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FOREIGN PATENTS

173,901 1/1922 Great Britain..... 239/552

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[54] **SPRAY NOZZLE**
14 Claims, 3 Drawing Figs.

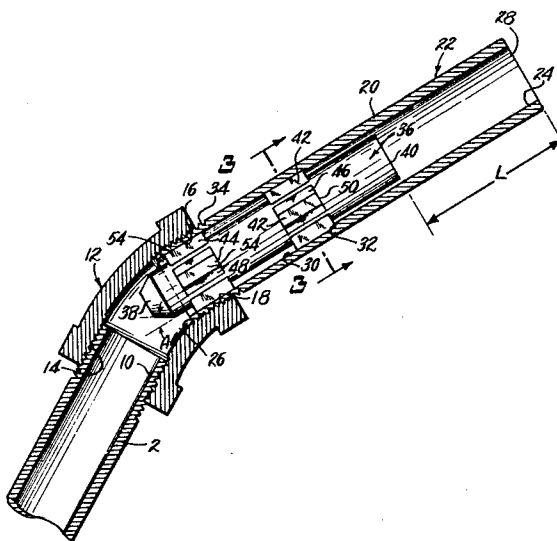
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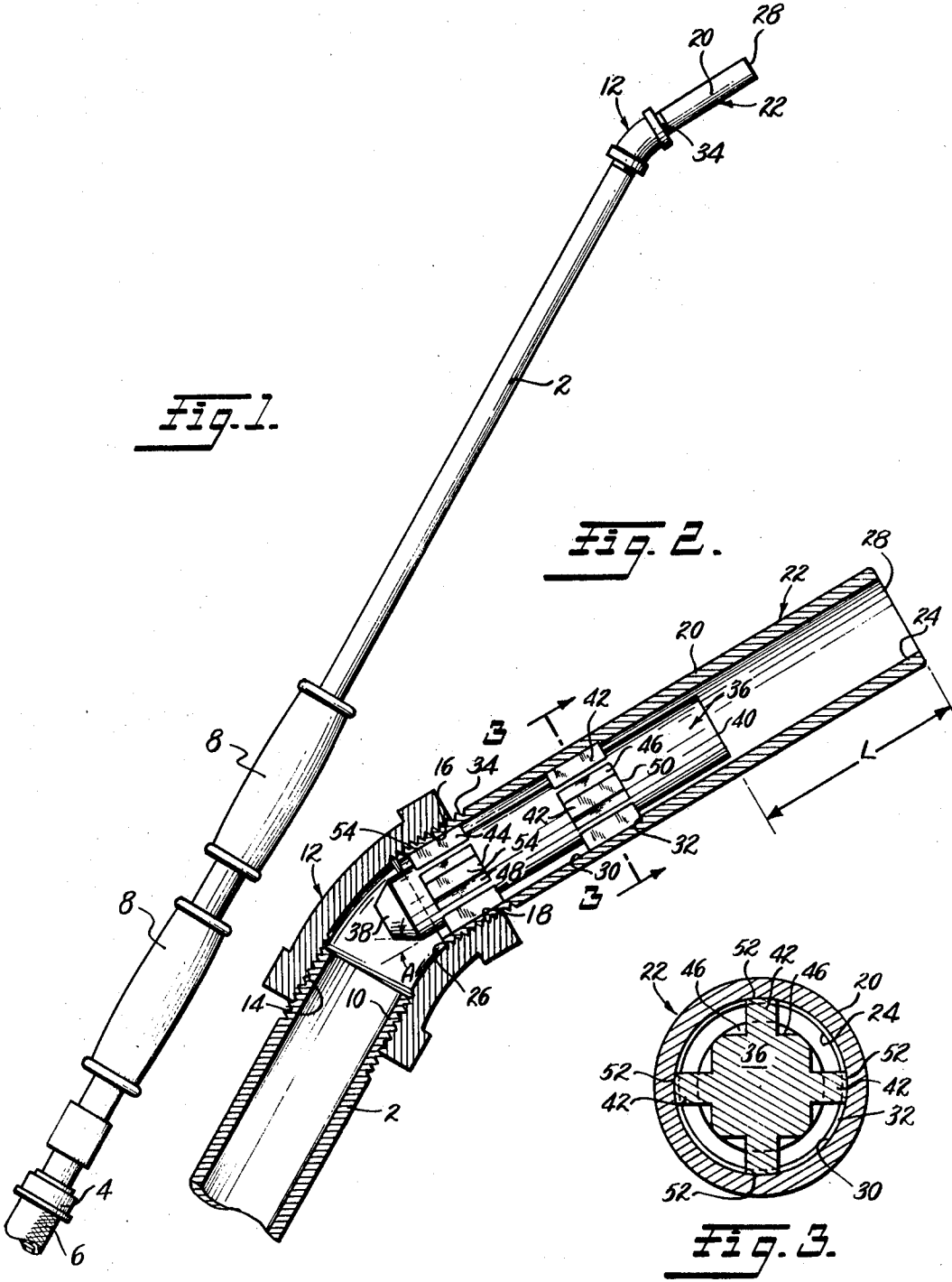
References Cited

