first of said tubular members into contact with said second of said tubular members.

3. The dry sprinkler assembly according to claim 1, wherein a third of said tubular members is adjacent said second of said tubular members.

4. A dry sprinkler assembly comprising:

a housing having an inlet end, an outlet end, a fluid flow passage extending from said inlet end to said outlet end, and a central longitudinal axis along said fluid flow passage, and said inlet end being adapted for mounting to a fluid supply pipe and having an inlet port axially aligned with said central longitudinal axis of said housing for fluid communication with the fluid supply pipe;

a sprinkler head assembly having a sprinkler head and a trigger assembly, said sprinkler head being in fluid communication with said fluid flow passage and having an outlet opening, and said trigger assembly substantially closing said outlet opening and releasing said closure during a fire condition; and

an actuator assembly, said actuator assembly having a sealing subassembly sealing said inlet port, said actuator assembly being operatively coupled to said trigger assembly such that said sealing subassembly releases said sealing of said inlet port in response to said trigger assembly releasing said closure at said outlet opening, and said sealing subassembly moving in a linear path substantially parallel with said central longitudinal axis when releasing said sealing of said inlet port;

wherein said actuator assembly comprises a plurality of collinear tubular members, each of said tubular members having a passage, said passages forming said fluid flow passage, a first of said tubular members comprises a first outwardly flared conical section extending radially outward from a cylindrical body section of said first of said tubular members, a second of said tubular members being adjacent to and aligned with said first of said tubular members and including a diameter reducing conical section disposed adjacent to and aligned with said cylindrical body section of said first of said tubular members; and

wherein a spring support assembly is adjacent said outwardly flared conical section of said first of said tubular members.

5. The dry sprinkler assembly according to claim 4, wherein said spring support assembly is coupled to said first of said tubular members.

6. The dry sprinkler assembly according to claim 4, wherein said spring support assembly comprises a base, a plurality of arms, and a spring plate coupled to said base, said arms being coupled to said first of said tubular members.

7. A dry sprinkler assembly comprising:

a housing having an inlet end, an outlet end, a fluid flow passage extending from said inlet end to said outlet end, and a central longitudinal axis along said fluid flow passage, and said inlet end being adapted for mounting to a fluid supply pipe and having an inlet port for fluid communication with the fluid supply pipe;

a sprinkler head assembly having a sprinkler head and a trigger assembly, said sprinkler head being in fluid communication with said fluid flow passage and having an outlet opening, and said trigger assembly substantially closing said outlet opening and releasing said closure during a fire condition; and

an actuator assembly, said actuator assembly having a sealing subassembly sealing said inlet port, said actuator assembly being operatively coupled to said trigger assembly such that said sealing subassembly releases said sealing of said inlet port in response to said trigger assembly releasing said closure at said outlet opening, and said sealing subassembly moving in a linear path substantially parallel with said central longitudinal axis when releasing said sealing of said inlet port;

wherein said actuator assembly comprises a plurality of collinear tubular members, each of said tubular members having a passage, said passages forming said fluid flow passage, a first of said tubular members comprises an outwardly flared conical section, a second of said tubular members being adjacent to and aligned with said first of said tubular members, wherein said second of said tubular members comprises a diameter reducing conical section, said first of said tubular members being adjacent and aligned with said conical section; and

a spring urging said first of said tubular members into contact with said second of said tubular members.

8. A dry sprinkler assembly comprising:

a housing having an inlet end, an outlet end, a fluid flow passage extending from said inlet end to said outlet end, and a central longitudinal axis along said fluid flow passage, and said inlet end being adapted for mounting to a fluid supply pipe and having an inlet port for fluid communication with the fluid supply pipe;

a sprinkler head assembly having a sprinkler head and a trigger assembly, said sprinkler head being in fluid communication with said fluid flow passage and having an outlet opening, and said trigger assembly substantially closing said outlet opening and releasing said closure during a fire condition; and

an actuator assembly, said actuator assembly having a sealing subassembly sealing said inlet port, said actuator assembly being operatively coupled to said trigger assembly such that said sealing subassembly releases said sealing of said inlet port in response to said trigger assembly releasing said closure at said outlet opening, and said sealing subassembly moving in a linear path substantially parallel with said central longitudinal axis when releasing said sealing of said inlet port;

wherein said actuator assembly comprises a plurality of collinear tubular members, each of said tubular members having a passage, said passages forming said fluid flow passage, a first of said tubular members comprises an outwardly flared conical section, a second of said tubular members being adjacent to and aligned with said first of said tubular members, wherein said second of said tubular members comprises a diameter reducing conical section, said first of said tubular members being adjacent and aligned with said conical section; and

wherein a third of said tubular members is adjacent said second of said tubular members, wherein said third of said tubular members contacts said trigger assembly.

9. A dry sprinkler assembly comprising:

a housing having an inlet end, an outlet end, a fluid flow passage extending from said inlet end to said outlet end, and a central longitudinal axis along said fluid flow passage, and said inlet end being adapted for mounting to a fluid supply pipe and having an inlet port for fluid communication with the fluid supply pipe;

a sprinkler head assembly having a sprinkler head and a trigger assembly, said sprinkler head being in fluid communication with said fluid flow passage and having an outlet opening, and said trigger assembly substantially closing said outlet opening and releasing said closure during a fire condition; and

an actuator assembly, said actuator assembly having a sealing subassembly sealing said inlet port, said actuator assembly being operatively coupled to said trigger assembly such that said sealing subassembly releases said sealing of said inlet port in response to said trigger assembly releasing said closure at said outlet opening, and said sealing subassembly moving in a linear path substantially parallel with said central longitudinal axis when releasing said sealing of said inlet port wherein the flow of fire suppressant through said inlet port and into said fluid flow passage is substantially unimpeded; and

wherein said sealing subassembly comprises:

a plate and a plate support, said plate support supporting said plate, and said plate sealing said inlet port;

a first tubular member attached to said plate support at a first end;

a second tubular member adjacent to a second end of said first tubular member, said second tubular member including a diameter reducing conical section; and

a tubular seat member adjacent to said second tubular member and disposed in said outlet opening of said sprinkler head assembly.

10. The dry pipe sprinkler assembly according to claim 9, wherein said first tubular member is biased toward said second tubular member.

11. The dry pipe sprinkler assembly according to claim 9, wherein said tubular seat member includes two semi-cylindrical sections.

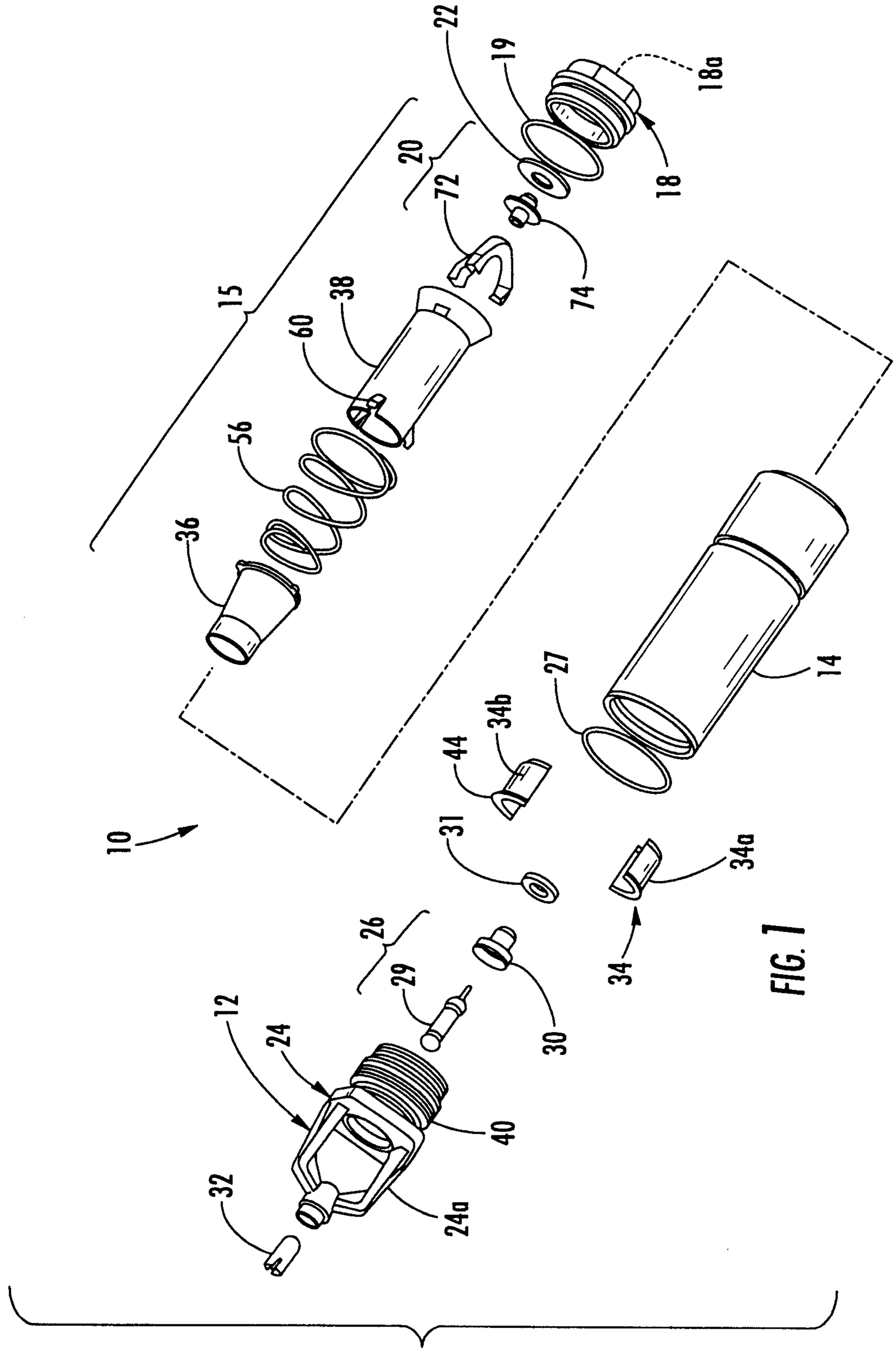
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FIG. 1

