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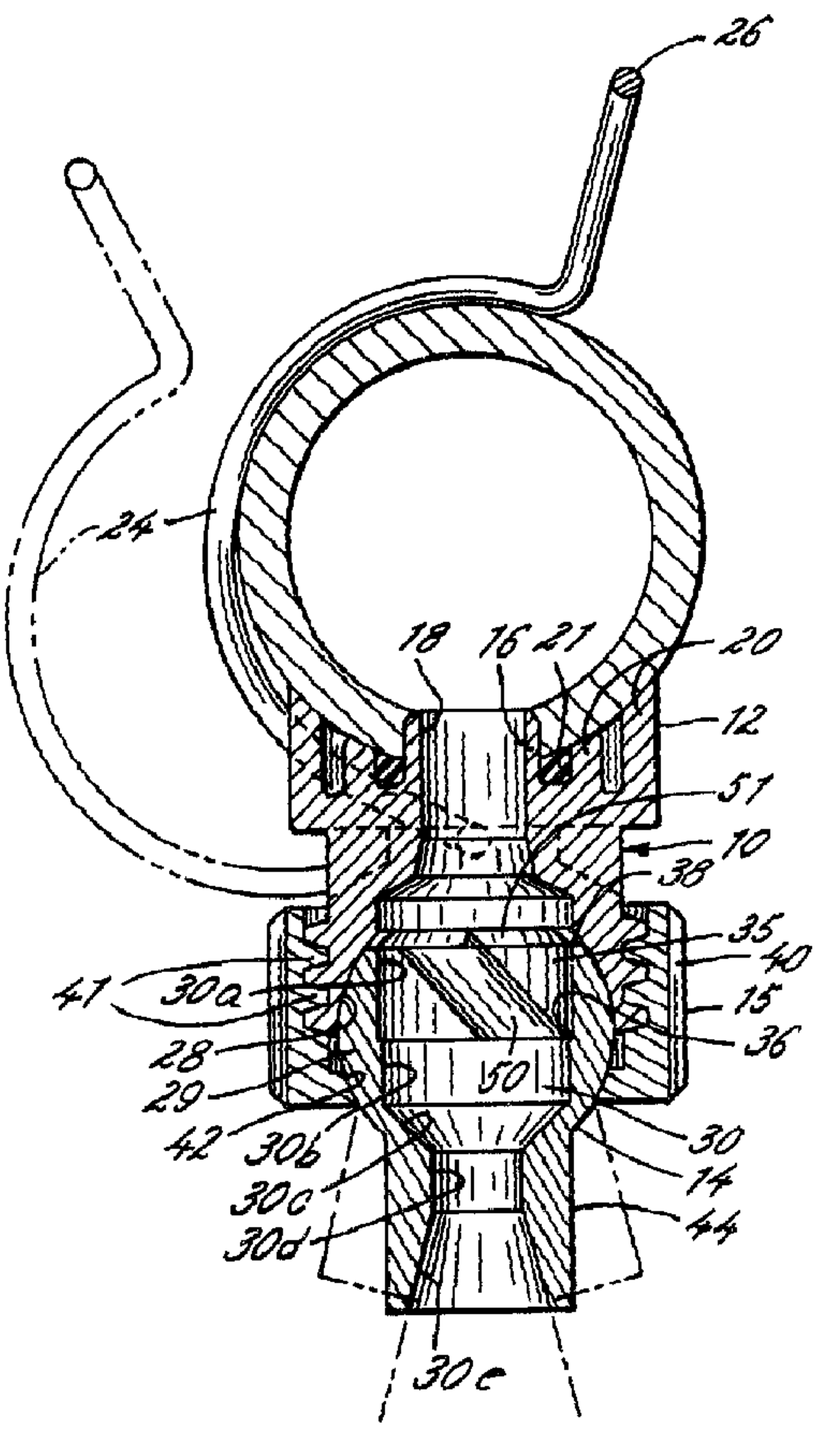
(54) Titre : BUSE DE VAPORISATION A CHAPEAU D'AIR DE JET EN CONE CREUX MONTE SUR ROTULE
(54) Title: SPRAY NOZZLE ASSEMBLY WITH SWIVEL MOUNTED HOLLOW CONE SPRAY TIP



(57) Abrégé/Abstract:
A spray nozzle assembly including a body and a nozzle tip having a ball-shaped mounting end for selected swivel positioning within a socket in the body. The nozzle tip contains a vein for imparting swirling movement to liquid passing through the nozzle

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assembly such that the discharging liquid has a hollow cone spray pattern. The vein has a pair of liquid flow passageways each having a diameter of at least .22 the diameter of the ball-shaped mounting end of the tip and at least .32 the diameter of the vein for permitting the free passage of liquids with relatively larger solid materials than heretofore possible with comparably sized nozzle elements. To ensure that the vein passageways extend through the vein without the existence of an axial see-through condition, the vein has a chamfered upstream end extending outwardly of the tip.

ABSTRACT OF THE DISCLOSURE

A spray nozzle assembly including a body and a nozzle tip having a ball-shaped mounting end for selected swivel positioning within a socket in the body. The nozzle tip contains a vein for imparting swirling movement to liquid passing through the nozzle assembly such that the discharging liquid has a hollow cone spray pattern. The vein has a pair of liquid flow passageways each having a diameter of at least .22 the diameter of the ball-shaped mounting end of the tip and at least .32 the diameter of the vein for permitting the free passage of liquids with relatively larger solid materials than heretofore possible with comparably sized nozzle elements. To ensure that the vein passageways extend through the vein without the existence of an axial see-through condition, the vein has a chamfered upstream end extending outwardly of the tip.