UNITED STATES PATENTS

2,130,628	9/1938	Kerrick	239/11
2,408,588	10/1946	Watts	239/590.5X
2,573,982	11/1951	Ofeldt	239/590.3X
2,627,439	2/1953	Wornall	239/590.5X
597,842	1/1898	Edmonds	239/590.5
1,425,343	8/1922	Schumann	239/552
1,466,088	8/1923	Coen	239/590.5
2,033,568	3/1936	Coberly	239/553
2,143,128	1/1939	Machlet	239/552

ABSTRACT: A nozzle for spraying hot or superheated fluid, comprising a nozzle body having a nontapered bore therethrough within which a solid cylindrical core is concentrically mounted. The cross-sectional area of the nozzle bore is a little less than twice that of the core, and the outer end of the core is spaced a distance from the discharge end of the nozzle equal to about one-third the length of the nozzle, so that a stream of hot or superheated fluid discharged from the nozzle is caused to contract to form a high-velocity discharge stream of liquid surrounded by steam that can be directed against a surface to clean the same, without drip or drizzle at the nozzle end when in use. The cylindrical core has longitudinally spaced, radial positioning ribs formed thereon, and is received in a counterbore in the inner end of the nozzle body, said inner end having tapered external threads thereon for mating with the tapered pipe threads in a mounting elbow carried by a spray gun barrel. When the nozzle body is threaded into the elbow, the tapered threads cause the rear end of the nozzle body to be contracted to thereby lock or secure the ribbed core in its counterbore.





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SPRAY NOZZLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to nozzles for spraying hot or superheated fluid, and more particularly to a nozzle designed to produce a high velocity, concentrated discharge stream comprised of approximately 90 percent liquid and 10 percent steam.

2. Description of the Prior Art

The present nozzle is a substantial improvement over its predecessor shown in U.S. Pat. No. 2,130,628, utilized to spray hot fluid containing detergent against a surface to be cleaned. The foregoing nozzle includes a solid cylindrical core mounted concentrically within a tapered nozzle member, the hot liquid passing under pressure through the converging annular space between the core and the inner wall of the nozzle member. The core terminates close to the end of the nozzle so that as the liquid flows over the outer end of the core a vacuum is created, which concentrates and forms the discharging stream into a conical shape that gives it cohesion for some distance beyond the nozzle tip where it then diverges very slightly. The present concentrated stream is far more effective than the prior stream for cleaning objects against which it is sprayed. Also, the present nozzle eliminates dripping and drizzle which occurred under certain conditions of use of the prior nozzle.

The operation of the nozzle of U.S. Pat. No. 2,130,628 is generally satisfactory, but greater concentration and higher velocity of the discharge stream has been found to be desirable to provide more rapid and efficient cleaning of surfaces. The present nozzle is specifically designed to maximize flow conditions, so that a more coherent, concentrated stream of substantially higher velocity than that available from the prior nozzle is obtained.

The nozzle of the prior patent requires an angled elbow discharge tip for mounting of the core, which tip must be specially cast, and otherwise imposes certain maneuverability and design limitations on the nozzle. The present nozzle utilizes conventional pipe and fittings to contain and mount the cylindrical core, and thus offers advantages in design simplicity and flexibility, as well as economy of manufacture.

