

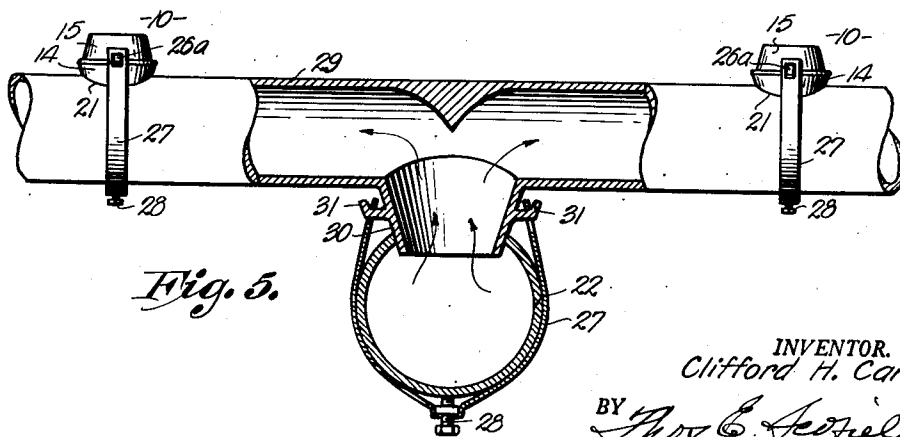
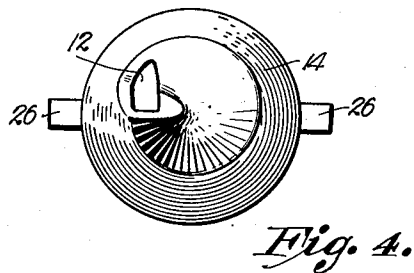
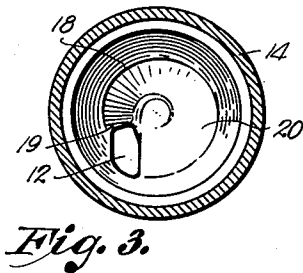
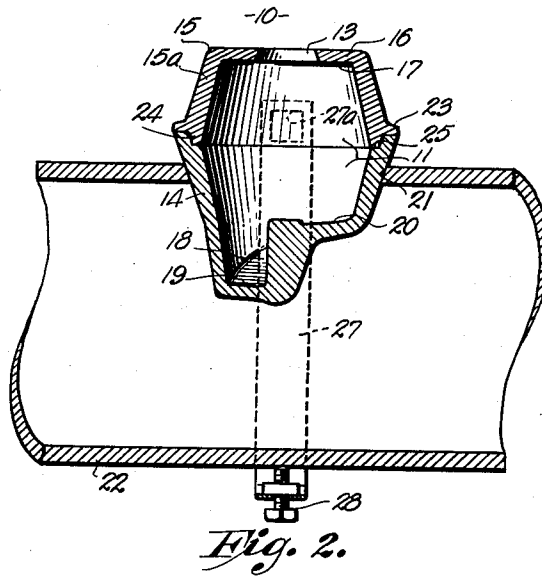
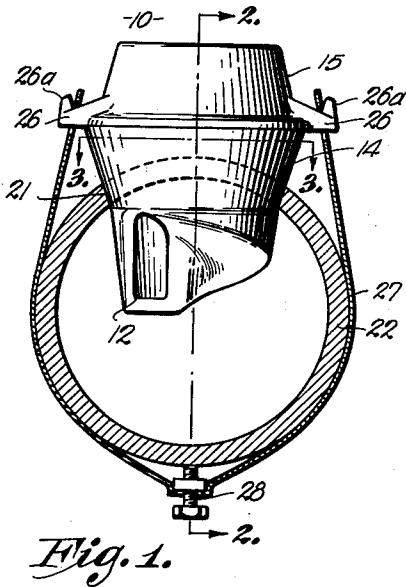
July 7, 1953