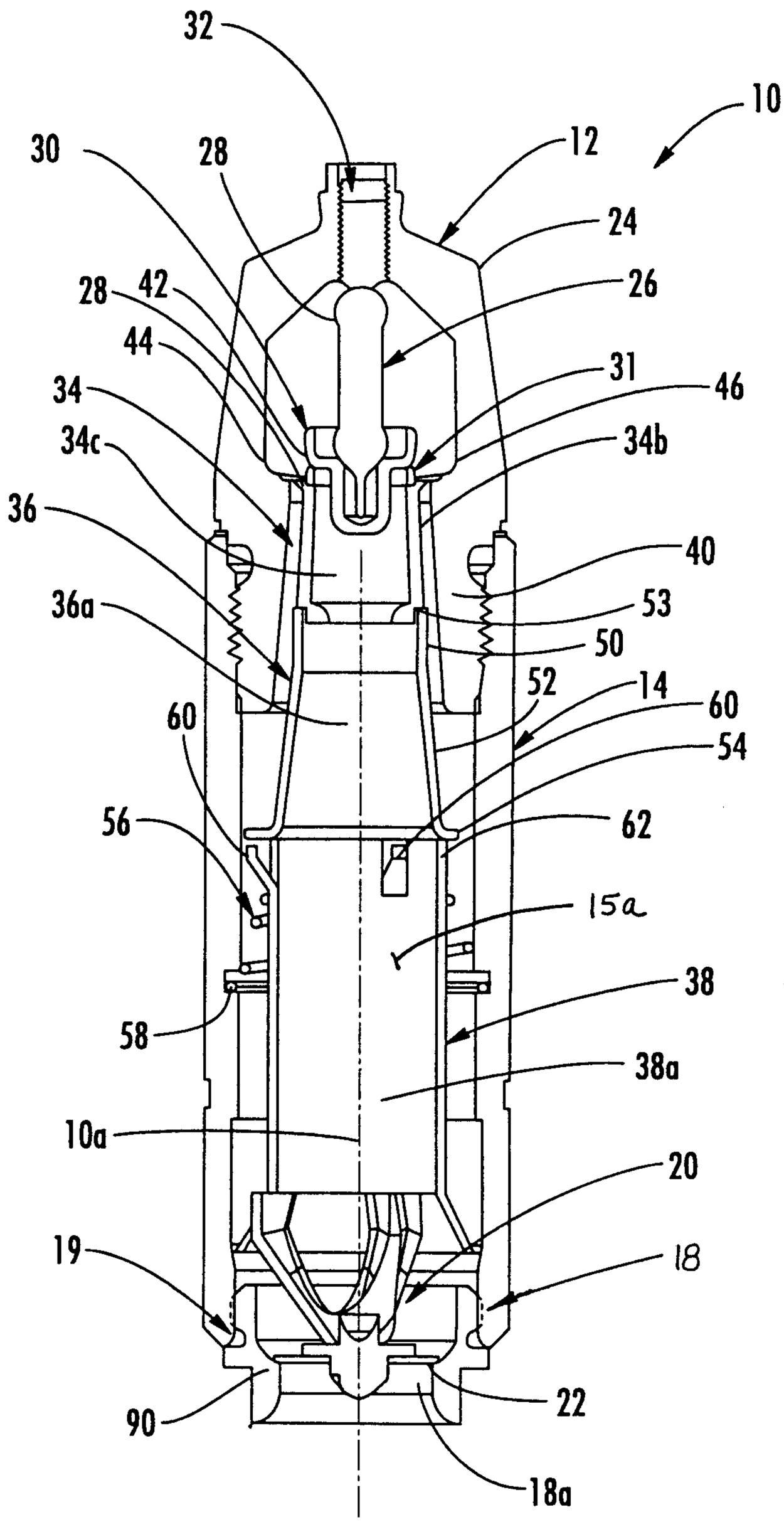
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FIG. 2

