Dec. 2, 1924. 1,517,598

J. W. STEVENSON

APPARATUS FOR SPRAYING FLUIDS AND MIXING THE SAME

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FIG. 1.

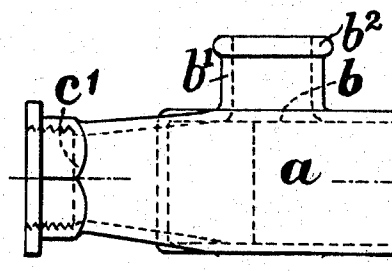


FIG. 2.

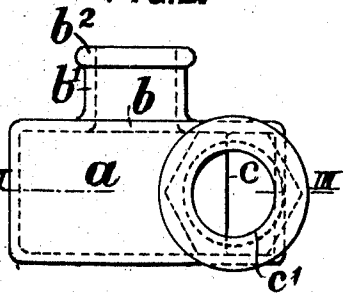


FIG. 3.

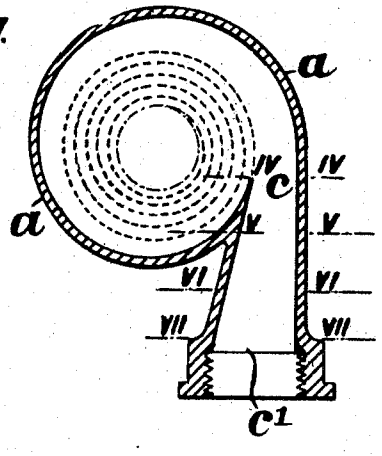


FIG. 4. FIG. 5. FIG. 6. FIG. 7.

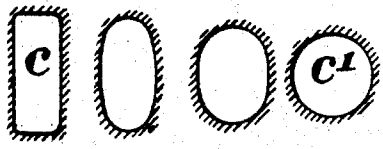
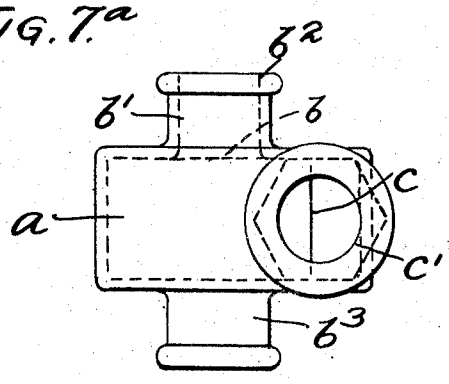


FIG. 7a



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FIG. 8.

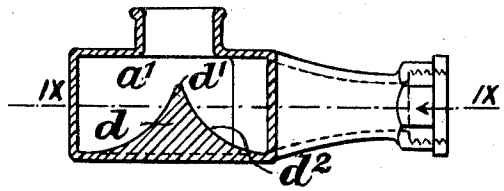


FIG. 9.

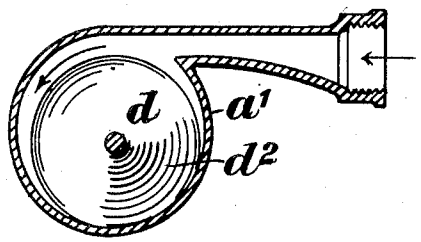


FIG. 10.

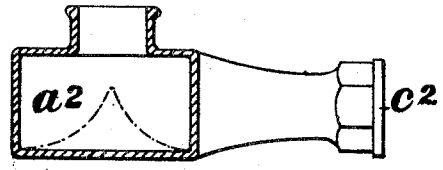
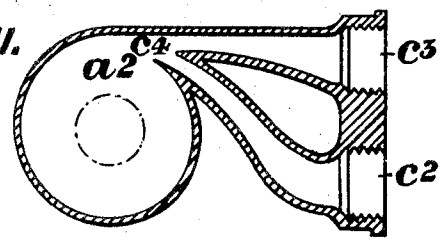


FIG. 11.



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APPARATUS FOR SPRAYING FLUIDS AND MIXING THE SAME

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FIG. 12.

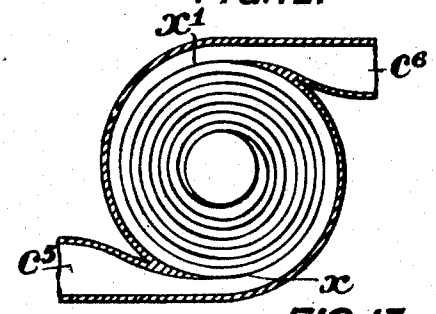


FIG. 13.