SPRAY NOZZLE ASSEMBLY WITH SWIVEL MOUNTED HOLLOW CONE SPRAY TIP

FIELD OF THE INVENTION

The present invention relates generally to spray nozzle assemblies, and more particularly, to spray nozzle assemblies of the type which have a selectively positionable swivel-mounted spray tip adapted for producing a hollow cone spray pattern.

BACKGROUND OF THE INVENTION

Spray nozzle assemblies are known, sometimes referred to as clip-eyelet nozzles, which comprise a body that may be clamped to a liquid supply pipe and which supports a nozzle tip in a conical socket for swivel movement in order to permit selected direction of the discharging spray. While various types of spray tips may be supported in the body socket, nozzle assemblies of such type which include a tip adapted for producing a hollow cone spray pattern have been particularly problem prone. In such nozzle assemblies, the spray tip commonly includes a vein upstream of the discharge orifice of the tip for imparting a whirling action to liquid sufficient to discharge the spray in a conical pattern about a central hollow air core.

Since such hollow cone nozzle assemblies are used in many industrial applications for spraying solids containing liquids, it is desirable that liquid passageways in the vein and tip be as large as possible to permit the free passage of the solids in the flow stream. On the other hand, space constraints dictated by the universal design of tip supporting body or particular application specifications, commonly require that the nozzle tip and vein be of limited size. In such case, it has been proposed to utilize a vein with a single relatively large port or

passageway in order to permit the free passage of the solids containing flow streams. Such single port veins, however, usually are ineffective in generating whirling action sufficient for producing a uniform hollow cone spray pattern. Instead, the discharging spray pattern can be uneven, and this condition can worsen depending upon the particular orientation of the nozzle tip. Moreover, relatively short length veins dictated by space limitations may not allow for sufficiently long vein passageways to effect adequate tangential direction of the passing liquid, nor prevent the existence of an axial see-through condition in the nozzle that permits the straight passage of a portion of the liquid without effect by the vein, which again deters from the performance of the nozzle and the desired spray pattern. To compensate for these problems and to prevent excessive pressure drops in the liquid passing through the nozzle, it has been necessary to utilize relatively small diameter flow passages in the vein and spray tip, which prevent effective spraying of liquids with relatively large solid materials therein.

OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the present invention to provide a spray nozzle assembly having a swivel mounted spray tip adapted for more effectively generating a uniform hollow cone spray pattern throughout its range of selective movement.

Another object is to provide a spray nozzle assembly as characterized above which is relatively small in size. A related object is to provide a nozzle assembly of the foregoing type in which the nozzle body has a relatively small diameter tip receiving socket that may be used with a variety of spray tips.

A further object is to provide a spray nozzle assembly of the above kind which includes a relatively small sized spray tip with a vein adapted for more effective tangential direction of liquid flow streams with relatively large sized solids.

Still another object is to provide a spray nozzle assembly of the foregoing type in which the swivel mounted tip has a dual passage vein and a relatively large diameter discharge orifice that permit unrestricted passage of relatively large sized solid materials within the liquid flow stream.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a perspective of a spray nozzle assembly embodying the present invention mounted on a liquid supply pipe;

FIG. 2 is an enlarged vertical section of the spray nozzle assembly shown in FIG. 1, taken in the plane of line 2-2;

FIG. 3 is an exploded perspective of the nozzle tip and vein of the illustrated spray nozzle assembly;

FIG. 4 is an enlarged upstream end view of the vein of the illustrated spray nozzle assembly taken in the plane of line 4-4 in FIG. 3;

FIGS. 5 and 6 are right side and front views, respectively, of the vein shown in FIG, 4;

FIG. 7 is a downstream end view of the vein taken in the plane of line 7-7 in FIG. 5; and

FIG. 8 is a fragmentary section taken in the plane of line 8-8 in FIG. 5.

While the invention is susceptible of various modifications and alternative constructions a certain

illustrated embodiment thereof has been shown in the drawings and will be described below in detail. It should be understood, however, that there is no intention to limit the invention to the specific form disclosed, but on the contrary, the intention is to cover all modifications, alternative constructions and equivalents falling within the spirit and scope of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawings, there is shown an illustrative spray nozzle assembly 10 embodying the present invention mounted on a pipe or liquid supply conduit 11. The supply conduit 11 typically would support a plurality of such nozzle assemblies at longitudinally spaced intervals and would be supplied with pressurized liquid, which may or may not include solid materials of various size.

The nozzle assembly 10 basically comprises a body 12, a nozzle tip 14 mounted for selective swivel positioning within the body 12, and a cap 15 for removably retaining the tip 14 in mounted position in the body. The nozzle body 12 is mounted on the underside of the supply conduit 11 and has an upstanding nipple 16 positioned within an aperture in the underside of the supply conduit 11 for permitting communication of liquid from the supply conduit 11 to a passageway 18 in the body 12. The nozzle body 12 has a curved base 20 of a diameter corresponding to the diameter of the conduit 11, and an "0" ring sealing member 21 is disposed about the nipple 16 in interposed relation between the conduit 11 and the body 12. For removably mounting the nozzle assembly 10 on the liquid supply conduit 11, an arcuate configured clip 24 is secured to the body 12.

The clip 24 has inwardly directed opposed ends 25

engageable in mounting apertures in opposed longitudinal sides of the body 12 that support the clip 24 for pivotal movement between a retracted position, shown in phantom in FIG. 2, and a mounted position engageably surrounding the supply conduit 11. The clip 24 in this instance has a handle portion 26 extending outwardly from the conduit 11 when in its mounted position to facilitate easy pivoting of the clip 24 during mounting and disassembly.