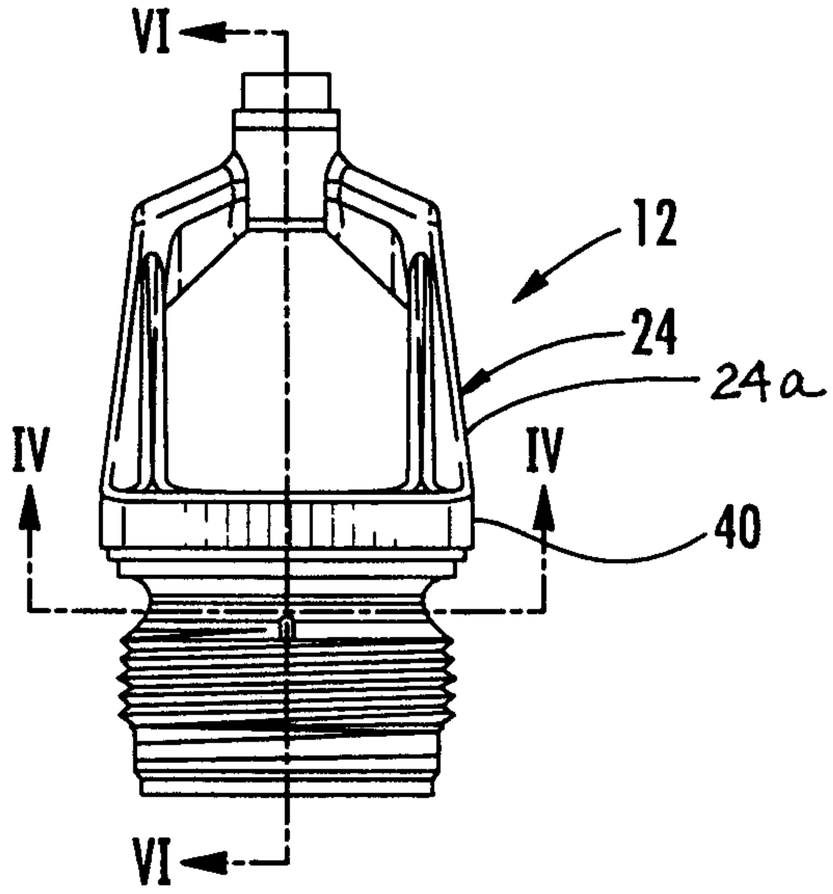



FIG. 3

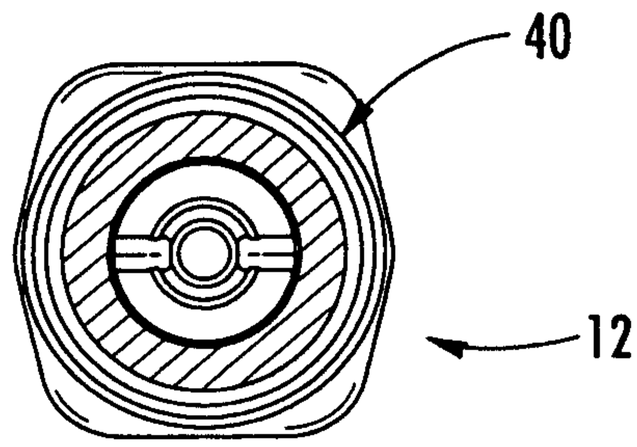



FIG. 4

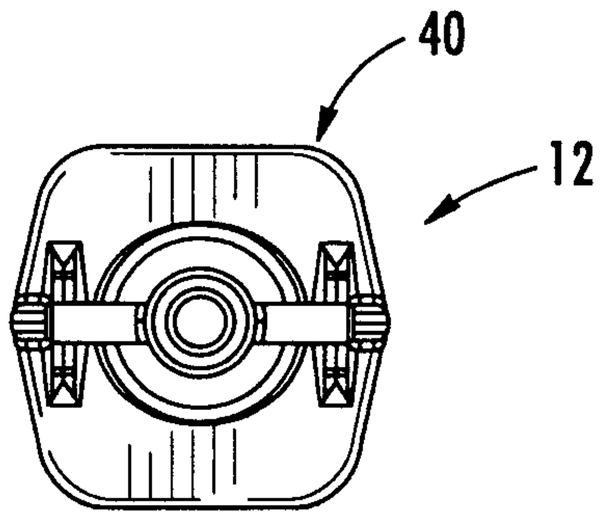



FIG. 5

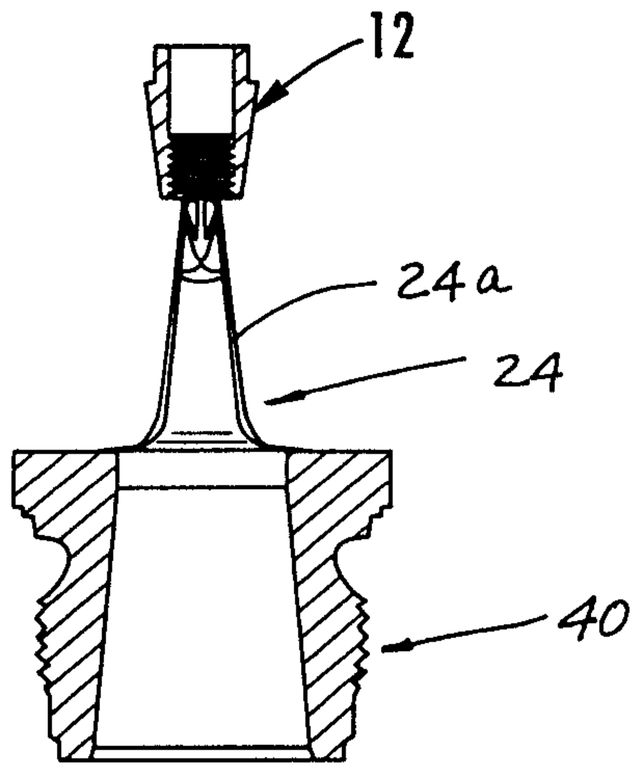



FIG. 6

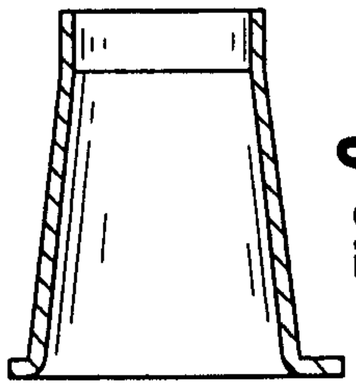


FIG. 9

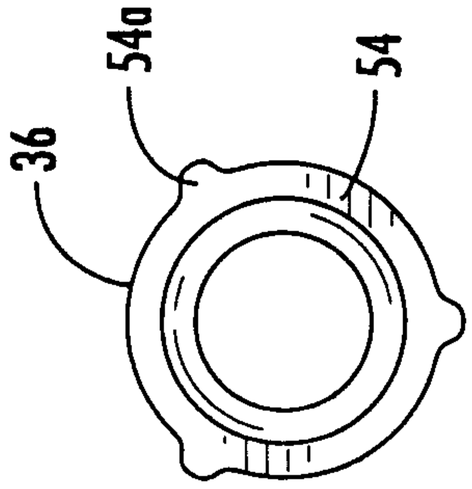



FIG. 8

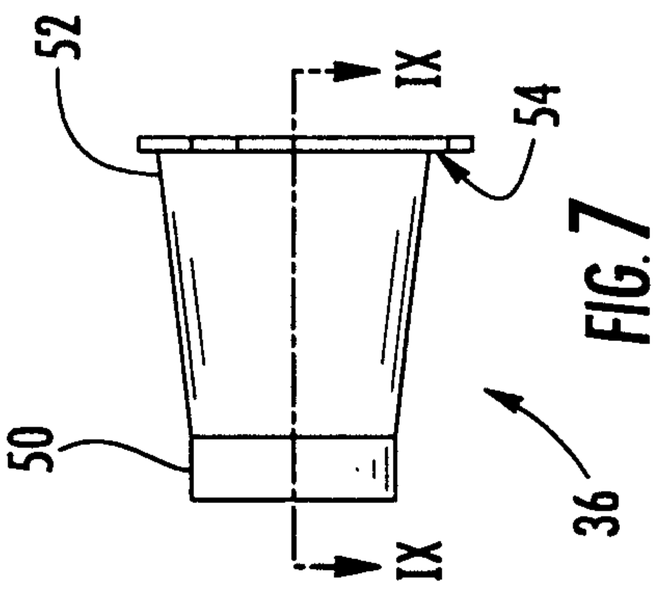