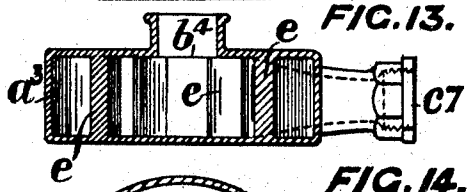


FIG. 14.

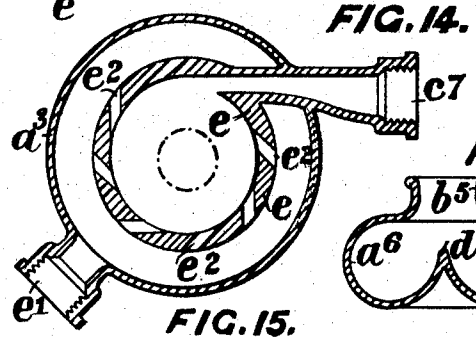
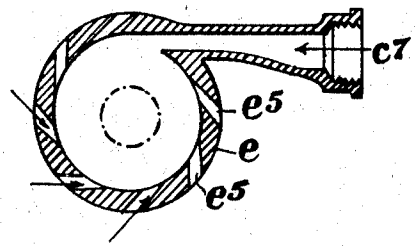


FIG. 16.

FIG. 15.



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Patented Dec. 2, 1924. 1,517,598

UNITED STATES PATENT OFFICE.

JOHN WILLIAM STEVENSON, OF EBBW VALE, ENGLAND.

APPARATUS FOR SPRAYING FLUIDS AND MIXING THE SAME.

Application filed September 1, 1921. Serial No. 497,789.

To all whom it may concern:

Be it known that I, JOHN WILLIAM STEVENSON, a subject of the King of Great Britain, residing at "Belcombe," Libanus Road, Ebbw Vale, in the county of Monmouthshire, England, have invented new and useful Improvements in Apparatus for Spraying Fluids and Mixing the same (for which I have filed applications in Great Britain, October 22, 1917, application #15340, Patent No. 120,078, dated October 22, 1917; Australia, June 30, 1920, application #16,350, Patent #16,350 of 1920, dated October 22, 1917; New Zealand, June 17, 1920, application #43936, Patent #43936, dated October 22, 1917; Union of South Africa, Sept. 20, 1920, application #1046 of 1920, Patent No. 1046 of 1920, dated September 20, 1920), of which the following is a specification.

This invention relates to an improved apparatus for spraying or atomizing fluids (hereinafter referred to as "fluid" for sake of brevity) and, if desired, for heating, cooling or mixing the same. The type of apparatus concerned is that in which the fluid under pressure is admitted tangentially into a drum in which it swirls and is then delivered axially through an orifice in an end wall of the drum. One object of the invention is to avoid the use of small ports or orifices for the entry or exit which are liable to become clogged particularly when foul waters are sprayed by such apparatus. Another object is to facilitate the coiling up of the fluid in the drum so that practically all the pressure of the entering fluid is used up for such coiling of the fluid. Such coiling of the fluid cannot be accomplished in accordance with this invention if restricted orifices are employed, and particularly if orifices for the inlet of the fluid extend a fraction only of the distance between the end walls of the drum. The coiling effect which this invention has for its object to secure is similar to the coiling of the main spring of a time piece.

According to this invention, the inlet orifice extends from one end wall of the drum to the other, or thereabouts, and the cross sectional area of the outlet is approximately equal to, or is greater than, the cross sectional area of such inlet. Preferably the inlet orifice is oblong with the greater sides parallel to the axis of the drum, and the inlet duct merges from the circular hose or pipe connection at one end into the oblong shape at the orifice without reduction of the cross sectional area. In this way, a tape or strip of liquid, equal in width to the length or depth of the drum, being introduced tangentially as aforesaid, coils itself within the drum, the speed increasing and the pressure diminishing as it reaches the outlet. To increase this coiling action, the interior of the drum is given a spiral formation hereinafter described. If desired, there may be more than one inlet and more than one outlet.

