

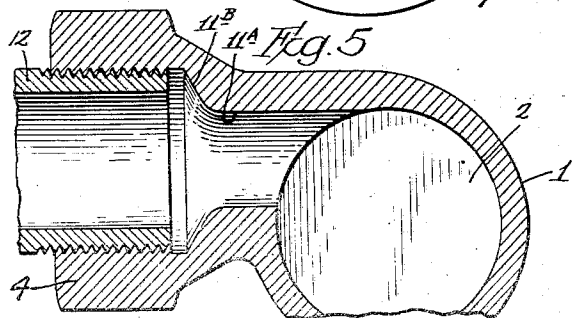
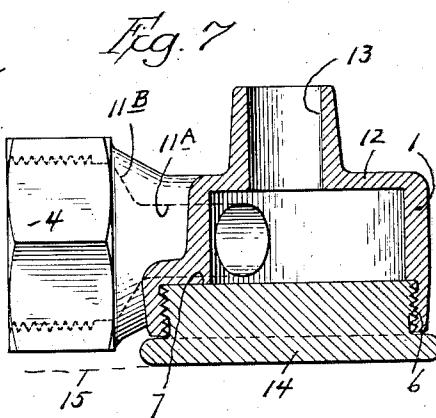
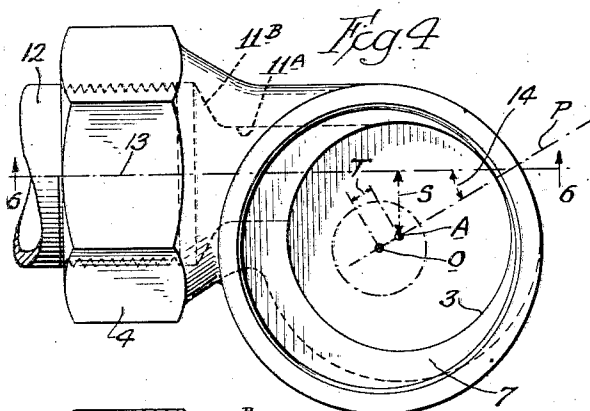
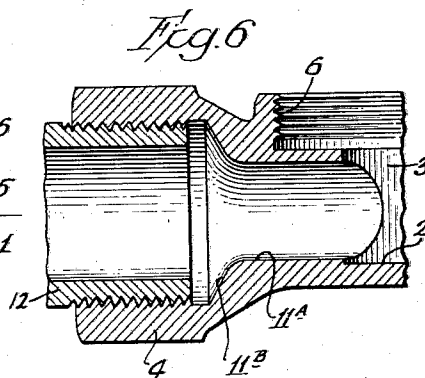
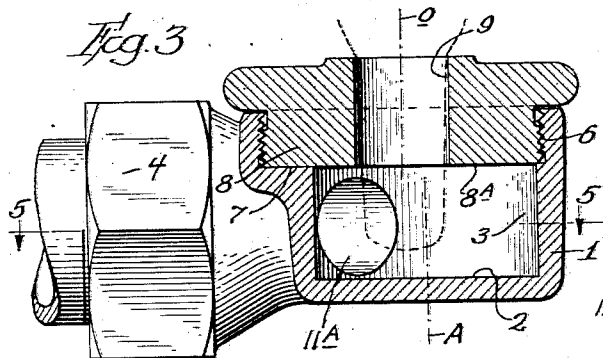
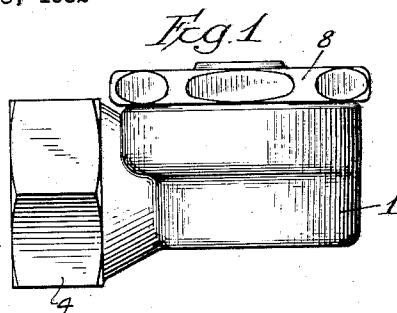
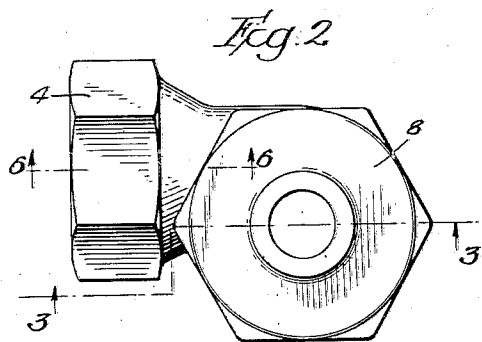
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F. WAHLIN

1,961,408

SPRAY HEAD

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UNITED STATES PATENT OFFICE

1,961,408

SPRAY HEAD

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Application May 28, 1932, Serial No. 614,119

4 Claims. (Cl. 299—114)

My invention relates to a spray nozzle or spray head for projecting liquid upwardly in the form of a hollow conical spray, such spray heads being commonly employed for spraying water of condensation above ponds in order that the air commingling with the finely divided spray will cool the water.