SUMMARY OF THE INVENTION

The present nozzle is designed for attachment to the outer end of the discharge barrel of a spray gun connected by a hose with the boiler of a steam cleaner unit or the like, and functions to convert hot or superheated liquid supplied thereto into a high velocity, concentrated discharge jet comprised of about 90 percent liquid and 10 percent steam, the steam flowing about a coherent liquid center. The nozzle is designed to maximize flow conditions, so that the discharge stream has an impact against a surface to be cleaned of from 20 percent to 25 percent greater than can be obtained with the nozzle of U.S. Pat. No. 2,130,628.

The nozzle of the present invention is designed for connection to a conventional 30° elbow pipe fitting mounted on the outer end of a cleaning gun barrel, and includes a tubular nozzle or body having a bore of uniform diameter therethrough with a shallow counterbore in its inner end, the inner end of said body having external, tapered pipe threads thereon for connecting with the tapered internal threads of the elbow. Received within the cylindrical body is a solid cylindrical core of uniform diameter having a plurality of identical, spaced, radially projecting forged ribs thereon that engage the wall of the counterbore to position the core concentrically within the nozzle body. When the core is in place and the nozzle body is threaded into the 30° elbow, the tapered threads cause the inner end of the tubular body to deform or contract inwardly behind the rearmost ribs on the core, so that the core is held in position until such time as the nozzle is unthreaded from the elbow. This unique mounting method permits the core to be easily inserted, or removed for cleaning or replacement, and makes for economy in manufacture and servicing.

While U.S. Pat. No. 2,130,628 indicates generally the principle on which the present nozzle operates, it contains no teaching of the structural relationships that will produce maximum conditions of coherency and velocity in the discharge stream. The present nozzle is designed to achieve such maximum conditions, and thus constitutes a significant improvement over the prior nozzle.

In the present nozzle, the cross-sectional area of the bore in the nozzle body is a little less than twice the cross-sectional area of the cylindrical core, a relationship that gives maximum convergence of the pressurized hot liquid flowing through the nozzle and imparts maximum velocity to the discharge stream. In addition, the core is set back sufficiently from the nozzle outlet to substantially eliminate undesirable dripping or drizzle from the nozzle during operation.

It is an important object of the present invention to provide a nozzle for use with superheated or hot liquids, designed to produce a discharge stream of maximum coherency and velocity.

Another object is to provide a nozzle designed to minimize dripping or drizzle from the nozzle during operation.

A further object is to provide a nozzle including a cylindrical core formed to be precisely centered within its tubular body, and which can be easily inserted and removed.

Still another object is to provide a nozzle including a tubular body having a counterbore therein for receiving a ribbed cylindrical core, the inner end of the body being deformable during threading into a mounting opening for securing the ribbed core in position.

Yet another object is to provide a cylindrical core for a nozzle, designed with positioning ribs thereon that direct flow and ensure precise locating of the core within a tubular body.

Other objects and many of the attendant advantages of the invention will be readily apparent from the accompanying drawings, and following description of the preferred embodiment.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a steam cleaning gun with the nozzle of the invention attached to the gun barrel;

FIG. 2 is an enlarged axial sectional view through the nozzle, showing the structural relationship between the cylindrical core and the tubular body which provides for maximum flow conditions in the discharge stream; and

FIG. 3 is an enlarged cross-sectional view taken on the line 3-3 in FIG. 2 showing the positioning ribs formed on the cylindrical core.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a cleaning gun barrel is indicated at 2, which comprises an elongated pipe connected at one end by a coupling 4 to a flexible conduit 6 leading from the outlet of a steam cleaner unit or other apparatus (not shown) for furnishing superheated or hot liquid to the cleaning gun. A pair of insulated handles or grips 8 is mounted on the barrel 2 so that an operator can hold and manipulate the same without getting burned. Suitable valve means (not shown) controls the supply of heated liquid to the gun 2.

The other end 10 of the barrel 2 is externally threaded, and received thereon is a conventional 30° elbow pipe fitting 12. The fitting 12 has internally threaded ends 14 and 16, the threads being conventional tapered pipe threads. The barrel 2 is threaded into the elbow end 14, and threaded into the other end 16 is the inner end 18 of a tubular body 20 of the present nozzle 22.