For permitting selective positioning of the tip 14 relative to the body 12, the body 12 is formed with a ball shaped socket recess 28 on its underside for receiving a ball shaped mounting end 29 of the tip 14. The recess 28 preferably has a relatively small radius, on the order of .56 inches, and is adapted for receiving common diameter mounting ends 29 of any of a variety of nozzle tips.

The tip 14 has a fluid passageway 30 communicating with the body passageway 18. The spray tip fluid passageway 30 is defined by a relatively large diameter upstream bore 30a, a whirl chamber 30b having an inwardly tapered, conical downstream end 30c, and a cylindrical discharge orifice 30d having an outwardly tapered conical discharge end 30e. For imparting swirling and tangential movement to liquid passing through the nozzle, a vein 35 is mounted within the upstream bore 30a of the tip 14. The bore 30a in this case is slightly larger in diameter than the whirl chamber 30b for defining a shoulder 36 against which the vein 35 is seated. The tip 14 has a flat upstream end 38, adjacent the entrance to the passage 30, which is in a plane perpendicular to the axis of the tip 14.

For retaining the nozzle tip 14 in mounted position in the body socket 28 and for securing it in

a selectedly adjusted position for directing the spray from the discharge orifice 30d in the desired direction, the retaining cap 15 is adapted for threadable engagement with external threads 41 of the body 12. The retaining cap 15 is formed with a central circular opening 42 slightly smaller in diameter than the diameter of the ball shaped mounting end 29 of the tip 14. It will be seen that by virtue of the ball and socket mounting of the tip 14 in the body 12, the tip 14 may be swiveled in a circular fashion relative to the body, limited by engagement of a depending cylindrical end 44 of the tip with the perimeter of circular opening 42 of the cap 15, and when properly positioned, the tip 14 may be secured by tightening of the cap 15 onto the threaded end of the body 12. The cap 15 in this instance has circumferentially spaced vertically oriented ridges 45 about its perimeter to facilitate gripping and turning of the cap 15 into and out of clamping engagement with the tip 14.

In accordance with the invention, the vein has a pair of relatively large diameter flow passageways and the tip has a comparatively sized discharge orifice for permitting the free passage of liquids with relatively large sized solids while being adapted for imparting sufficient whirling movement to the liquid in the whirl chamber such that a hollow cone spray with substantial uniformity is effected at any selected swiveled position of the nozzle tip. In the illustrated embodiment, the vein 35 is formed with a pair of angularly oriented flow passageways 50 on diametrically opposed sides thereof. The flow passageways 50 in this instance each are defined by an outwardly opening U-shaped slot having a diameter "d" and extending a distance "1" into the vein (FIG. 8).

For imparting substantially tangential direction to the liquid exiting the vein into the whirl chamber 30e of the nozzle tip 14, the passageways 50 preferably each have an exit angle Ø relative to the longitudinal axis of the tip of at least 40", and preferably about 42" (FIG. 5). To facilitate manufacture, the slots that define the vein passageways 50 extend in straight fashion through the nozzle tip 14 at a constant angle p relative to the longitudinal axis of the spray tip.

In carrying out the invention, the diameters of the vein passageways are relatively large as compared to the diameters of the vein and mounting end of the tip. More particularly, the ratio of the diameter "d" of the vein liquid passageways 50 to the diameter of the ball-shaped mounting end 29 of the tip is at least .22 and preferably about .24, and the ratio of the diameter "d" of the vein passage to the diameter of the vein is at least .32 and preferably about "34. The diameter of the discharge orifice 30d is no less than the diameter "d" of the vein passageways 50, and in the illustrated embodiment, the nozzle tip discharge orifice 30d is slightly larger than the diameter d of the vein passageways 50.

In accordance with a further feature of the invention, in order that the vein passageways have sufficient lengths to prevent the existence of an axial see-through condition in the vein 35, or in other words, a condition in which a portion of the liquid can pass straight through the vein 35 without effect from the vein and discharge from the nozzle tip within the air core or center of the hollow cone spray pattern, the vein 35 has an upstream extension or end 51 extending outwardly of the nozzle tip bore 30a. The extension 51, which may be on the order of '18 the length of the vein 35, enables the vein passageways 50

to have sufficient length to prevent an axial see-through condition. Without the extension, it will be understood by one skilled in the art that the vein passageways 50 would have to be disposed at a greater angle Ø relative to the longitudinal axis of the tip to prevent axial seethrough, which in turn would necessitate forming the flow passageways 50 with a smaller diameter, which in turn would impede or prevent the free passage of larger solid materials within the flow stream. The upstream extension 51 of the vein 35 in this instance is formed with a chamfer 52 so that the extension 51 does not impede pivotal movement of the tip 14 within the body socket 28.

In practice, the spray nozzle assembly 10 of the present invention has been found effective for generating relatively uniform distribution hollow cone spray patterns with liquids containing relatively larger sized solids, as compared to prior similarly sized nozzle assemblies. In a typical nozzle assembly, the nozzle tip 14 has a ball shaped mounting end 29 of a diameter of 1.125 inches mounted in a similarly size socket in the body. The vein 35 has a diameter of .804 inches and is disposed in the bore 30a in the tip 14 with a slight interference fit. The nozzle tip 14 has a discharge orifice 30d of a diameter of .363 inches. In such nozzle assembly, the vein 35 is formed with a pair of vein passageways 50 having a diameter "d" of .274 inches and extending inwardly from the periphery of the vein a distance "1" of .342 inches. The vein 35 has an overall length of .451 inches, with an end 52 extending outwardly of the nozzle tip a distance .080 inches. The vein passageways 50 have an exit angle Ø of %2" with respect to the longitudinal axis of the tip 14 and extend through the vein 35 in straight fashion on

diametrically opposed sides thereof without the existence of an axial see-through condition in the vein. During testing, such a nozzle assembly has been found to permit the free passage of solid metal balls of .25 inches in diameter and discharge liquid flow streams with a substantially uniform hollow cone spray pattern.

