July 4, 1950 C. H. LINDSAY 2,513,417

AIRFOAM NOZZLE

Filed Feb. 5, 1946

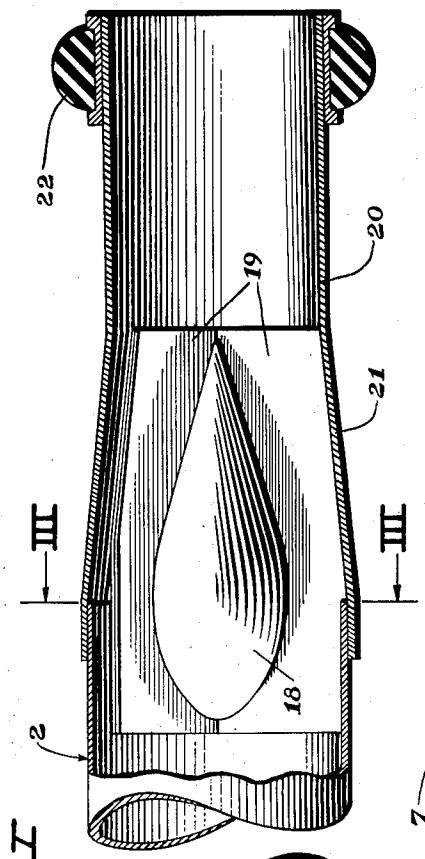


Fig. I

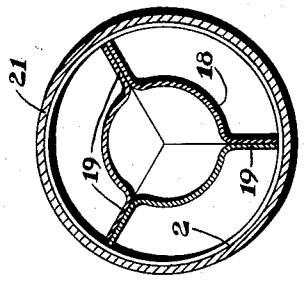


Fig. III

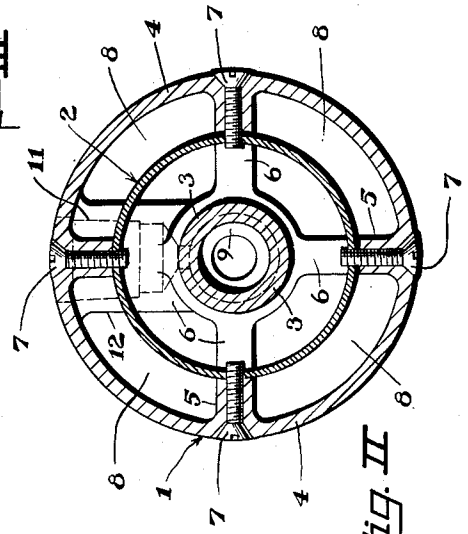
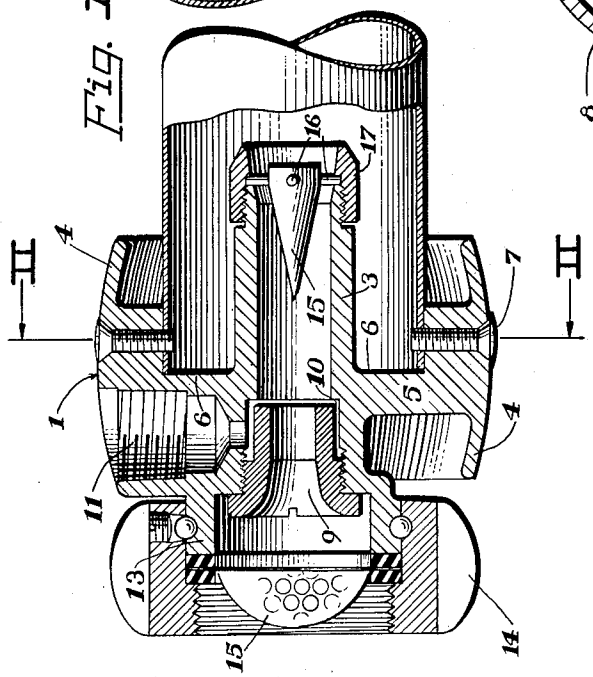


Fig. II



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Patented July 4, 1950 2,513,417

UNITED STATES PATENT OFFICE

2,513,417

AIRFOAM NOZZLE

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Application February 5, 1946, Serial No. 645,592

5 Claims. (Cl. 261—116)

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The invention relates to a so-called airfoam nozzle, by which is meant a form of hand-held device adapted to mix and convert into airfoam appropriate ingredients supplied to it, and also to serve for discharging and directing the resulting airfoam. More particularly, the invention is concerned with such a nozzle of a form adapting it to be coupled to a supply of water under pressure and including means whereby suction created by the water stream serves to draw into the stream an airfoam liquid and whereby suction created by the resulting mixture in turn serves to draw in and incorporate with it sufficient air to convert the mixture into airfoam.