C. H. CARR
INSERT NOZZLE

2,644,720

Filed Dec. 16, 1949

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

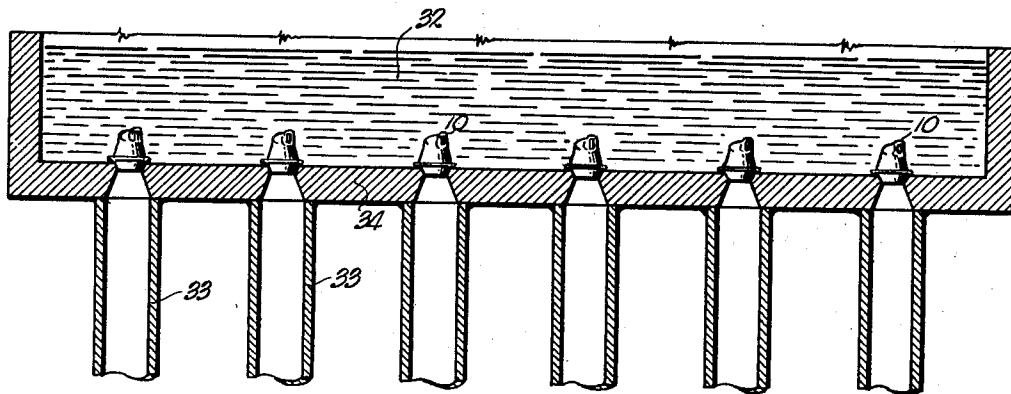


Fig. 6.

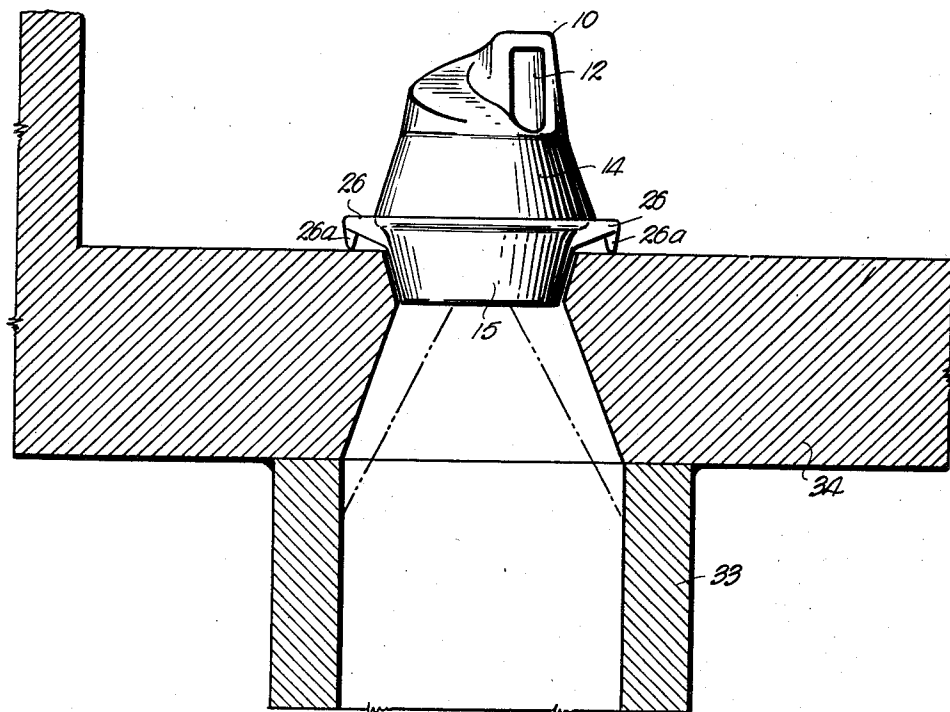


Fig. 7.