The tubular body 20 has a cylindrical bore 24 extending completely therethrough, and the end faces 26 and 28, respectively, thereof are perpendicular to the longitudinal axis of the bore 24. Extending into the tubular body from the inner end face 26 is a shallow counterbore 30 of uniform diameter, and which is disposed concentrically relative to the bore 24. The counterbore 30 terminates in a radial shoulder 32. The inner end 18 of the tubular body 20 has external threads 34 thereon,

which extend axially for about one-third of the length of the counterbore. The threads 34 on the body end 18 are conventional tapered pipe threads, like the tapered threads within the end 16 of the elbow 12, and mate with the elbow pipe threads. Thus, when the tubular body end 18 is threaded into the elbow end 16 it is deformed slightly inwardly by the mating tapered threads. This deformation is utilized to secure the nozzle core 36 in position, as will be described.

The cylindrical core 36 is made from solid bar stock, and has a main body portion of uniform diameter throughout its length. The inner end of the core 36 has a frustoconical tip 38 formed at an angle A of 30°, while the outer end face 40 thereof is perpendicular to the longitudinal axis of the core. Formed from the metal of the core 36, by forging, are outer and inner sets of radially projecting positioning ribs 42 and 44, respectively, there being four equally spaced ribs in each set, as shown in FIG. 3, which space the periphery of the main body portion of the core from the bore 24. The forging process whereby the ribs 42 and 44 are formed, leaves shallow depressions 46 and 48, respectively, in the core 36 between the ribs.

The overall length of the core 36 from inner end 38 to outer end 40 is about two-thirds the length of the tubular body 20. The inner end of the core 36 should project rearwardly out of the tubular body 20 a distance equal to about twice the axial length of the frustoconical tip 38. The ribs 42 cooperating with the shoulder 32 are located to ensure such positioning of the core. The ribs 42 and 44 serve to precisely center the core concentrically in the bore 24.

The ribs 42 are positioned axially on the core 36 so that the outer end faces 50 thereof all lie in the same plane, and so that said faces 50 will all abut the shoulder 32 when the core is properly positioned axially of the tubular body 20. The peripheral faces 52 of the ribs 42 are all arcuate and lie on a common circle of a diameter just slightly less than the diameter of the counterbore 30. The ribs 44 have similarly formed and disposed peripheral faces 54 thereon, and are positioned to lie directly beneath the threaded inner end 18 of the tubular body 20.

Thus, the core 36 is easily positioned correctly within the tubular body 20 merely by inserting it into the counterbore 30 until the end faces 50 of the ribs 42 engage the shoulder 32. The tubular body 20 is then threaded into the elbow 12, the tapered threads automatically functioning to contract the inner end 18 of the tubular body 20, resulting in gripping of the ribs 44 so that the core is immovably secured in place. When the tubular body 20 is unthreaded from the elbow 12 the gripping force on the ribs 44 is relieved, and the core 36 can then be easily removed for cleaning and then reinstalled.

The core 36, as has been stated, is about two-thirds the length of the tubular body 20. Thus, the outer one-third of the tubular body, indicated at L in FIG. 2, is completely open and the bore 24 is of uniform diameter. It has been found that a setback of about the length L from the tubular body end face 28 to the core end face 40, which setback is far greater than the setback in U.S. Pat. No. 2,130,628, substantially eliminates nozzle drip or drizzle when in operation, and results in all escaping liquid being a part of the discharge stream.

The ratio of the cross-sectional area of the uniform diameter cylindrical bore 24 to the cross-sectional area of the uniform diameter cylindrical core 36 has been found to be important to maximizing the coherency and velocity of hot or supersaturated liquid discharging from the nozzle 20, the best results being obtained when the area of the bore 24 is about twice that of the core 36. For proper performance the core 36 must be precisely centered within the bore 24, which is accomplished by the ribs 42 and 44.

In theory, the nozzle 20 functions much like the nozzle of U.S. Pat. No. 2,130,628. Experiments with both nozzles have shown, however, that for the same fluid pressure the present nozzle will deliver a discharge stream with a 20 percent to 25 percent greater impact than the prior nozzle, which stream is also more compact and hence has a greater trajectory or range.

In operation, superheated or hot liquid is supplied under pressure from the conduit 6 to the barrel of gun 2, from whence it enters as liquid into the nozzle 20 over the frustoconical core tip 38. The liquid remains in a liquid state as it flows over the core 36, and as it leaves the core end face 40 a vacuum is formed that causes the stream to converge into a coherent jet, as explained in U.S. Pat. 2,130,628. The ribs 42 and 44 direct the stream axially as it flows along the core 36. As the discharge stream of hot liquid leaves the nozzle 20 at the end face 28 expansion occurs, with the result being that the discharge stream is about 90 percent liquid and about 10 percent steam. The core of the stream is all liquid, and the steam surrounds the core as a vapor. By properly manipulating the barrel 2 the discharge stream can be played against any desired surface.