The object of the invention is an improved nozzle of this general character, the various features of advantage being shown incorporated in preferred form, but by way of example only, in the accompanying drawings.

In these drawings, Fig. I is a broken-out longitudinal section through the preferred form of nozzle; Fig. II is a section on the line II—II of Fig. I (with part of the background omitted for the sake of clearness); and Fig. III is a cross-section on the line III—III of Fig. I.

The nozzle illustrated consists of a cast body, generally designated 1, and a pipe section, generally designated 2, the former serving as a supply unit by means of which the ingredients are introduced, and the latter serving as a receiver within which the airfoam is formed and by which it is discharged.

The body 1 comprises an integrally formed tubular hub 3 encircled by a rim or sleeve portion 4, the two being united by an intervening spider 5. As shown, the rim overhangs the spider on both sides. The front face of the spider (meaning the right-hand side as viewed in Fig. I) is recessed, as at 6, and the pipe section 2 is telescoped into the recess. By making the recess of adequate depth to provide a substantial length of bearing for the pipe section, the latter may be rigidly locked in position, abutting the spider face, by means of screws 7 extending radially inwardly from the periphery of the rim and through the intervening portion of the spider.

As shown more particularly in Fig. II, the spider apertures 8, of which there are four in this instance, extend substantially from the hub to the rim; and the diameter of the recess 6 and the pipe section 2 are such that the latter intersects the apertures intermediate the hub and the rim. When the interior of the pipe section is under suction (as presently described) external air is thus free to flow from front to rear of the spider

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in the outer portions of the apertures 8, that is, between the pipe section and the rim; and air is likewise free to flow directly to the rear face of the spider and into the pipe section through the inner portions of the apertures 8, that is, between the pipe section and the hub. With this arrangement it is virtually impossible for anyone handling the nozzle inadvertently to block off the air supply and thereby interfere with satisfactory foam formation within the nozzle. Without conscious attention the person handling the nozzle can grasp it as happens to be most convenient. If, by chance, his hand happens to obstruct the flow of air into the nozzle directly from the exterior to the rear face of the spider, it is of no material consequence, because free air flow is still provided for from the front face of the spider between the rim and the nozzle as above described. Similarly, an adequate air supply by way of the direct or rear inlet is provided notwithstanding inadvertent obstruction of the front air inlet. It will be understood that while the width of the rim is not critical, it should be such that even a heavily-gloved hand grasping it will not obstruct both inlets at the same time. It will also be recognized that by making the dual air inlet structure an integral part of the body portion of the unit, as is preferred, an extremely rugged structure is provided.

The central bore of the hub 3 is formed with sections of two diameters. In this instance, the section of the bore which extends forwardly from about the center line of the spider to the front end of the hub is of substantially uniform diameter throughout; and the rear section of the bore is of a greater diameter and internally threaded to receive a water nozzle member 9. As illustrated, the member 9 is arranged to project a stream of water into the forward or receiver section of the bore so as to create suction in the space 10 surrounding the member 9. Communicating with the space 10 is a radial inlet 11 incorporated in the enlarged "spoke" 12 of the spider and adapted for connection to a source of supply of airfoam liquid.

From the rear end of the unit projects a flange 13 on which is mounted a hose coupling collar 14, a strainer 15 preferably being provided to exclude large particles of foreign matter from the unit. As will be observed, the flange 13 and the collar 14 are so dimensioned and located as not to obstruct the entry of air directly to the rear face of the spider and thence into the pipe section or main receiver 2.

In the normal course, the stream of water and airfoam liquid emerging from the forward end of the hub bore diverges and strikes the wall of the pipe section, the forward flow of the stream thus creating the suction which draws air into the pipe section in the manner above described. Preferably, means are provided for spreading the emerging stream at a somewhat greater angle (and hence causing it to strike the receiver wall sooner) than would otherwise be the case, a greater length of the receiver thereby being made available for the thorough incorporation of the air with the liquid to form foam. In order to minimize interference with the flow of the stream emerging from the hub bore, such means may consist of a conical spreader **15** of the form commonly used in garden hose nozzles and positioned by means of four slender spokes **16** which are clamped against the front end of the hub by a nut member **17**.

As illustrated, and as is preferred, the receiver **2** is of generally uniform diameter throughout the major portion of its length; but, unless otherwise controlled, the emerging stream of airfoam is not of an ideal character from the standpoint of uniformity and range of discharge. It has been found that the stream is very much improved in both these respects by selectively controlling its velocity within and adjacent the outlet end of the receiver in such manner that the entire stream throughout its cross-section travels at about the same speed. Left to its own devices, the stream exhibits substantial differences in velocity throughout its cross-section, it being materially slowed down at its skin or outer surface due to friction between it and the receiver wall. The core of the stream, on the other hand, is not so hindered and emerges at a higher velocity. The stream as a whole, after it has emerged, is thus less uniform or "solid" and its range is adversely affected, particularly when projected in a strong breeze.