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UNITED STATES PATENT OFFICE

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INSERT NOZZLE

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Application December 16, 1949, Serial No. 133,418

10 Claims. (Cl. 299-114)

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My invention relates to liquid spray nozzles and refers more particularly to nozzles for cooling liquids by spraying the liquid into a cooling atmosphere in the form of conical sprays. This type of nozzle is adapted for use in spray cooling systems such as cooling ponds, cooling towers, systems for washing, cooling, humidifying or dehumidifying air, and aeration of sewage or for chemical spraying.

The present invention is an improvement over that disclosed in United States Letters Patent No. 2,270,033, granted January 13, 1942.

Generally speaking, the type nozzle to which the present invention relates comprises a whirl chamber which has an inlet tangent to the outside wall so the velocity of the incoming liquid imparts a whirling motion to the liquid passing through the nozzle and discharging through an outlet orifice whose axis is at right angles to the whirl chamber of the nozzle and inlet.

A salient feature of the invention resides in the elimination of the usual threaded connections since the construction of the nozzle body is such that it may be inserted by a press fitting into the side of a flow pipe. In other words, the body of the nozzle is constructed to fit an aperture in the pipe or header made with a standard pipe beveling tool.

In nozzles of this type prior to my invention it has been the usual practice to connect the nozzles to supply headers or branch pipes by using standard fittings employing threaded connections. The cutting and threading of pipe for attachment of such nozzles as well as the providing nipples, couplings and other necessary pipe fittings entail expensive labor operations but also costly materials. The instant invention represents a departure from the usual practice in that it provides a nozzle construction easily insertable into round apertures cut into the side of the flow pipe bevelled with a standard pipe reamer at proper spacing and secured to the pipe by simple clamping means. At the same time the advantages of the nozzle described in Letters Patent No. 2,270,033 mentioned hereinbefore are preserved in that a major part of the energy of the incoming pressure head is converted into kinetic energy of rotation and the areas of the inlet and outlet are so related that substantially no back pressure develops in the whirl chamber. The spray contour or discharge of the liquid from the nozzle outlet is therefore governed substantially entirely by the centrifugal force urging a thin film of the liquid over the inside surfaces of the outlet orifice.

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It is an object of my invention, therefore, to provide a nozzle construction that may be inserted into the side of a pipe without the use of fittings normally required yet retain the advantages of the nozzle construction disclosed in the Letters Patent No. 2,270,033.

Another object of the invention is to provide a nozzle construction which has an inlet immediately enlarged as it enters the nozzle so any solid particles that enter will pass through the nozzle without clogging and any solid particles even to substantially the size of the inlet will pass through due to its streamlined construction.

A further object of the invention is to provide a nozzle which will produce a uniform spray at lower pressures than are now standard for similar devices.

Another object is to provide a nozzle construction that permits the inlet of the nozzle to be adjusted in any direction.

Still another object is to provide a nozzle whose pipe insert portion is streamlined to reduce flow interference and turbulence thereby permitting installation of more nozzles on small branch headers than would usually be operable.

A further object is to provide a nozzle which can be cast in two pieces without the usual sand core and metal stamping, thus effecting a substantial economy in production.

Other objects and features of the invention will appear from the description which follows. In the accompanying drawings which form a part of the specification and are to be read in conjunction therewith and in which like reference numerals refer to like parts in the various views,

Fig. 1 is a side view of a nozzle embodying the invention installed in a pipe,

Fig. 2 is a sectional view taken along the line 2-2 in Fig. 1 in the direction of the arrows,

Fig. 3 is a sectional view taken along the line 3-3 in Fig. 1 in the direction of the arrows,

Fig. 4 is a bottom view,

Fig. 5 is a view partly in section showing a modified use of the invention,

Fig. 6 is a sectional view of a vertical condenser showing another modified use and,

Fig. 7 is an enlarged view of a portion of the condenser shown in Fig. 6.