From the foregoing, it can be seen that the nozzle assembly of the present invention is adapted for effectively generating a uniform hollow cone spray pattern utilizing a nozzle body formed with a relatively small diameter nozzle tip receiving socket that may be used to support a variety of spray tips. While the ball-shaped mounting end of the nozzle tip and the vein are relatively small in size, they are effective for hollow cone spraying of liquids containing relatively larger sized solid materials than heretofore possible with comparably sized nozzle bodies and tips.

WHAT IS CLAIMED IS:

1. A spray nozzle assembly comprising

a body formed with a liquid flow passageway and a ball-shaped socket,

a nozzle tip having a fluid passageway for communication with said body passageway and a ball shaped mounting end for selected swivel positioning within said body socket,

means for retaining said nozzle tip in a selected swivel position in said body socket so that liquid directed through said body and tip passageways discharges from said tip in a predetermined direction with respect to said body,

a vein for imparting swirling movement to liquid directed through said tip whereby liquid discharging from said tip has a hollow cone spray pattern, said vein having a pair of liquid flow passageways communicating with said body and tip passageways, and said vein passageways each having a diameter of at least .22 the diameter of the ball shaped mounting end of said tip.

2. The nozzle assembly of claim 1 in which said vein is a cylindrical member and said vein passageways are disposed on diametrically opposed sides thereof.

3. The nozzle assembly of claim 2 in which said vein passageways are formed by outwardly opening U-shaped slots in opposed sides of the vein.

4. The nozzle assembly of claim 1 in which said nozzle tip fluid passageway defines a discharge orifice, and means defining a whirl chamber downstream of said vein and upstream of said nozzle tip discharge orifice.

5. The spray nozzle assembly of claim 4 in which said nozzle tip discharge orifice is at least as large as each of the vein passageways.

6. The spray nozzle assembly of claim 4 in which said vein is disposed in an upstream end of said nozzle tip.

7. The spray nozzle assembly of claim 6 in which said vein has an end portion extending outwardly of the upstream end of said nozzle tip.

8. The spray nozzle assembly of claim 7 in which said outwardly extending vein end portion is .18 the overall length of said vein.

9. The spray nozzle assembly of claim 4 in which each said vein passageway directs liquid into said whirl chamber at an exit angle of at least 40" to the longitudinal axis of said tip.

10. The spray nozzle assembly of claim 9 in which each said vein passageway directs liquid into said whirl chamber at an exit angle of 42" to the longitudinal axis of said tip.

11. The spray nozzle assembly of claim 1 in which said vein passageways extend through said vein without the existence of an axial see-through condition so that liquid passing through the vein is tangentially directed.

12. The spray nozzle assembly of claim 11 in which said vein passageways extend through said nozzle in straight fashion.

13. The spray nozzle assembly of claim 1 in which said nozzle tip passageway defines an upstream bore within which said vein is mounted, a whirl chamber downstream of said vein, and a discharge orifice downstream of said whirl chamber.

14. The nozzle assembly of claim 13 in which said discharge orifice has a cylindrical configuration with an outwardly flared downstream end.

15. The spray nozzle assembly of claim 1 in which said vein has an end portion extending outwardly of the upstream end of said nozzle tip, and said vein

end portion is chamfered so as not to interfere with pivotal positioning of said nozzle tip within said body socket.

16. The nozzle assembly of claim 1 in which the ratio of the diameter of each vein passageway to the diameter of the ball-shaped mounting end of the tip is .24.

17. The nozzle assembly of claim 1 in which the ratio of each vein passageway to the diameter of the vein is at least .32.

18. A spray nozzle assembly comprising

a body formed with a liquid flow passageway and a ball-shaped socket,

a nozzle tip having a fluid passageway for communication with said body passageway and a ball shaped mounting end for selected swivel positioning within said body socket,

means for retaining said nozzle tip in a selected swivel position in said body socket so that liquid directed through said body and nozzle tip passageways discharges from said tip in a predetermined direction with respect to said body,

a cylindrical vein for imparting swirling movement to liquid directed through said tip whereby liquid discharging from said tip has a hollow cone spray pattern, said vein having a pair of liquid flow passageways communicating with said body and tip passageways, and said vein passageways each having a diameter of at least .32 the diameter of the vein.

19. The nozzle assembly of claim 18 in which said nozzle tip liquid passageway defines a discharge orifice, means defining a whirl chamber downstream of said vein and upstream of said nozzle tip discharge

orifice, and said discharge orifice is at least as large as each of the vein passageways.

20. The spray nozzle assembly of claim 4 in which said vein is disposed in an upstream end of said nozzle tip, said vein having an end portion extending outwardly of the upstream end of said nozzle tip, and said vein passageways extend through said vein without the existence of an axial see-through condition so that all liquid passing through the vein is tangentially directed into said whirl chamber.

21. The spray nozzle assembly of claim 20 in which said vein end portion is chamfered so as not to interfere with pivotal positioning of said nozzle tip within said body socket.

22. A spray nozzle assembly comprising

a body formed with a liquid flow passageway and a ball-shaped socket,

a nozzle tip having a fluid passageway for communication with said body passageway and a ball shaped mounting end for selected swivel positioning within said body socket,

means for retaining said nozzle tip in a selected swivel position in said body socket so that liquid directed through said body and tip passageways discharges from said tip in a predetermined direction with respect to said body, and

a vein disposed within an upstream end of said nozzle tip and being formed with a pair of passageways for imparting swirling movement to liquid directed through said tip whereby liquid discharging said tip has a hollow cone spray pattern, said vein having an end portion extending outwardly of the upstream end of said tip, and said vein passageways extending through said vein without the existence of an axial

see-through condition so that all liquid passing through the vein is tangentially directed.