FIG. 7

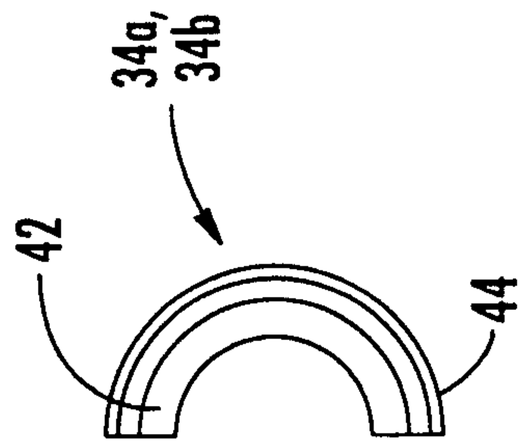



FIG. 12

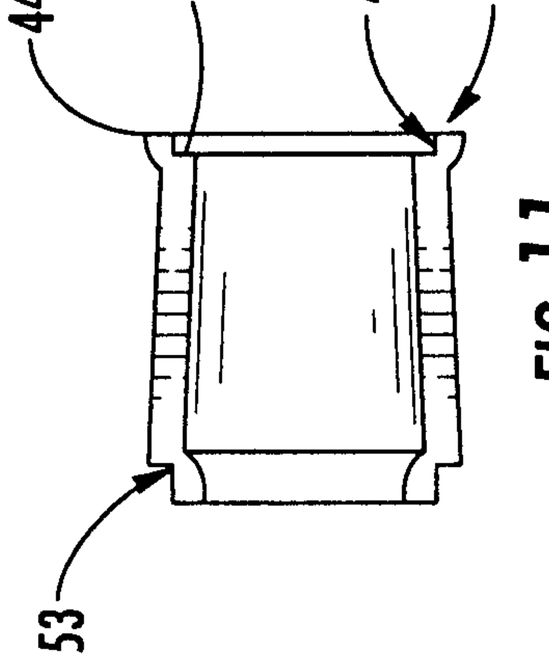



FIG. 11

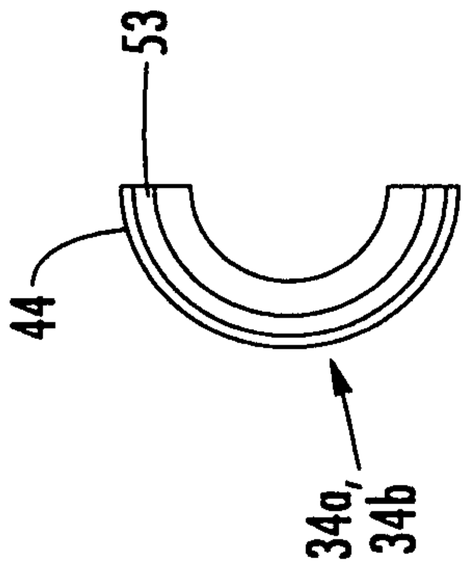



FIG. 10

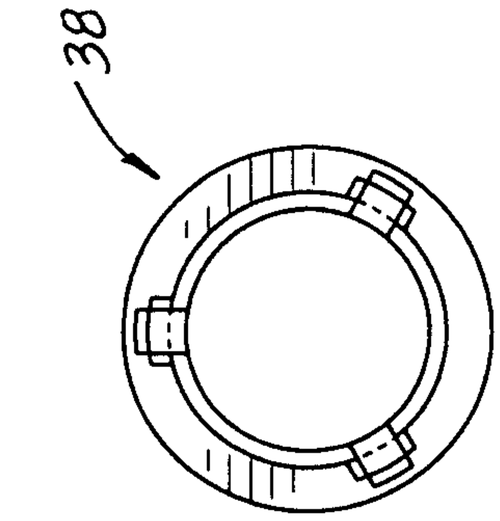



FIG. 14

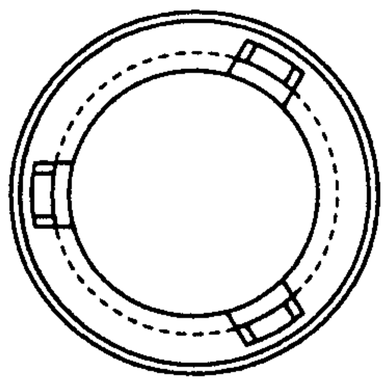


FIG. 16

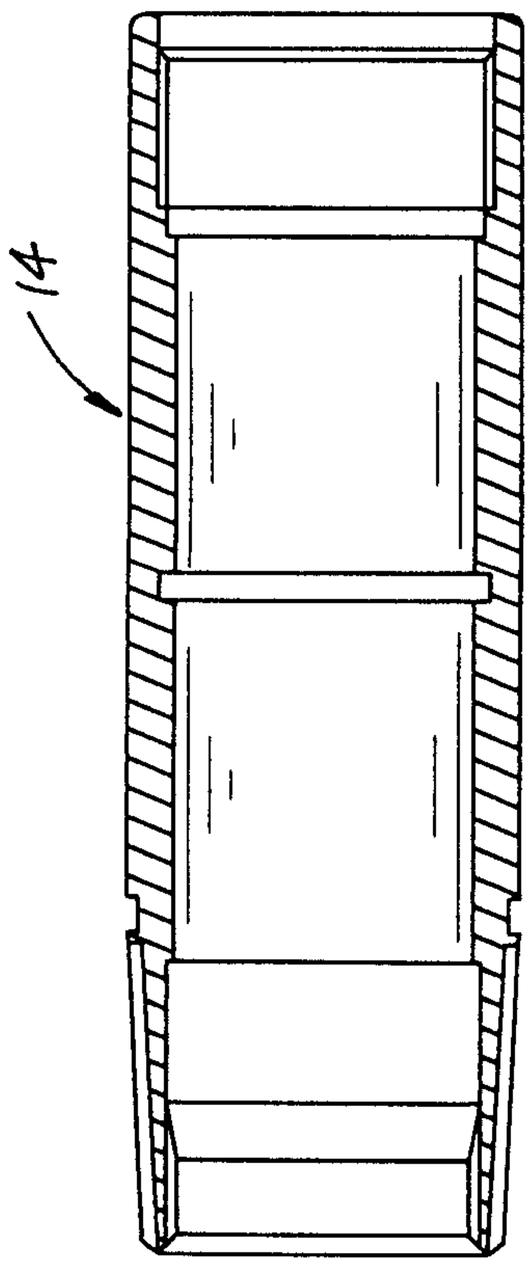



FIG. 13