Referring to the drawings, the nozzle as a whole has been designated by the numeral 10. Its cone-shaped whirl chamber 11 has an inlet 12 and an outlet 13, the axes of the inlet and outlet openings being at substantially right angles to each other and laterally displaced. The nozzle body is constructed in two pieces, a lower portion 14

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and an upper portion or cap 15. The whirl chamber 11 is formed within the united parts and has a top 16 having a smooth inner surface 17 surrounding the outlet. The bottom of the whirl chamber adjacent the inlet and designated by the numeral 18 is in the form of a helix. The helix which forms the inlet rotates the liquid through 180° as it enters the whirl chamber. The floor of the helix, numbered 19 at the entrance and as 20 where it merges into the floor of the whirl chamber, is indicated best in Fig. 2. The pitch of the helix in the drawings is illustrated to be substantially the same as the height of the opening to the whirl chamber.

The wall of the lower portion 14 is tapered toward the bottom and serves to wedge the nozzle body in the pipe when it is fitted in a bevelled opening 21, best shown in Figs. 1, 2 and 7. As previously stated the within pipe construction of the nozzle is such as to cause a minimum of flow resistance to the fluid.

The cap portion 15 is flanged at 23 and has a downwardly extending annular ring portion 24 which registers with and fits into a corresponding annular groove 25 inside the upper edge of the lower half of the nozzle. Fitting of the two parts in this manner forms a stepped lap joint which reduces or eliminates leakage, without interrupting the smooth continuity of the whirl chamber 11. The wall of the cap portion is likewise circular and tapers upwardly, providing a surface similar to that on the lower part which may be used as the joint or union with the bevelled aperture of the flow pipe or header. Two ears, 26 extend diametrically from the lower margin of the cap portion 15. These ears are integral with the cap and have upturned ends 26a which serve as attachments for the clamping means which mount the nozzles on the pipe.

In the embodiment shown in Figs. 1 and 2, the lower section 14 of the nozzle is inserted into the bevelled opening 24 in the pipe wall 22 and the cap is then fitted in groove 25. A steel strap 27 apertured midway its length and near its ends as indicated in Figs. 1 and 2 is wrapped around the pipe and attached to the hooks 26a extending upwardly at the ends of ears. A tightening bolt 28 is fitted into the central aperture of the strap and when screwed against the pipe draws the nozzle into a liquid tight union with the pipe and holds the two parts of the nozzle fixedly engaged. With this type fastening the nozzle inlet may be adjusted in any direction depending upon the cleanliness of the liquid. If the fluid is clean, the inlet may be placed facing its direction of flow; if there is foreign matter in the fluid, the inlet is faced away from the direction of flow to reduce likelihood of clogging. The particular type of clamping means may be varied so long as the parts of the nozzle are held rigidly together and the nozzle body is sealed firmly in the pipe. A further feature of importance is the fact that the nozzle is so constructed that it may be easily fitted into a bevelled opening in a pipe and is clamped by a simple strapping means, thus eliminating fittings, threading of pipe and additional materials and operations usual to the attachment of nozzles, liquid flow pipes, headers or manifolding.

While tests indicate little difficulty in obtaining liquid tight joints, a small amount of leakage is unobjectionable, and if desired, a rubber gasket may be inserted in the connection. A modified form of the invention is illustrated in Fig. 5 wherein a branch pipe 29 is connected to a main flow line 22 by a joint similar to that de-

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scribed above. A tapered T connection 30 is provided on the branch pipe with hooked shaped ears, 31, extending opposite sides thereof. The branch pipe or manifold is clamped onto the flow pipe in the same fashion as the nozzles were attached to the flow pipe or header as described hereinbefore. With this type connection numerous nozzles may be mounted on the branch pipe 29 instead of having but one nozzle connected into the main flow pipe 22.