23. The spray nozzle assembly of claim 22 in which each said vein passageway directs liquid at an exit angle of at least 40" to the longitudinal axis of said tip.

24. A spray nozzle assembly comprising

a body formed with a liquid flow passageway and a ball-shaped socket,

a nozzle tip having a fluid passageway for communication with said body passageway and a ball shaped mounting end for selected swivel positioning within said body socket, said nozzle tip fluid passageway defining a discharge orifice and a whirl chamber upstream of said discharge orifice,

means for retaining said nozzle tip in a selected swivel position in said body socket so that liquid directed through said body and tip passageways discharges from said tip in a predetermined direction with respect to said body, and

a vein disposed in an upstream end of said nozzle tip and being formed with a pair of fluid passageways for imparting swirling movement to liquid directed through said tip into said whirl chamber whereby liquid discharging from said discharge orifice has a hollow cone stray pattern, said vein having an upstream end extending outwardly of said nozzle tip, and said vein passageways extending through the vein without the existence of an axial see-through condition so that all liquid passing through the vein is tangentially directed into said whirl chamber.

25. The nozzle assembly of claim 24 in which the ratio of each vein passageway to the diameter of the vein is at least .32.

26. A spray nozzle assembly comprising

a body formed with a liquid flow passageway and a ball-shaped socket,

a nozzle tip having a fluid passageway which defines a discharge orifice in communication with said body passageway and a ball-shaped mounting end for selected swivel positioning within said body socket,

means for retaining said nozzle tip in a selected swivel position in said body socket so that liquid directed through said body and tip passageways discharges from said tip in a predetermined direction with respect to said body,

a vein having a pair of liquid flow passageways communicating with said body and tip passageways for imparting swirling movement to liquid directed through said tip whereby liquid discharging from said tip has a hollow cone spray pattern, and

said body socket having a diameter of less than 1.2 inches, said vein passageways and said nozzle tip discharge orifice each having a diameter of at least 26 inches, and said body passageway, vein passageway and nozzle tip passageway being operable for permitting the free passage and spraying of liquids containing solids up to .25 inches in diameter.

27. The spray nozzle assembly of claim 26 in which said vein is disposed in an upstream end of said nozzle tip, said vein having an end portion extending outwardly of the upstream end of said nozzle tip, means defining a whirl chamber downstream of said vein, and said vein passageways extend through said vein without the existence of an axial see-through condition so that all liquid passing through the vein is tangentially directed into said whirl chamber.

28. The spray nozzle assembly of claim 27 in which said vein end portion is chamfered so as not to

interfere with pivotal positioning of said nozzle tip within said body socket.

29. The spray nozzle assembly of claim 26 in which said nozzle tip passageway defines an upstream bore within which said vein is mounted, a whirl chamber downstream of said vein, and said discharge orifice downstream of said whirl chamber.

30. A spray nozzle assembly for mounting on a liquid supply pipe comprising

a body formed with a liquid flow passageway and a ball-shaped socket, means for mounting said body on said supply pipe with said flow passageway in communication with liquid in said pipe,

a nozzle tip having a flow passageway in communication with said body passageway and a ball shaped mounting end for selected swivel positioning within said body socket,

means for retaining said nozzle tip in a selected swivel position in said body socket so that liquid directed through said body and tip passageways discharges from said tip in a predetermined direction with respect to said body,

a vein for imparting swirling movement to liquid directed through said tip whereby liquid discharging from said tip has a hollow cone spray pattern, said vein having a pair of liquid flow passageways communicating with said body and tip passageways, and said vein passageways each having a diameter of at least .22 the diameter of the ball shaped mounting end of said tip.

31. The spray nozzle assembly of claim 30 in which said body mounting means includes means for releasably securing said body in mounted position on said pipe.

32. The spray nozzle assembly of claim 31 in which said releasable securing means is a clip mounted on said body for pivotal movement between a first position positively engaging said pipe and a second position removed from said pipe.

33. The spray nozzle assembly of claim 32 in which said body has an upstream nipple positioned into and communicating with the interior of said pipe.

34. The spray nozzle assembly of claim 31 in which said vein is disposed in an upstream end of said nozzle tip, said vein having an end portion extending outwardly of the upstream end of said nozzle tip, means for defining a whirl chamber downstream of said vein, and said vein passageways extending through said vein without the existence of an axial see-through condition so that all liquid passing through the vein is tangentially directed into said whirl chamber.