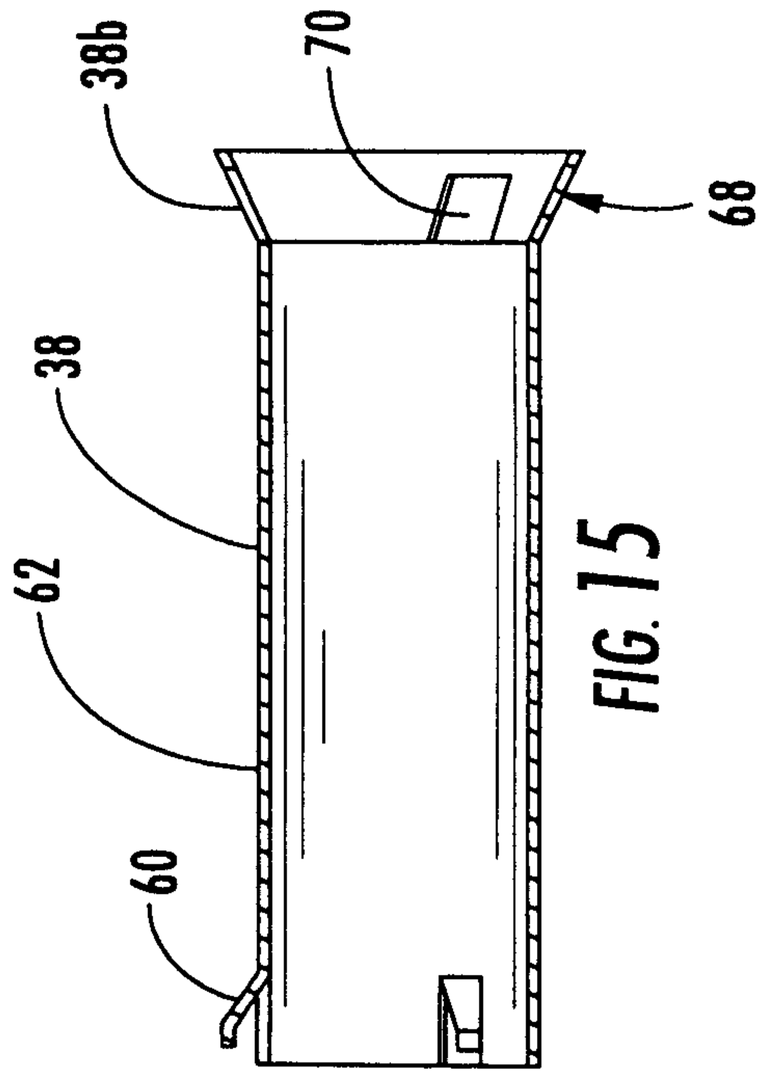



FIG. 15

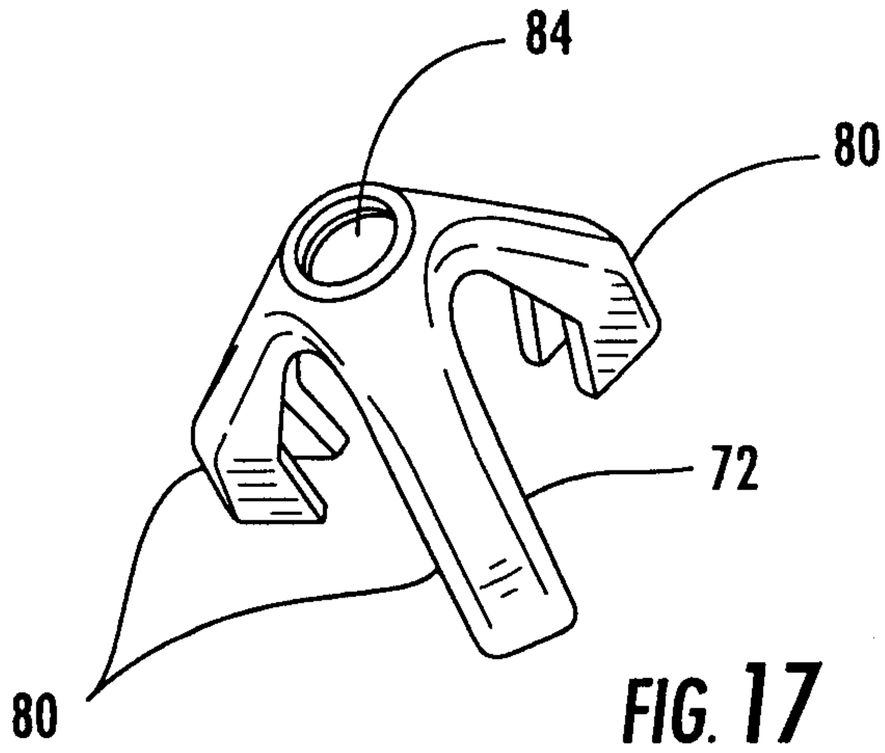



FIG. 17

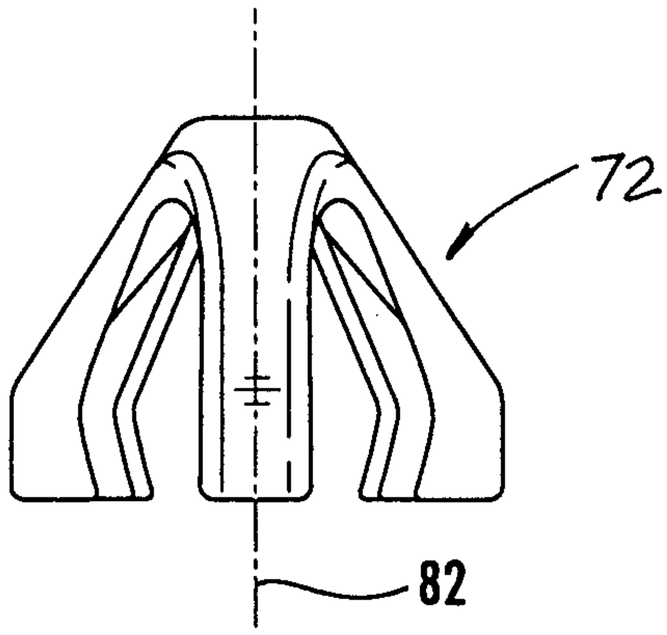



FIG. 18

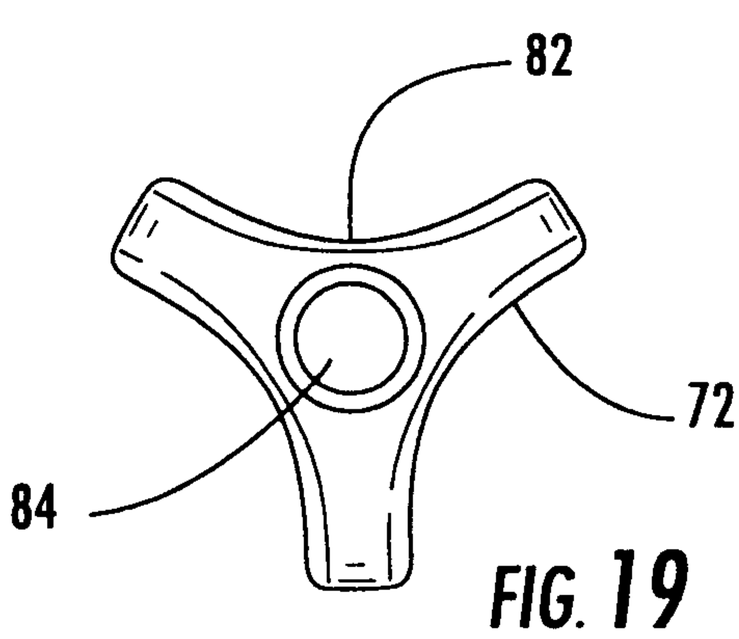



FIG. 19

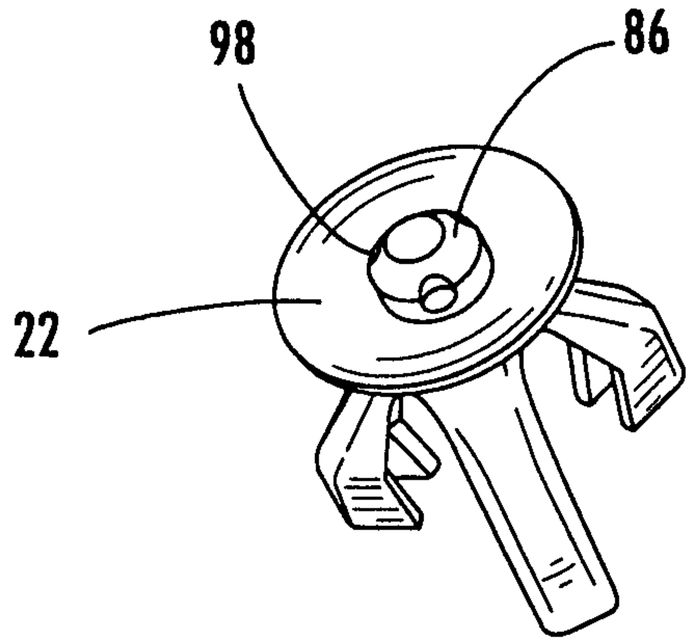



FIG. 20

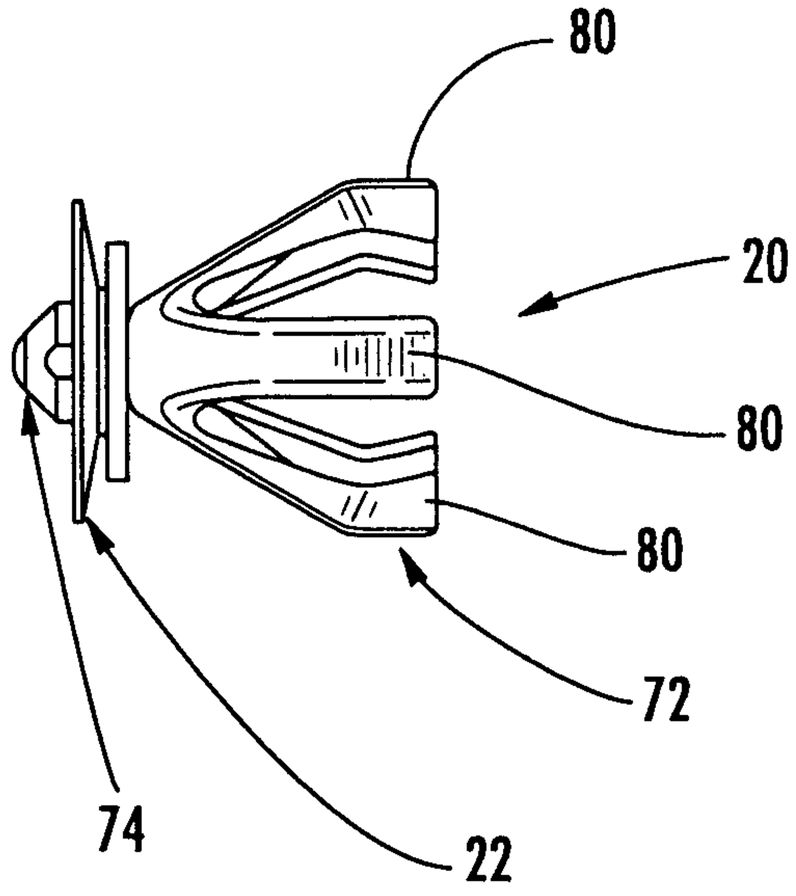



FIG. 21