Figs. 6 and 7 illustrate a further modified use wherein the nozzle caps are used as the insert joints and the flow is from a liquid body 32 through the nozzles with individual sprays jetting into the vertical tubes 33. The pressure head of water above the nozzles serve to keep the nozzles firmly lodged in the bevelled openings in the floor of the reservoir or tube header 34. By using the nozzles in this manner the cones of water from the nozzles are spread upon the inside surfaces of the tubes distributing the water uniformly thereover in a swirling motion, thus increasing the heat transfer and efficiency of the apparatus. Thus such use of the nozzles in a condenser or heat exchanger reduces difficulties with foreign matter since the dirt and scale will tend to settle on the header 34 of the heat exchanger and the nozzles act as short standpipes blocking their entrance to the tubes. By eliminating the tubes 33, the arrangement shown in Figs. 6 and 7 may be employed as a water spray distribution system, permitting operation with very low heads.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinbefore set forth together with other advantages which are obvious and which are inherent to the apparatus disclosed.

It will be understood that certain features and subcombinations are of utility and may be employed with reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

While I have disclosed some uses of my invention, many other possible embodiments and uses may be made without departing from the scope thereof. Therefore, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. In combination, a fluid receptacle having an aperture in one wall thereof, a cup-shaped member disposed in said aperture with its bottom on one side of said wall and its rim on the other, said member being larger in size at its rim than said aperture but tapering externally from the rim toward the bottom and the tapered portion being seated against the margin of said aperture; a second cup-shaped member inverted with respect to said first member and disposed with its rim abutting the rim of said first member whereby said cup-shaped members together form an enclosed whirl chamber of a spray nozzle, means for applying solely on said second member a force directed toward said wall thereby to maintain said rims together and hold said tapered portion seated against the margin of said aperture, said second member containing a fluid port, said first member containing a fluid port on the opposite side of said wall from said first port whereby fluid is adapted to flow from said receptacle through said chamber via said ports, and one of said fluid ports comprising a tangential inlet passage for said whirl chamber.

2. A combination as in claim 1 wherein the

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rim of said cupped members have complementary rabbeted edges forming a stepped lap joint.

3. In combination, a fluid receptacle having an aperture in one wall thereof, a cup-shaped member disposed in said aperture with its bottom on one side of said wall and its rim on the other, said member being larger in size at its rim than said aperture but tapering externally from the rim toward the bottom and the tapered portion being seated against the margin of said aperture, a second cup-shaped member inverted with respect to said first member and disposed with its rim abutting the rim of said first member whereby said cup-shaped members together form an enclosed whirl chamber of a spray nozzle, clamping means unconnected with said first member between said second member and said wall for drawing the two toward one another thereby to maintain said rims together and hold said tapered portion seated against the margin of said aperture, said second member containing a fluid port, said first member containing a fluid port on the opposite side of said wall from said first member whereby fluid is adapted to flow from said receptacle through said chamber via said ports, and one of said fluid ports comprising a tangential inlet passage for said whirl chamber.

4. In combination, a fluid conduit having an aperture in the wall thereof, a cup-shaped member having its bottom projecting through said aperture into said conduit and having its rim on the outside thereof, a second cup-shaped member inverted with respect to said first member and disposed with its rim abutting the rim of said first member whereby the two cup-shaped members together form an enclosed whirl chamber of a spray nozzle, means including an element embracing the conduit and connected to said second member for drawing the latter toward said conduit thereby to maintain said rims in abutment and urge the rim of said first member toward said conduit, complementary annular abutting surfaces on said first member and said conduit limiting the inward movement of said first member and sealing said aperture around said first member, said first member containing at a point within said conduit a tangential inlet passage for the whirl chamber thereby to admit fluid from said conduit into said chamber, and a fluid discharge orifice in said second member.