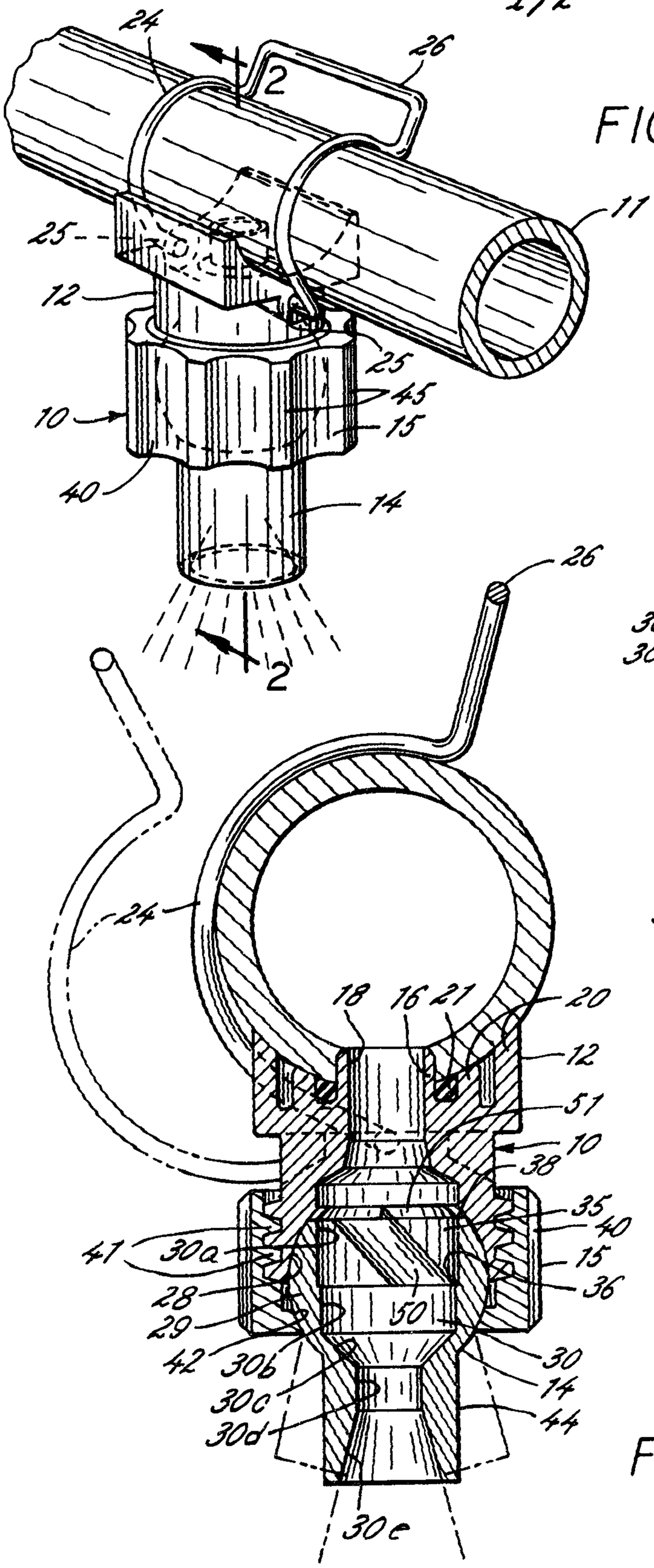

FIG. 2

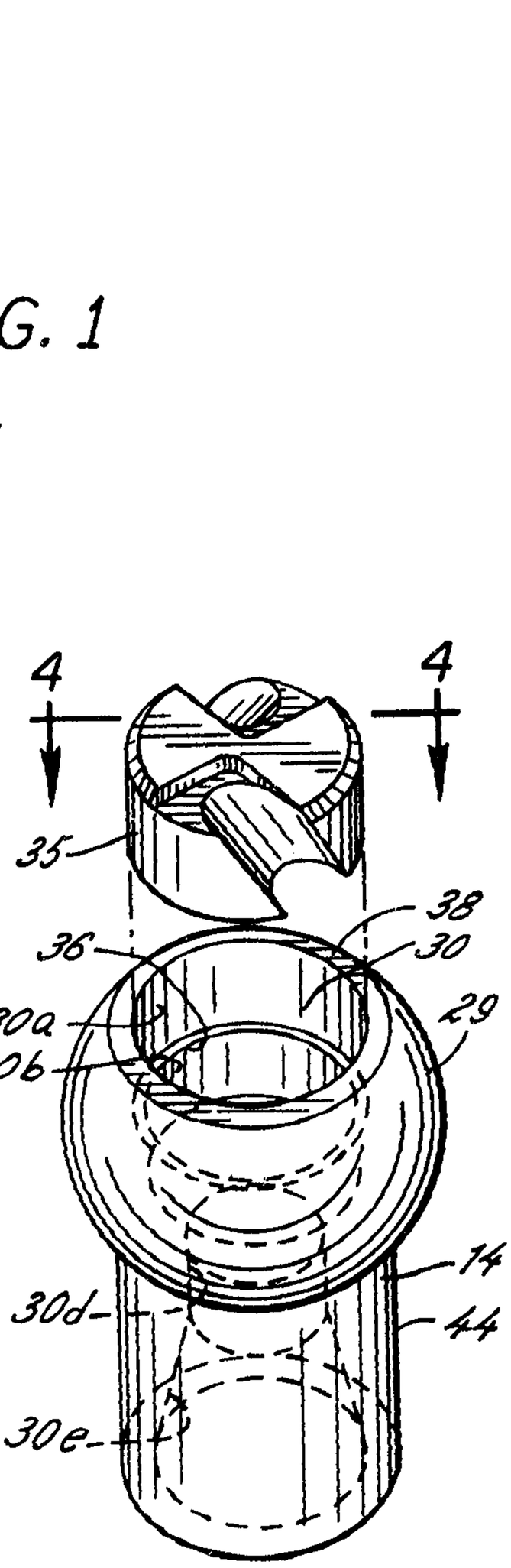

FIG. 3

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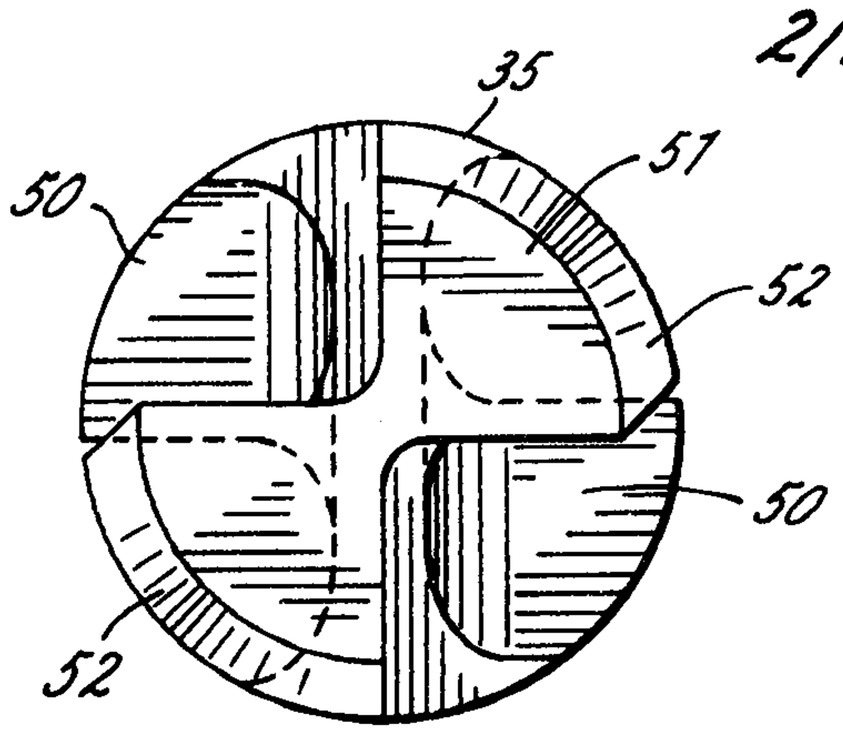