Each outlet may be furnished with a nozzle or series of nozzles. Furthermore, and in order to enhance circular movement of the fluid, the closed end or bottom of the drum may be provided, in known manner, with a cone, the apex of which is outwardly directed, approximately concentric with the outlet orifice and so constructed and arranged as not to project into or through the outlet. In any case owing to the large area of outlet, the fluid is not in any way constricted in its exit, consequently, the tendency to be atomized is entirely unrestricted and in effect an extremely fine spray or atomization is produced. If two outlet orifices be used and it is desired to enhance the circular motion of the fluid, then two cones may be employed, placed base to base and integral, if desired, and these cones are conveniently suspended or mounted approximately in the centre of the drum and with their apices pointing towards their outlets. For cooling, heating, or mixing purposes, a second fluid may be introduced, in known manner, through holes or ports in the periphery of the drum. Obviously, the combination of these spraying devices may be employed so that the spray from one device impinges on that delivered by another or others.

In order that the invention may be readily understood, reference is made to the accompanying drawings, in which:—

Figure 1 is an elevation of an apparatus constructed according to this invention.

Figure 2 is an end elevation of the same.

Figure 3 is a horizontal section on the line III—III of Figure 2, and

Figures 4, 5, 6 and 7 are diagrammatic sections on the lines IV—IV, V—V, VI—VI and VII—VII respectively of Figure 3.

Figure 7^a is a view, similar to Fig. 2, of a modified construction.

Figure 8 is a part sectional elevation of another construction and

Figure 9 is a horizontal section of the same on the line IX—IX of Figure 8.

Figure 10 is a part sectional elevation of a modified construction of drum and

Figure 11 is a horizontal section of the same.

Figure 12 is a horizontal section showing two inlets removed from each other.

Figure 13 is a sectional elevation of an apparatus having an inner and outer chamber and

Figure 14 is a horizontal section of Figure 13.

Figure 15 shows in horizontal section another construction of fluid chamber.

Figure 16 is a sectional elevation of another modified construction of apparatus or drum.

In carrying the invention into effect and according to one construction, shown in Figures 1 to 7, the apparatus or device consists of a drum a closed at one end and provided at the other end with a central opening b surmounted, if desired and as shown, by a nozzle b^1 having an internal diameter of, say, rather more than one third of that of the drum a. The size of the outlet orifice is dependent on the quantity of fluid to be discharged and on the degree of atomizing. The discharge orifice can be made anything between a fifth and nearly the full diameter of the drum. If desired, the outlet or discharge orifice or orifices may be surrounded by a bead b^2 or the edge may be quite sharp. As indicated in Figure 7, the drum may also have a second outlet b^3 so that the spraying or atomizing takes place at each end, in which case, unless the pressure be very high, the inlet c may be somewhat larger in diameter or there may be two inlets and two outlets. The inlet c extends from top to bottom of the drum being preferably relatively narrow and of oblong shape, as shown in Figure 4. This inlet orifice c is connected with the pipe connection c^1 by a duct which is shaped so as to gradually merge the oblong section into the circular, as will be readily understood from the series of Figures 4 to 7, the cross sectional area of the duct remaining the same throughout. To facilitate or intensify the coiling action as aforesaid the interior of the drum is given a spiral formation seen in Figure 3, and also seen in similar views hereinafter described, and the tangential entry of the fluid at the point of maximum radius prevents the entering stream from colliding with or directly impinging upon the inner convolution of fluid which has already performed a circuit of the drum, as will be readily understood from the dotted spiral lines in Figure 3.

In Figures 8 and 9, the cone d is formed or provided on one end wall of the drum concentric with the outlet orifice in the other end wall. The apex d^1 is at a height about two-thirds of the height of the drum but, in any case, the height of the cone is less than the height of the inlet orifice. The sides of the cone may be straight but, preferably, they are slightly concave as shown at d^2.

As shown in Figures 10 and 11, the drum may have several inlets close together or merging into one another, as is the case with the inlets c^2 c^3. Or, as shown in Figure 12, the inlets c^5 c^6 may be removed from each other. In Figure 12 the lines x x^1 indicate the films of liquid travelling round the drum, as in the case of the dotted lines in Figure 3.

As shown in Figures 13 and 14, according to another modification and for mixing two fluids, the drum e with inlet c^7 and outlet orifice b^4, is surrounded by or enclosed in another drum a^3 also furnished with an inlet e^1 and the inner drum e has a number of tangential ports e^2 in its periphery for the entry of the liquid from the outer drum a^3.