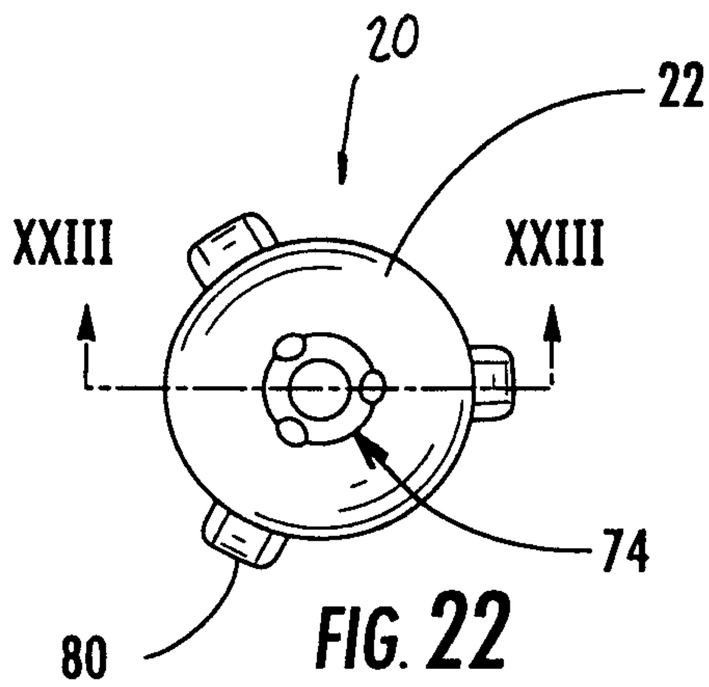



FIG. 22

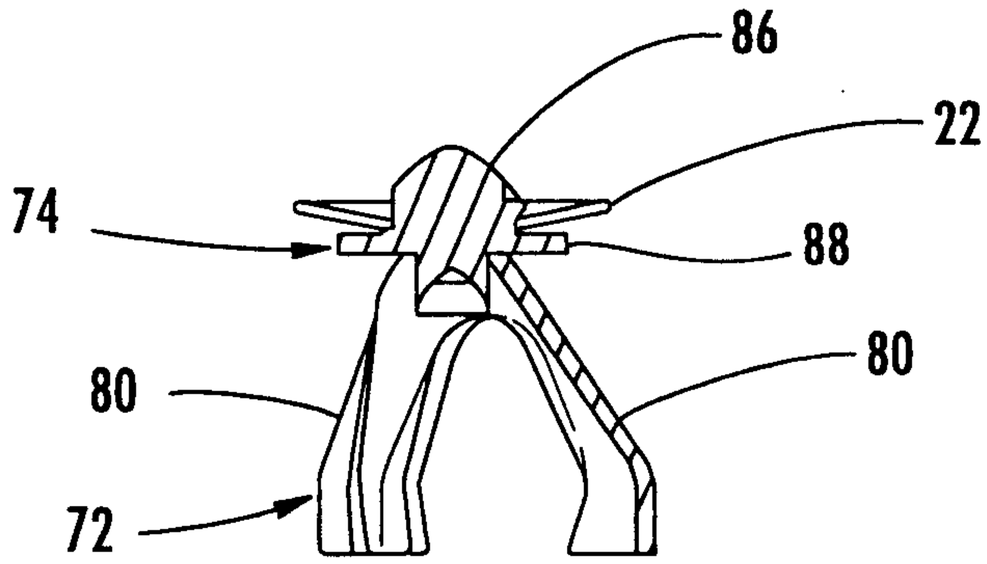



FIG. 23

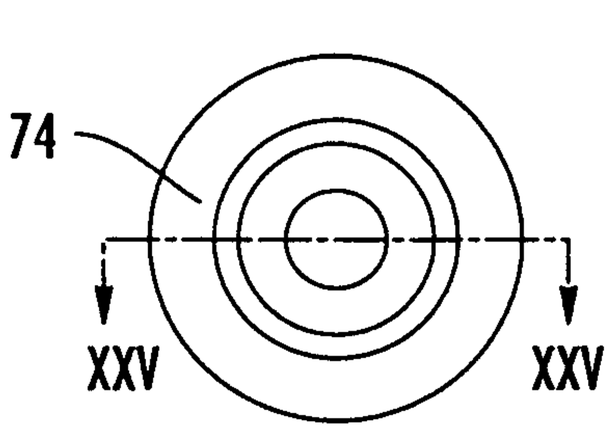



FIG. 24

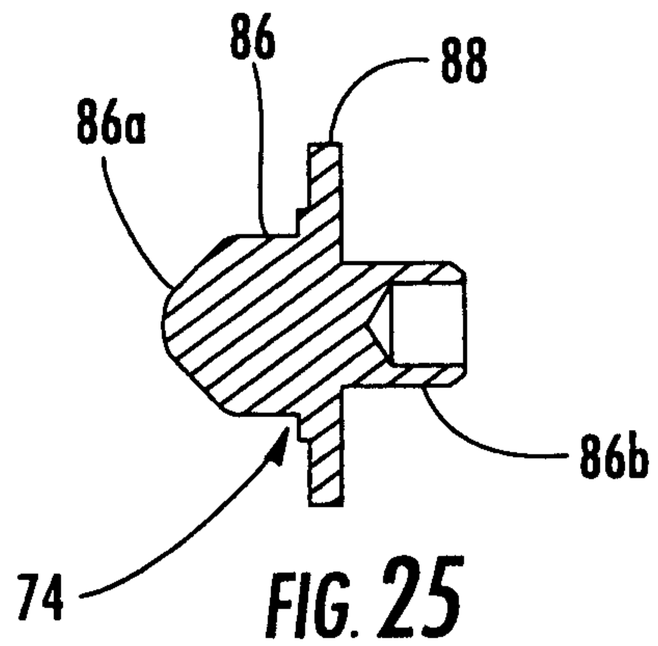



FIG. 25

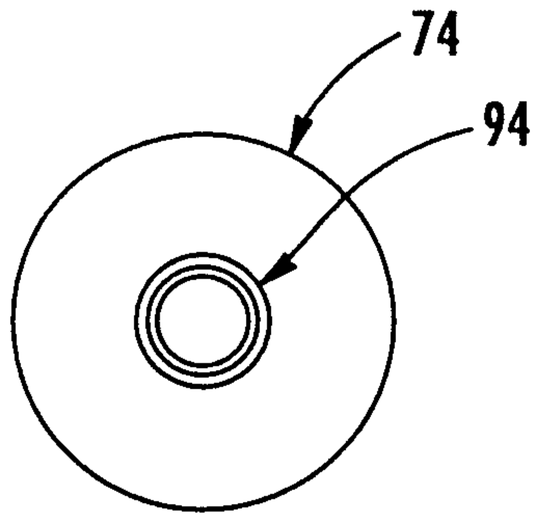



FIG. 26

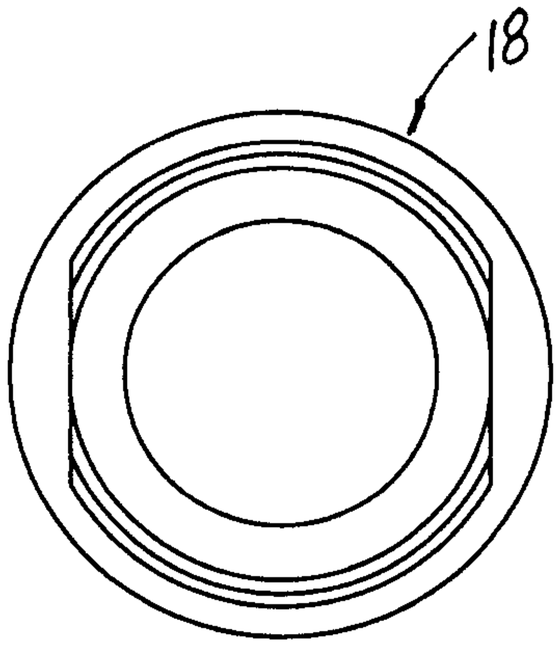



FIG. 27

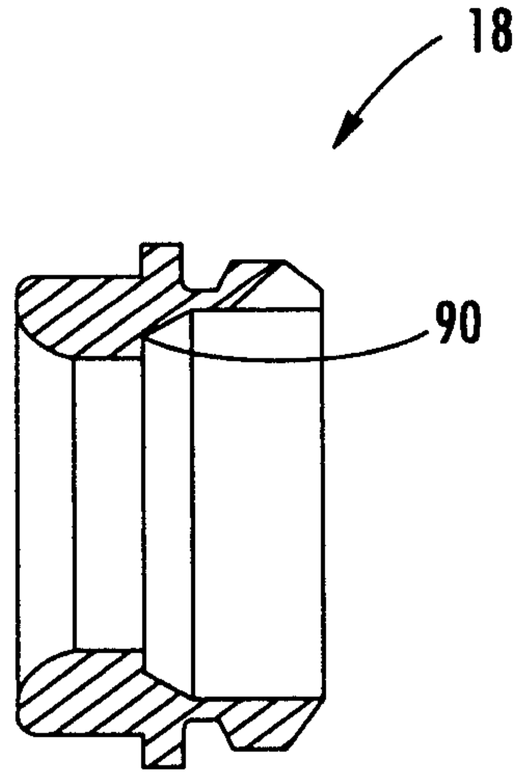