FIG. 4

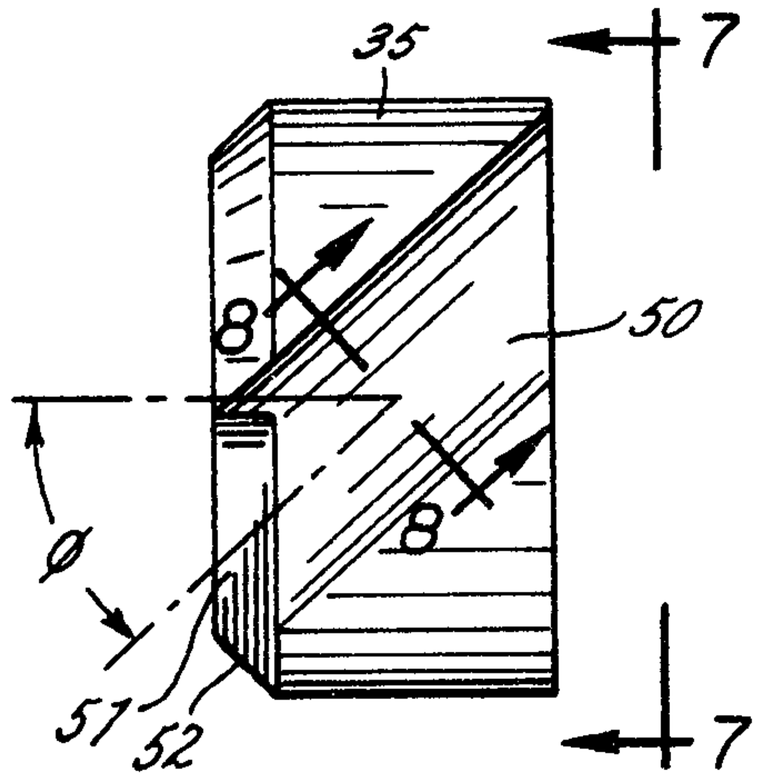

FIG. 5

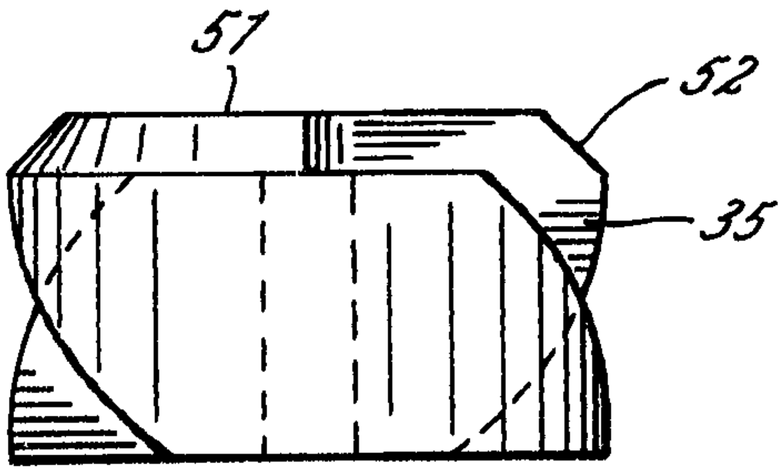

FIG. 6

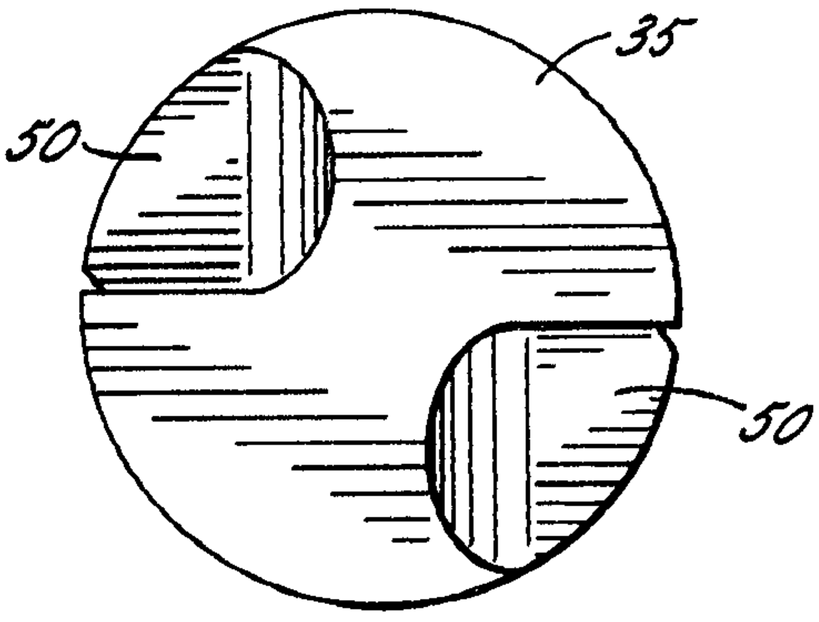

FIG. 7