While the proportions of the nozzle 22 can be varied, the following dimensions will provide an operative example of a nozzle that meets all the objects of the invention:

20	Overall length of the tubular body 20.....	3.25"
	Overall length of the core 36.....	2.25"
	Diameter of bore 24.....	0.50"
	Diameter of core 36.....	0.38"
	Length L of core set-back.....	1.25"

25 Accordingly, the cross-sectional area of the bore 24 is 0.196 sq. inches and the area of the core 36 is 0.110 sq. inches, or approximately twice that of the core area. Mathematically, the bore area is 1.78 times the core area. Also, the core 36 is about two-thirds as long as the tubular body 20, although mathematically it is nine-thirteenths as long, or the body length is 1.44 times that of the core.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings.

I claim:

35 1. A nozzle for use with a steam cleaning gun or the like, comprising: a tubular body having a cylindrical bore therethrough, one end of said tubular body being an inlet and the other end a discharge; and a solid cylindrical core having a main body portion with radial ribs projecting therefrom and being positioned concentrically within said cylindrical bore with said main body portion spaced throughout its periphery from said cylindrical bore, the downstream or discharge end of said core having a flat face and being spaced inwardly from said discharge end of said tubular body a sufficient distance to prevent dripping or drizzling when in use, the cross-sectional area of said bore being approximately twice that of said core.

45 2. A nozzle, as recited in claim 1, wherein the cross-sectional area of the bore is about 1.78 times the cross-sectional area of the main body portion core.

50 3. A nozzle, as recited in claim 1, wherein the tubular body has a concentric counterbore in the inlet end thereof and wherein the core has a plurality of radially projecting ribs thereon receivable within said counterbore, said ribs being dimensioned to center said core within said cylindrical bore and to space the one end of the core from the discharge end of the tubular body.

55 4. A nozzle, as recited in claim 1, wherein the core has one set of radially projecting ribs adjacent one end thereof and a second set of radially projecting ribs located about midway between said one set of ribs and said flat end face of said core.

60 5. A nozzle, as recited in claim 1, wherein the other end of the core is beveled and projects outwardly a short distance beyond the inlet end of the tubular body.

65 6. A nozzle, as recited in claim 5, wherein the core is about two-thirds as long as the tubular body.

7. A nozzle, as recited in claim 5, wherein the length of the tubular body is about 1.44 times the length of the cylindrical core.

70 8. A nozzle, as recited in claim 1, wherein the cylindrical core is unitary, and wherein the other end of the core is frustoconical, and wherein the flat end face of the core is perpendicular to the longitudinal axis of said core.

75 9. A nozzle, as recited in claim 1, wherein the flat end face of the core is set back from the end of the tubular body a

distance equal to about one-third the length of the tubular body.

10. In combination: a hollow fitting adapted to be connected at one end thereof with a source of hot liquid, and having internal pipe threads in its other end; and a nozzle, comprising: a tubular body having a cylindrical bore therethrough extending from an inlet end to a discharge end of said body, said body having a counterbore extending inwardly from said inlet end, the inlet end of said body having external tapered pipe threads thereon for mating with the threads in said fitting; and a cylindrical core mounted in said cylindrical bore, said core having a plurality of radially extending positioning ribs thereon received within said counterbore, at least a portion of said ribs lying in the region of said external pipe threads, said tapered pipe threads on said tubular body and in said fitting cooperating when threaded together to deform said inlet end of said body inwardly to thereby grasp said ribs and secure

said core in position.

11. The combination, as cited in claim 10, wherein the counterbore terminates in a radial shoulder, and wherein the ribs on said core are seated against said shoulder.

12. The combination, as recited in claim 10, wherein the cross-sectional area of the cylindrical bore is about twice that of said core.

13. The combination, as recited in claim 12, wherein the forward end of said core is set back from the discharge end of said body about one-third the length of said body.

14. The combination, as recited in claim 10, wherein the core includes a frustoconical tip on an end thereof that projects beyond the inlet end of said body, and wherein the other end of said core has a face that lies in a plane perpendicular to the longitudinal axis of said core.

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