Generally speaking, the objects of my invention are those of providing a simple and inexpensive spray head of this class which will be efficient in affording a wide projection and fine atomization of the spray, which can easily be manufactured without requiring specially designed tools or machinery, and which will be nonclogging.

Spray heads of this class generally depend upon the upward projecting of liquid in the form of a tube of liquid which rotating at a sufficient rate about its own axis so that centrifugal force will initially flare the emitted liquid tube to a thinner walled conical form, and thereafter will cause this conical tube to rupture into tendrils which in turn are severed into drops and then atomized into more minute droplets by the action of the air.

In practice, it is highly desirable that both the converting of the admitted solid stream of liquid into an upright tubular stream and the imparting of a spirally advancing movement to this tubular stream of liquid be secured without requiring posts, vanes or other interior formations within the spray, for these reasons:

First, because every such interior formation retards the velocity at which the liquid moves within the spray head, thereby reducing the spray-producing capacity of the device in proportion to its size and also reducing the degree of atomization of the liquid when the latter is supplied at a relatively low pressure.

Second, because of the difficulty and expense in machining or otherwise manufacturing such interior posts, spiral vanes or other formations with sufficient accuracy for their intended purposes.

And third, because every such interior vane, partition, post or the like forms an obstruction which will easily cause the spray head to clog in case the liquid supplied to it has not first been carefully strained.

In my copending application #614,120 on a Hollow-cone spray nozzle, as filed May 28, 1932, I have disclosed a single-piece spray head free from such objectionable interior formations and yet designed so as to be highly efficient both as to the liquid-projecting capacity in propor-

tion to its size, as to the degree of atomization, and as to a maintaining of the fine atomization with wide ranges in the pressure at which the liquid is supplied.

However, the spray head of this copending application depends for its efficiency partly on the accuracy with which the interior of a whirling chamber can be cored out, and on a proper machining of the part of the chamber top wall adjacent to the outlet of the device. In practice, this accuracy can be secured to an adequate degree with ordinary brass foundry coring and machining for spray heads of large sizes, as for example those designed for connection to water supply pipes of over one inch bore size, since the effect of irregularities due to the coring of castings is relatively small in such large spray heads.

Such roughnesses are apt to be particularly serious when they occur on the riser wall of the whirling chamber, because protuberances or the like when caused on this wall will deflect petty portions of the liquid inwardly. This causes an irregular intermingling of parts of the liquid within this chamber and spoiling the intended uniform wall thickness of the issuing tubular stream of liquid so that part of this stream will rupture into fragments of such a size as not to become properly atomized.

My present invention aims to overcome the just recited difficulties, which have been particularly noticeable in spray heads having whirling chambers of spiral contour, by providing a spray head consisting of two parts, each of which can easily be machined on a lathe and arranged so as to project a uniform and finely atomized spray without requiring a spiral contour for any portion of these parts. Moreover, my invention aims to provide a two-part construction for this purpose which will insure a correct assembling of the parts by merely threading one thereof into the other, without requiring any particular relative rotational adjustment of these parts, and which will readily permit each of the parts to be a drop forging of far greater durability than any ordinary casting.

In a still further aspect, my invention aims to provide a spray device of this class which will effect an efficient hollow cone spray in a finely and uniformly atomized condition while employing a whirling chamber of circular section. Heretofore, spray devices of this type usually have included whirling chambers with spirally formed riser walls which are difficult to manufacture accurately; or else have

had these chambers relatively tall in proportion to their height, thereby projecting a poorly atomized spray and also rendering the devices inefficient when supplied with liquid at low pressures.

Generally speaking, my present invention is based on a long series of experiments with various types of spray devices designed for an upward projection of a hollow conical spray. These experiments have demonstrated that with a suitable displacement of the outlet from the axis of the chamber in which the liquid whirls, and with a particular relative disposition and size as well as shape of the inlet to this chamber, a highly uniform atomization of the liquid can be obtained even when the chamber has an entirely cylindrical riser wall.