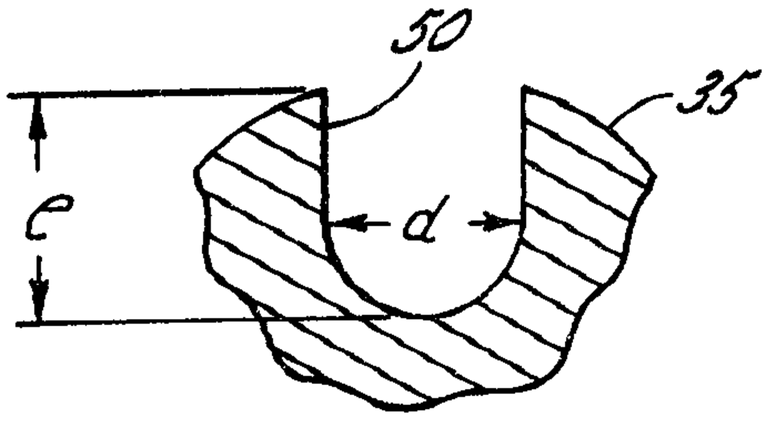

FIG. 8

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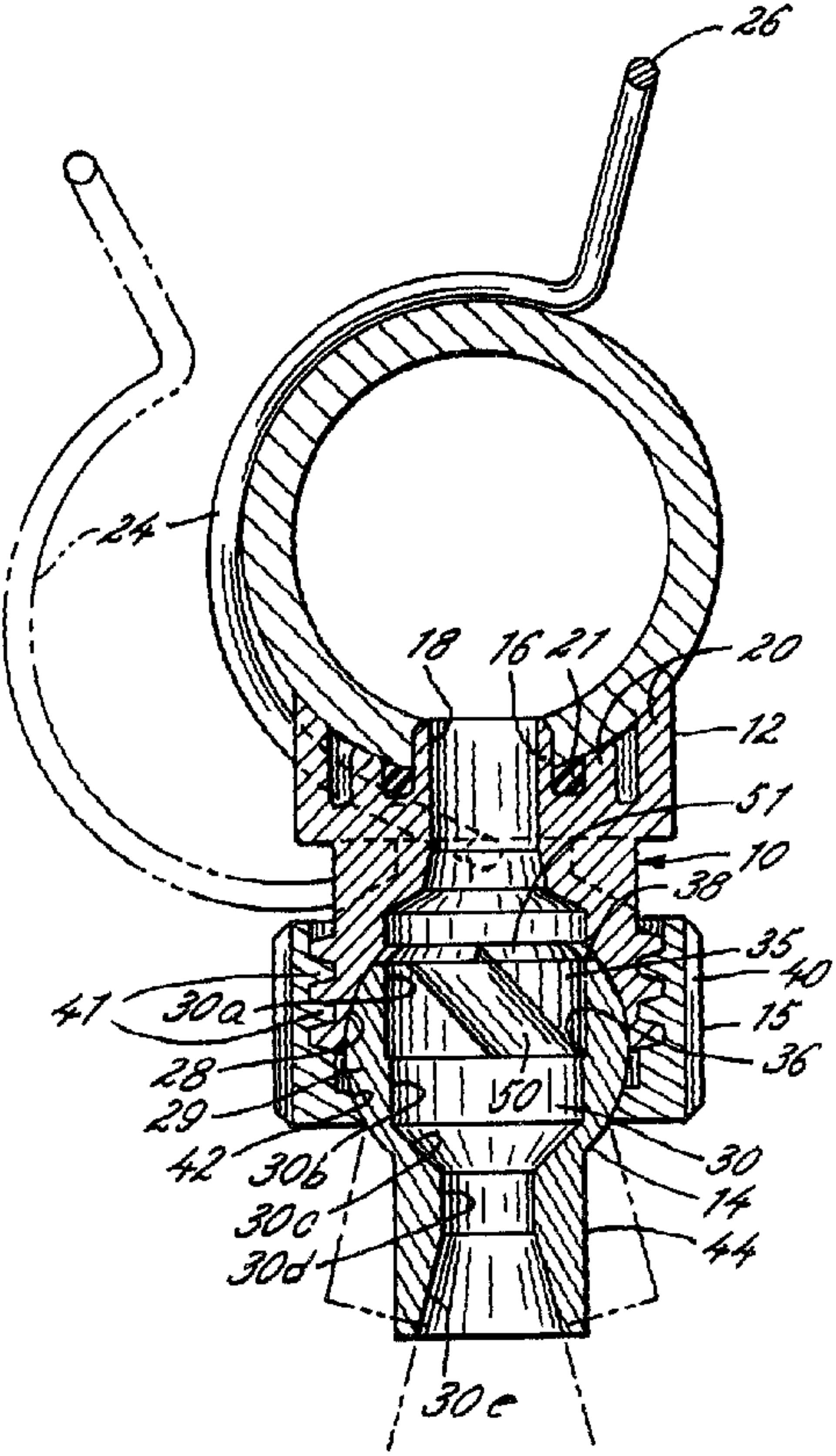
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