FIG. 28

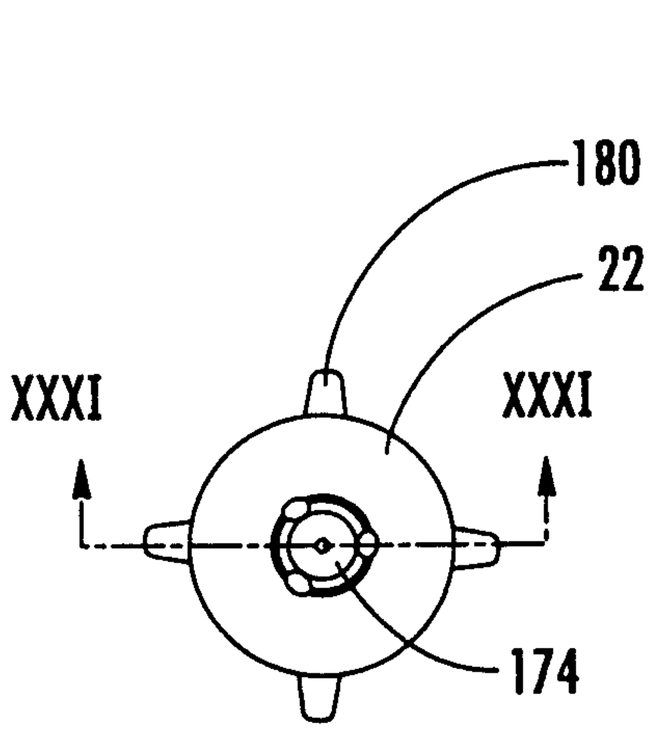



FIG. 30

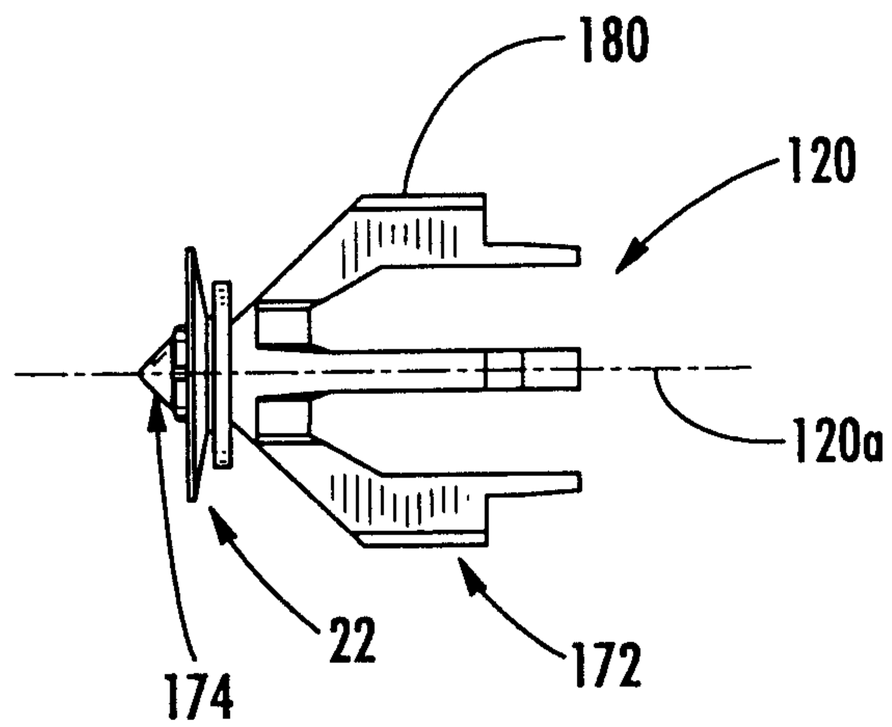



FIG. 29

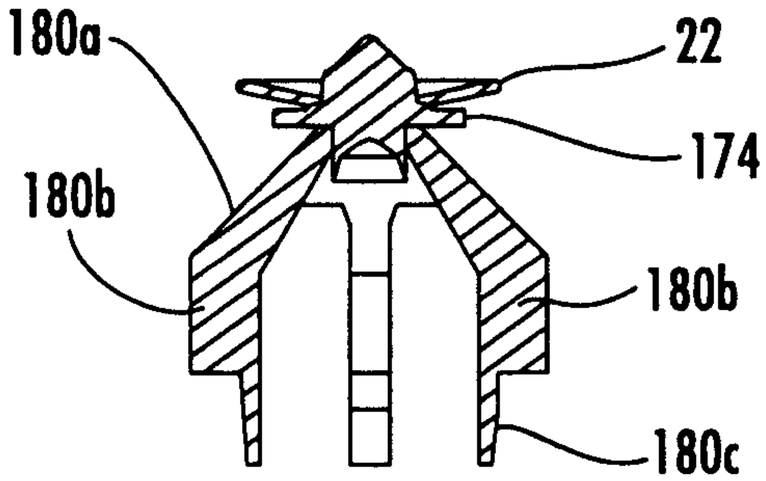



FIG. 31

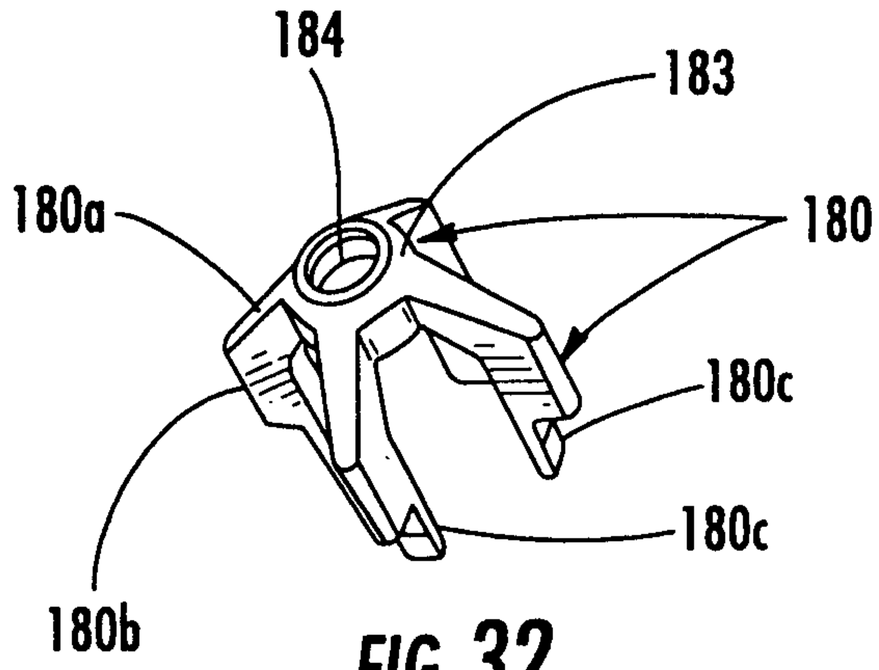



FIG. 32

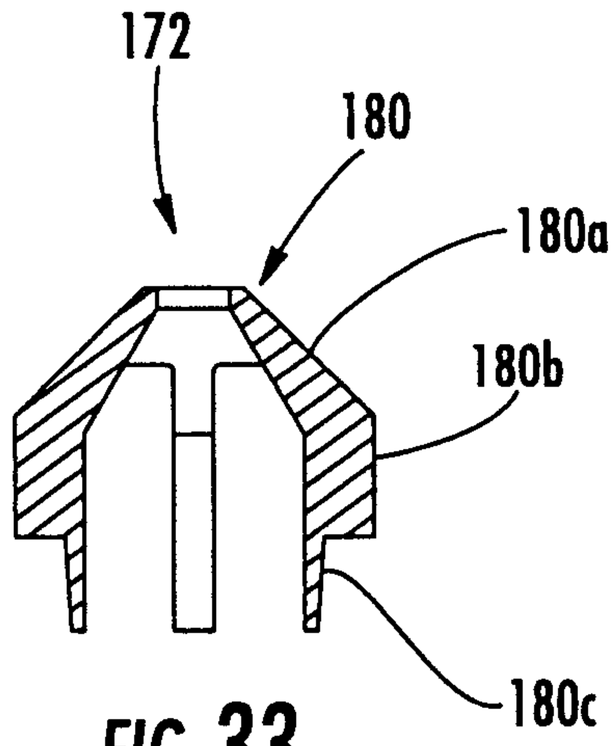



FIG. 33

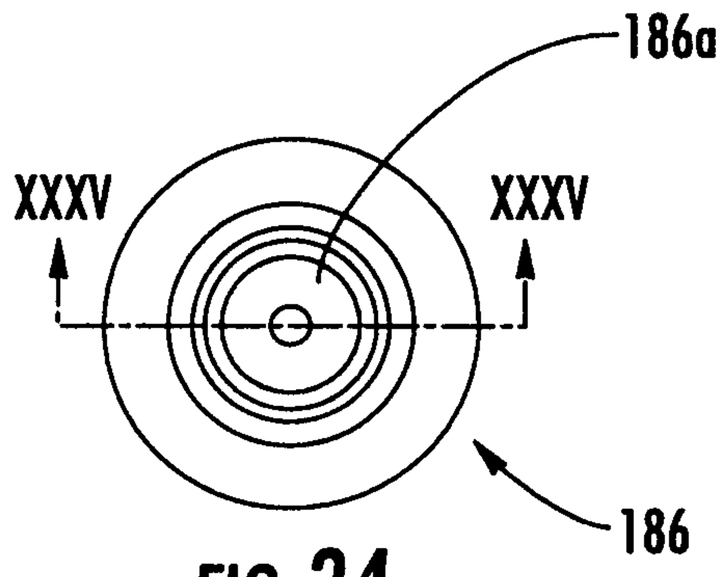



FIG. 34