In addition, my experiments have shown that with flat and parallel upper and lower chamber walls and with certain proportions of various parts, such a spray device will operate efficiently even with wide variations in the pressure at which the liquid is supplied.

Illustrative of my invention,

Fig. 1 is a side elevation of a spray head embodying the same.

Fig. 2 is a plan view of the same.

Fig. 3 is an enlarged side elevation of the same spray head, partly sectioned along the line 3—3 of Fig. 2.

Fig. 4 is a similarly enlarged plan view of the body member of the same spray head.

Fig. 5 is a fragmentary horizontal section taken along the line 5—5 of Fig. 3.

Fig. 6 is a fragmentary vertical section taken along the line 6—6 of Fig. 4.

Fig. 7 is a view allied to Fig. 3 but showing an embodiment of my invention in which the tubular outlet is integral with the inlet nipple and the riser wall of the whirling chamber.

In the embodiment of Figs. 1 to 6, the body member of my spray head comprises an upwardly open cup-like casing 1 having the lower portions of its interior formed to afford a whirling chamber which has a flat and horizontal bottom 2 and a cylindrical riser wall 3, the axis A of which wall is at right angles to the said chamber bottom; and the body member also includes an inlet nipple 4, the bore of which opens into the whirling chamber tangentially of the cylindrical chamber wall 3.

The upper portion of the casing part 1 is bored out and tapped to afford a screw thread 6 of larger diameter than that of the chamber wall 3, the axis O of this screw thread being parallel to the chamber wall axis A but offset from the latter axis as hereafter recited. Threaded into the screw thread 6 and preferably bottoming on an annular shoulder 7 (as shown in Fig. 3) is the lower portion 8 of a cap provided with an axial bore 9 which forms the outlet of the whirling chamber.

With the two parts of my spray head thus constructed and assembled, the liquid, admitted under pressure through the inlet 4, swirls around within the cylindrically walled whirling chamber 3 and thereafter advances spirally toward within the outlet bore 9, and centrifugal action keeps the liquid away from the axis of the outlet so that the cross-section of the liquid may be as shown in dotted lines at 10 in Fig. 3. As soon as the tubular spiraling stream of liquid issues from the outlet bore, centrifugal action flares it out into a hollow cone which ruptures into liquid filaments and thereafter is atomized.

By constructing my spray head of a body member which includes a whirling casing and an inlet nipple integral with that casing, and a separately attached cap, I permit both the bottom and the inner riser wall of this casing to be machined cheaply and accurately before the cap is attached. So also, both the lower end face 8A and the bore 9 of the cap can be accurately and smoothly machined, and the several portions of the bore of the nipple can be cheaply and accurately bored out.

Consequently, I entirely avoid the pitting, protuberances and other interior surface irregularities which will occur in a single piece spray head of this type when its interior is cored, and which irregularities interfere with the efficiency of the spray head to an increasing extent as the size of the spray head is decreased. In addition, the detachability of the cap, which preferably has its head portion of polygonal shape so as to be easily gripped by a wrench, permits speedy access to the interior of the casing for cleaning it when necessary, and the simplicity of both parts permits each of them to be roughed out inexpensively in the form of drop forgings from bronze or other non-corrosive and highly durable metal.

However, the efficiency of my spray head will vary greatly with the proportions and relative arrangement of different portions of my appliance, and to obtain both a high spraying capacity and the production of a uniformly divided fine spray, I have found the following proportions and other features highly important:

1. The interior height of the whirling chamber—namely the distance between the flat chamber bottom 2 and the bottom of the cap 8—should be approximately equal to, but not materially greater than, the radius of the riser wall 3 of the said chamber.

2. The diameter of the inward portion 11A of the bore of the inlet should be approximately five-eighths the interior diameter of the liquid supply pipe 12 attached to the nipple, the threads of the nipple for receiving this pipe should be coaxial with the said inward bore portion 11A, and the interposed bore portion 11B should be conical.

3. The spacings of the axis A of the riser wall of the whirling chamber from the axis 13 of the nipple bore, in a plane at right angles to the axis A, should be approximately equal to the difference between the radii of the said wall and the inner part 11A of the nipple bore.

4. The spacing T between the axis of the riser wall 3 and the axis of the threaded casing bore portion 6 should be approximately two-thirds the radius of the outlet bore 9 in the cap, and the diameter of this outlet bore should be approximately equal to but not greater than, the diameter of the inner inlet bore portion 11A.