Or, as shown in Figure 15, there may be one drum e^4 with tangential inlets e^5 for the admission of air to be mixed with the fluid entering at c^7.

Instead of the drum a^5 being cylindrical, the walls a^6 may, as shown in Figure 16, be curved. These walls a^6 merge at one end into the cone d^2, if there be one, and at the outlet end they are constricted and merge into the outlet orifice b^5.

The spraying or atomizing action may be controlled by varying the pressure of the fluid. If desired, the apparatus may be furnished with outlet or discharge nozzles of various sizes, or the said outlet may be constructed so that its cross sectional area is variable.

The fluid is admitted under pressure through the inlet or inlets and passes tangentially into the drum or casing and a revolving motion is set up due to the cylindrical or curved shape of the drum, the velocity increasing towards the centre of rotation. The revolving fluid finally emerges through the outlet orifice or orifices and, being then no longer restrained by the wall of the drum or casing, is, in obedience to the centrifugal force set up, formed into spray or atomized.

Having regard to the fact that this apparatus contains no restricted openings, it is obvious that relatively viscous liquids may be sprayed thereby, that while the inlet and outlet openings may be of large dimensions, the quantity of fluid delivered in atomized form may be relatively small, that foreign bodies may be freely passed through the apparatus without fear of clogging or interfering with the spray, that there are no moving or movable parts to get out of order and

that the motion imparted to the fluid within the drum affords a ready means of effecting intimate mixing of two or more fluids.

I claim:—

1. An apparatus for spraying or atomizing fluids, comprising a drum having end walls and a spiral circumferential wall, a tangentially directed rectangualr inlet on the latter wall and extending practically from one end wall of the drum to the other, said circumferential wall forming an interior chamber, the inner periphery of which forms a spiral having a radius vector gradually decreasing from the outer to the inner end of the spiral, one of said end walls having an axial outlet.

2. An apparatus for spraying or atomizing fluids, comprising a drum having end walls and a spiral circumferential wall, a tangentially directed rectangular inlet on the latter wall and extending practically from one end wall of the drum to the other, said circumferential wall forming an interior chamber, the inner periphery of which forms a spiral having a radius vector gradually decreasing from the outer to the inner end of the spiral, one of said end walls having an axial outlet, the cross sectional area of which is at least approximately equal to that of the inlet to the drum.

3. An apparatus for spraying or atomizing fluids, comprising a drum having end walls and a spiral circumferential wall, a tangentially directed rectangular inlet on the latter wall and extending practically from one end wall of the drum to the other, said circumferential wall forming an interior chamber, the inner periphery of which forms a spiral having a radius vector gradually decreasing from the outer to the inner end of the spiral, each of said end walls having an axial outlet.

4. An apparatus for spraying or atomizing fluids, comprising a drum having end walls and a spiral circumferential wall, one of the end walls having an axial outlet orifice, said circumferential wall having a plurality of tangentially directed orifices extending practically from one end wall to the other, an inlet duct communicating with one of said inlet orifices, said circumferential wall forming an interior chamber the inner periphery of which forms a spiral having a radius vector gradually decreasing from the outer to the inner end of the spiral.

5. Apparatus for spraying or atomizing fluids, comprising a drum having a spiral formation at the interior of the circumferential wall and an axial outlet orifice in one end wall and a plurality of tangentially directed inlet orifices in its circumferential wall said inlet orifices extending practically from one end wall to the other, an inlet duct communicating with a certain number of said inlet orifices, and a second inlet duct communicating with the remainder of said inlet orifices substantially as set forth.

6. Apparatus for spraying or atomizing fluids, comprising a drum having an axial outlet orifice in one end wall, and a tangentially directed inlet duct the port opening of which is oblong and extends practically from one end wall of the drum to the other the passage in said duct being of circular cross section at its outer end and gradually merging without change of cross-sectional area into the oblong cross section at its inner end substantially as set forth.

7. In a sprayer comprising a drum having end walls and a circumferential wall forming a chamber the periphery of which constitutes a spiral whose radius vector gradually decreases from the outer to the inner end of the spiral, an axially directed delivery nozzle on one end wall of said drum, and a tangentially disposed inlet duct on the circumferential wall, the port opening of said duct being of rectangular form and extending practically from one end wall of the drum to the other.

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