5. In combination, a fluid conduit having an aperture in the wall thereof, a cup-shaped member having its bottom projecting through said aperture into said conduit and its rim on the outside of the conduit, a second cup-shaped member inverted with respect to said first member and disposed with its rim abutting the rim of said first member whereby the two cup-shaped members together form an enclosed whirl chamber of a spray nozzle, clamping means connected to said second member and to said conduit for drawing said second member toward the conduit thereby to maintain said rims in abutment and urge the rim of said first member toward said conduit, complementary annular abutting surfaces on said first member and said conduit limiting the inward movement of said first member and sealing said aperture around said first member, said first member containing at a point within said conduit a tangential inlet passage for the whirl chamber thereby to admit fluid from the conduit into said chamber, and a fluid discharge port in said second member.

6. A combination as in claim 5, wherein said complementary abutting surfaces comprise a

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frusto-conical outside wall on said first cup-shaped member tapering toward the bottom thereof, and a matching beveled seat encircling said aperture.

7. In combination, a spray nozzle having a whirl chamber comprising a pair of opposed cup-shaped members disposed mouth-to-mouth with their rims in abutting relation, the bottom of one of said members being a plane end wall perpendicular to the axis of the whirl chamber and having a discharge orifice concentric with said axis, the bottom of the opposite member comprising a helical end wall with an inlet orifice substantially tangent to the inside annular wall of the whirl chamber and disposed entirely between the beginning and termination of said helical wall, the annular wall of at least one of said cup-shaped members having an exterior surface which tapers from the rim of that member toward the end, a fluid receptacle having in one wall an aperture adapted to receive said one member with the rim thereof on one side of said wall and the orifice therein on the other side, means for applying on the other cup-shaped member a force urging same toward said wall, said aperture being smaller in size than the rim of said one member whereby the medial portion of said tapered annular wall is maintained seated against the margin of said orifice by said force.

8. In combination, a spray nozzle having a whirl chamber comprising a pair of opposed cup-shaped members disposed mouth-to-mouth with their rims in abutting relation, the bottom of the first of said members being a plane end wall perpendicular to the axis of the whirl chamber and having a discharge orifice concentric with said axis, the bottom of the second member comprising a helical end wall with an inlet orifice substantially tangent to the inside annular wall of the whirl chamber and disposed entirely between the beginning and termination of said helical wall, the annular wall of said second member having an exterior surface which tapers from the rim of that member toward the end, a fluid receptacle having an aperture in one wall adapted to receive said second member with the rim of that member outside the receptacle and the orifice therein on the inside of the receptacle, clamping means connected to said receptacle and to said first member to draw the first member toward said wall, and said aperture being smaller in size than the rim of said second member whereby the medial portion of said tapered annular wall is maintained seated against the margin of said orifice by said force.

9. In combination, a fluid receptacle having an aperture in one wall thereof, a spray nozzle inside said receptacle, said nozzle having a whirl chamber comprising a pair of opposed cup-shaped members disposed mouth-to-mouth with their rims in abutting relation, the bottom of the first of said members being a plane end wall perpendicular to the axis of the whirl chamber and having a discharge orifice concentric with said axis, the bottom of the second member comprising a helical end wall with an inlet orifice substantially tangent to the inside annular wall of the whirl chamber and disposed entirely between the beginning and termination of said helical wall, the annular wall of said first member having an exterior surface which tapers from the rim of that member toward the end and said end being received in the aperture in said wall of the receptacle whereby the pressure of fluid in the receptacle holds the rim of said

second member against the rim of said first member and urges the latter member outwardly, said aperture being smaller in size than the rim of said first member and blocking the advance of said first member beyond a predetermined point.

10. In a spray nozzle, a whirl chamber having an annular wall tapering toward both ends from the middle in the form of opposed frusto-conical sections, the angles of inclination of said sections being substantially equal, one of said tapered sections having a flat end wall perpendicular to the axis of the chamber and having a discharge orifice concentric with said axis, the opposite end wall in the other tapered section being helical and having an inlet orifice substantially tangent to the annular wall thereof and disposed entirely between the beginning and termination of said helical portion.

CLIFFORD H. GARR. 20

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