5. The axis A of the riser wall 3 and the axis O of the eccentrically bored upper portion of the casing should both be in a common vertical plane P extending at an angle 14 of about 30° with respect to the axis 13 of the inlet bore, with the said axis O offset from the axis A in a direction away from the apex of the said angle.

6. The length (or height) of the outlet bore 9 should be at least equal to and desirably about one-sixth greater than its diameter.

7. The juncture of the bottom face 8A with

the outlet bore 9 should be sharply right-angled in all sections diametric of this bore.

8. The inner height of the whirling chamber should be somewhat greater than the diameter of the inward inlet bore portion 11A; and the shorter side of that inlet bore portion should be of a length at least equal to its radius.

9. The elevation of the upper end wall (8A in Fig. 3) of the whirling chamber above the top of the inlet bore 11A should be a minor fraction of the radius of the said inlet bore, for the reason that the incoming and initially cylindrical stream of liquid has its direct effect mainly on the liquid in the chamber which is at the height corresponding to the vertical spread of the inlet bore. Consequently, the liquid at higher elevation than the top of this horizontal inlet bore will be more free to shift so as to have its vertical bore (namely the corresponding part of the dotted line 9 in Fig. 3) axial of the cylindrical chamber. However, with the said elevation of the top of the chamber only slightly above that of the top of the inlet bore, this shifting tendency is immaterial.

10. The elevation of the lowermost portion of the inlet bore 11A above the bottom of the chamber likewise should be a minor fraction of the diameter of the said bore, and in practice desirably is just sufficient to afford ample clearance for the drill or reamer which bores or smooths the said bore, so that the diameter of the inlet bore should be at least approximately seven-eighths of the height of the inlet chamber.

With my spray head thus proportioned, the stream of water admitted through a supply pipe 12 attached to the nipple 4 is first contracted to a smaller diametered cylindrical stream within the inlet bore portion 11A and then admitted to the whirling chamber adjacent to the riser wall 3 of that chamber, and the admitted stream spreads along that wall to a somewhat greater height than the diameter of the entering stream. This provision for an initial upward and downward spreading of the admitted liquid and the subsequent whirling of the stream within the cylindrical chamber without a further increase in its height have been found to produce an effect allied to that of whirling a liquid stream within a spiral chamber which decreases in radius in the direction in which the stream whirls.

That is to say, the action is as if the chamber wall were curved about the axis O as a spiraling axis, so that I am able to secure the advantages of such a spiraling without encountering the manufacturing difficulties involved in machining a spiraled wall. Indeed, I have found that with my easily and cheaply manufactured two-part spray heads made for use with water supply pipes ranging all the way from one-fourth inch to one and one-quarter inch bores, I can efficiently produce hollow conical sprays of far more uniform atomization than those heretofore obtained with commercial spray heads employed for the same pipe sizes, and also have found that my here presented spray head will function effectively with considerable variations in the pressure at which the water is supplied.

However, while I have heretofore described my invention in an embodiment in which the outlet is formed in a spray head part detachable from the part which includes both the inlet nipple and the cylindrical riser wall of the chamber, I do not wish to be limited in this

respect, as the detachable part might be below the said chamber instead of being above the latter.

Thus, Fig. 7 shows an embodiment of my invention in which both the upper wall 12 of the whirling chamber and the upright outlet tube 13 are integral with the riser wall of the chamber and the inlet nipple 1, and in which the eccentrically disposed thread 6 extends upwardly into the body member. In this case, the flat top of the detachable part 14 forms the bottom of the whirling chamber and abuts upwardly against the annular shoulder 7 on the body member. With this embodiment, the lower face of the detachable part 14 desirably is flat and at right angles to the axis of that part, so that when placed on a floor 15 it will support the spray head with the outlet axis upright.

With each of the illustrated embodiments, it will be noted that I employ no posts, partitions or riser vanes within the whirling chamber as has heretofore been customary with spray heads of this class, thereby avoiding all tendency toward a clogging of the spray head by non-liquid materials carried into it or which might drop into it when the spray head is not in use. Moreover, since the detachable part can easily be unscrewed, the user has convenient access to all interior parts, which could not be obtained in a single-piece spray head.