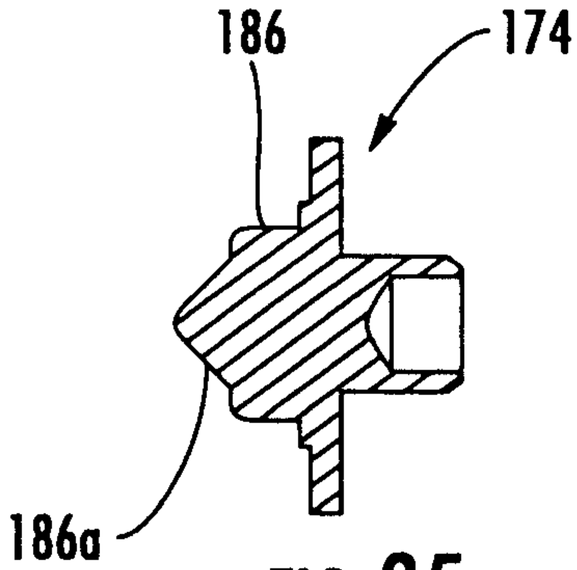
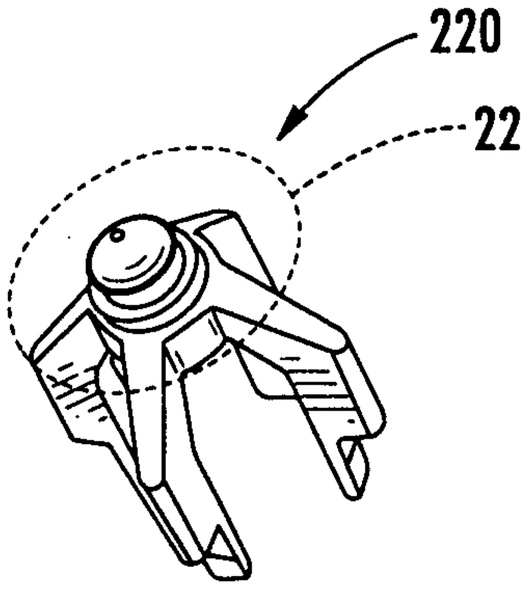



FIG. 35

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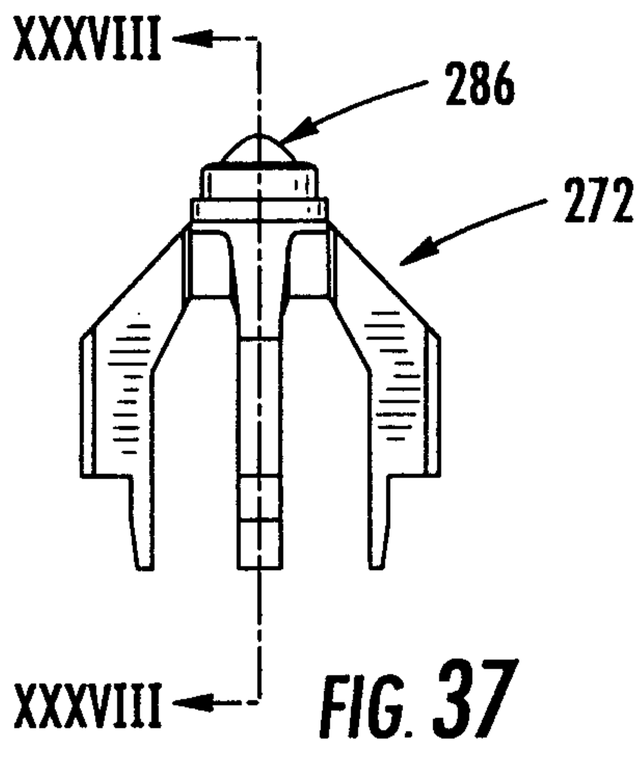



FIG. 37

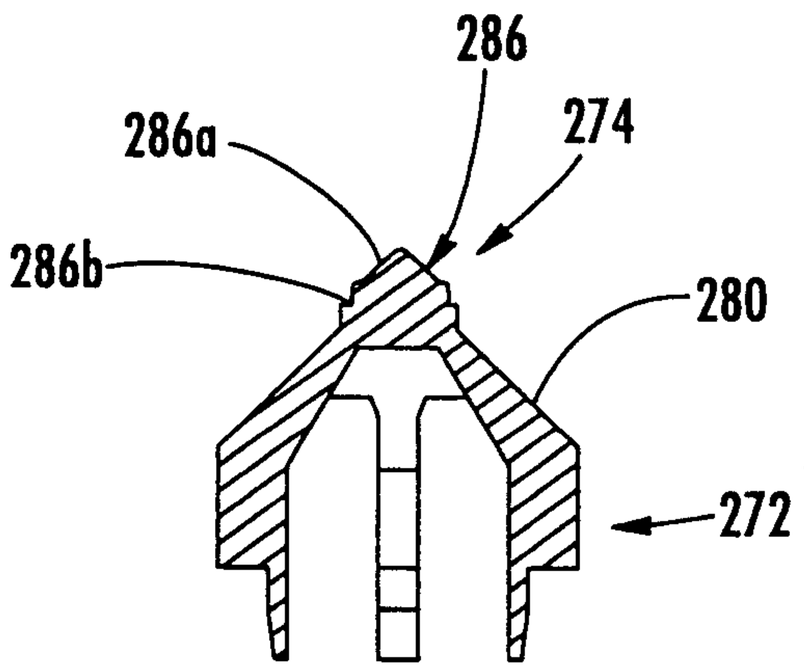
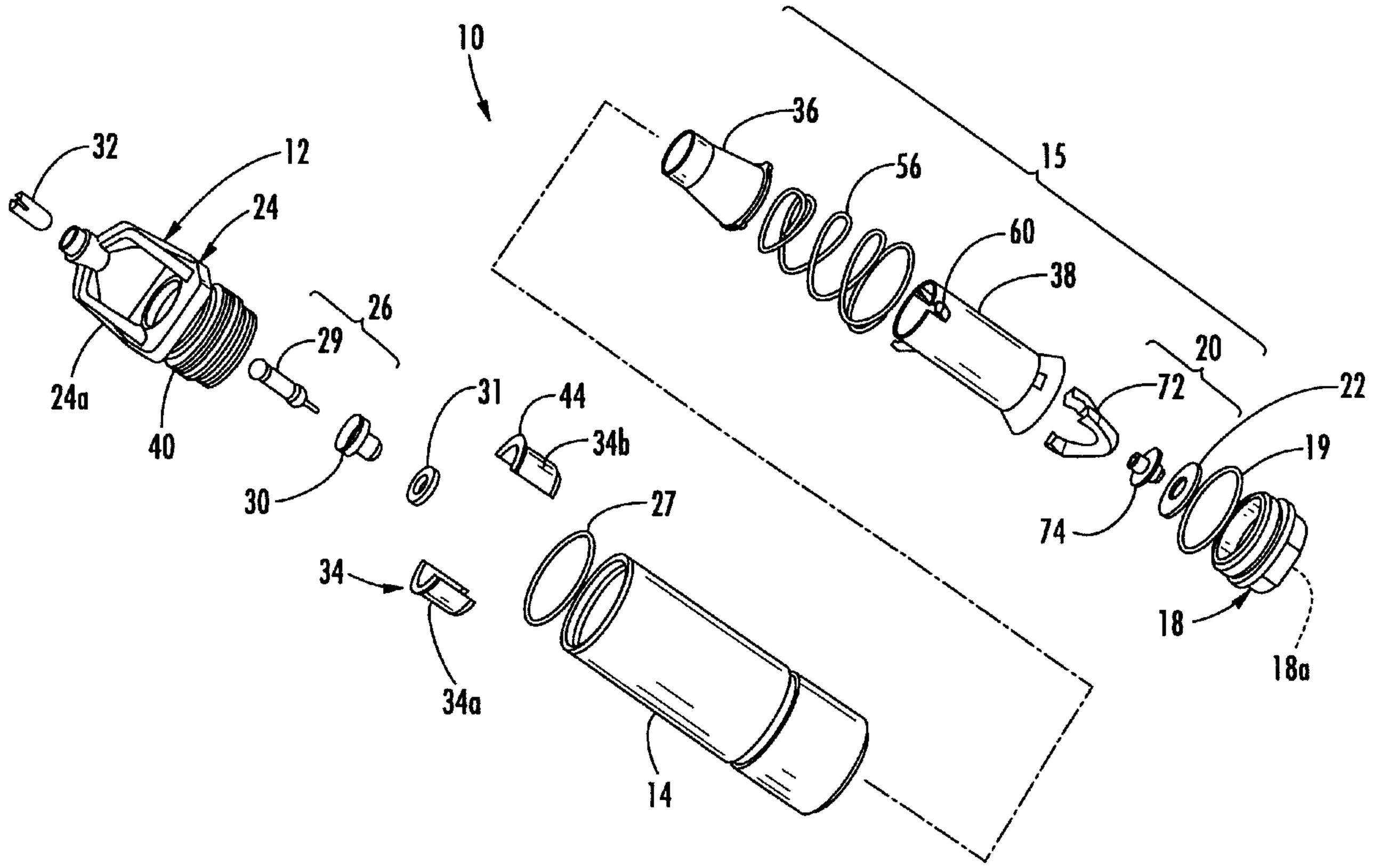



FIG. 38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