In general, the desired control is affected by slowing down the core of the stream to conform its velocity substantially to that of its skin; and this may conveniently be done by mounting in the receiver, toward its outlet end, a tear drop shaped baffle **18** supported by thin struts or ribs **19**. The core of the stream is thus itself subjected to frictional resistance comparable to that experienced by the skin of the stream.

To insure maximum range, the receiver is preferably provided with a short outlet tip **20** of a diameter slightly less than that of the receiver proper, the tip being coupled to the receiver by a tapered section **21**. As indicated, the tip **20** may be provided with a protective ring **22** of rubber or the like. Optimum conditions are found to obtain when the minimum area of the annular stream as it passes the baffle **18** is substantially equal to the cross sectional area of the tip **20**. While, of course, the dimensions of the parts are subject to variation as may be convenient or preferred, it may be noted that the proportions indicated by the following are productive of excellent results: diameter of main section of receiver, about 2½''; maximum diameter of the tear drop baffle, about 1⅛''; diameter of outlet tip, about 2''.

While the nozzle has been described primarily with reference to its use for so-called portable operation, in which the airfoam liquid supply is usually carried by the person handling the nozzle, it will be understood that it is equally adaptable for use in conjunction with motorized apparatus. In the latter case, as is well known, the airfoam liquid is or may be conveniently mixed with the water stream at or near the water pump, so that the nozzle receives already-mixed airfoam liquid and water by way of the hose coupled to it by collar **14**, the nozzle otherwise functioning just as described.

In the light of the foregoing specific description, for illustrative purposes only, of a preferred form of the invention and its principles, the following is claimed:

1. In an airfoam nozzle, the combination of a tubular hub constituting a receiver for water and foam-forming liquid, a concentric rim encircling the hub and spaced from and united therewith by a spider having apertures therein extending substantially from the hub to the rim, the said rim having forwardly and rearwardly projecting portions overhanging the spider, a hose coupling supported at the rear of the hub and spaced both from the rear face of the spider and from the rearwardly projecting rim portion, thereby permitting free flow of external air to the rear face of the spider, said spider and rim incorporating a radial liquid passage leading into the hub, and a pipe section abutting and protruding from the front face of the spider concentrically with the hub and of a diameter to intersect the said apertures intermediate the hub and the rim, thereby providing for free flow of external air from front to rear of the spider intermediate the rim and the pipe section.

2. In an airfoam nozzle, the combination of a tubular hub, a concentric rim encircling the hub and spaced from and united therewith by a spider having apertures therein extending substantially from the hub to the rim, the said rim having forwardly and rearwardly projecting portions overhanging the spider, a hose coupling supported at the rear of the hub and spaced both from the rear face of the spider and from the rearwardly projecting rim portion, thereby permitting free flow of external air to the rear face of the spider, and a pipe section protruding from the front face of the spider concentrically with the hub, the rear end of the pipe section being of a diameter to intersect the said apertures intermediate the hub and the rim, thereby providing for free flow of external air from front to rear of the spider intermediate the rim and the pipe section.

3. In an airfoam nozzle, the combination of a tubular hub, a concentric rim encircling the hub and spaced from and united therewith by a spider having apertures therein extending substantially from the hub to the rim, the said rim having forwardly and rearwardly projecting portions overhanging the spider, and a pipe section protruding from the front of the spider concentrically with the hub and of a diameter adjacent the spider to intersect the said apertures intermediate the hub and the rim, thereby providing for free flow of external air from the front of the spider to the rear thereof, intermediate the rim and the pipe section, and from the rear of the spider to the interior of the pipe section.

4. In an airfoam nozzle, an integrally formed unit including a tubular hub, a concentric rim, and a spider, the latter spacing the rim from the hub and having a plurality of circumferentially spaced apertures extending substantially from the hub to the rim, a pipe section secured to the unit concentric to the hub with

one of its ends abutting the front face of the spider, the diameter of said section being intermediate the diameter of the hub and rim and means to introduce foam-making liquids into the nozzle through said hub, the apertures in said spider constituting air passageways to said nozzle from both sides of said rim.

5. An airfoam nozzle as claimed in claim 4 in which the front face of the spider defines a cylindrical recess and the pipe section is telescopically received in said recess with the end of the pipe section abutting the front face of the spider and wherein screws extend inwardly from said hub into locking engagement with a portion of said section that is telescoped within said recess.

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