However, while I have heretofore described my spray head as positioned for the upward projecting of a hollow conical spray, I do not wish to be limited in this respect, since it obviously might be inverted or tilted if desired. Nor do I wish to be limited to the above described details of construction and arrangement, since changes might obviously be made without departing either from the spirit of my invention or from the appended claims.

For example, the manner in which the detachable cap is secured to the body of my spray head is obviously immaterial so long as the proper eccentric disposition of the outlet with respect to the whirling chamber is obtained. So, also, the outlet bore need not be cylindrical, as a light upward taper can be employed advantageously in the smaller sizes, such as spray heads for use with a water pipe of one-quarter inch bore; that is to say, an upward taper of no more than about two degrees might be employed, although too small to illustrate on the scale of the present drawing.

In the claims, it is to be understood that the term "cylindrical" as describing the shape of the riser wall of the whirling chamber is used in its generally accepted meaning of indicating that this wall has a uniform circular section.

I claim as my invention:

1. A spray head for projecting liquid in the form of an upwardly widening conical spray from a whirling chamber, comprising two threadedly connected parts; one part being formed to afford having an upright cylindrical riser wall and a horizontal top wall of the chamber, and the other part affording a horizontal lower end wall of the chamber; one of the parts including an inlet nipple disposed with the axis of the nipple horizontal and with the bore of the nipple opening into the said chamber through a circular chamber inlet tangential of the said riser wall, and the upper of the two parts having an outlet of cylindrical bore leading upward from the interior of the said chamber; the axis of the said outlet being displaced from

the axis of the said riser wall both away from the riser wall portion to which the inlet is tangential, and in a direction opposite to that of the liquid entering the chamber through the inlet.

2. A spray head for projecting liquid in the form of an upwardly widening conical spray, comprising a hollow and rigid body formed to afford an upright interior circular-cylindrical whirling chamber having a circular horizontal section, and having horizontal top and bottom walls, a horizontal inlet bore of circular section leading to the said chamber tangential to the riser wall of the said chamber, and an upright outlet bore leading from the top of the said chamber; the diameter of the inlet bore and the outlet bore being each approximately seven-eighths of the height of the said chamber; and the axis of the said outlet bore being offset from the axis of the said riser wall both away from the riser wall portion to which the inlet is tangential, and in a direction opposite to the direction in which the liquid enters the chamber through the said inlet; the said inlet bore being freely spaced both upwardly and downwardly from the said top and bottom walls of the whirling chamber.

3. A spray head for projecting liquid upwardly in the form of an upwardly widening conical spray from a whirling chamber, comprising two threadedly connected rigid body parts; one part being formed to afford having a recess having an upright circular-cylindrical riser wall and a horizontal end wall, and the other part affording a second horizontal end wall for the recess; one of the parts including an inlet nipple disposed with the axis of the nipple horizontal and with the bore of the nipple opening into the said chamber through a circular chamber inlet tangential of the side riser wall, and the upper of the two body parts having an outlet of cylindrical bore leading upward from the interior of the said chamber; the axis of the said outlet be-

ing displaced from the axis of the said riser wall both away from the riser wall portion to which the inlet is tangential, and in a direction opposite to that of the liquid entering the chamber through the inlet; the bore of the outlet and that of the said inlet being equal, and the horizontal chamber end wall afforded by the upper of the said two body parts being spaced upwardly from the uppermost portion of the said inlet by a distance which is a minor fraction of the radius of the said inlet.

4. A two-part spray head for projecting liquid in the form of an upwardly widening hollow conical spray, comprising a body member formed to provide an interior upright and circular-cylindrical recess having a horizontal end wall; the body member having at its other vertical end an upright threaded bore of larger diameter than the said chamber and into which the recess opens; and having a horizontal inlet bore of circular cross-section leading to the said recess tangential to the cylindrical riser wall of the recess; and a rigid cap member threaded into the said bore and affording a second horizontal end wall for the said recess; the member affording the upper of the said walls having an axial and upright cylindrical outlet of equal diameter with the said inlet bore extending upwardly from and integral with the last named wall; the axis of the said threaded bore displaced from the axis of the said riser wall of the chamber both away from the portion of the riser wall to which the inlet is tangential, and in a direction opposite to that of the liquid entering the chamber through the inlet; the body member and the cap member having interengaging formations for positively limiting the threaded interconnecting of the said two members so as to space the said end walls by a distance approximately one-seventh greater than the said equal diameters of the inlet and the outlet.

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