

Feb. 2, 1926.

1,571,629

E. HUGÉ

SPRAYER

Filed July 13, 1923

3 Sheets-Sheet 1

Fig. 8.

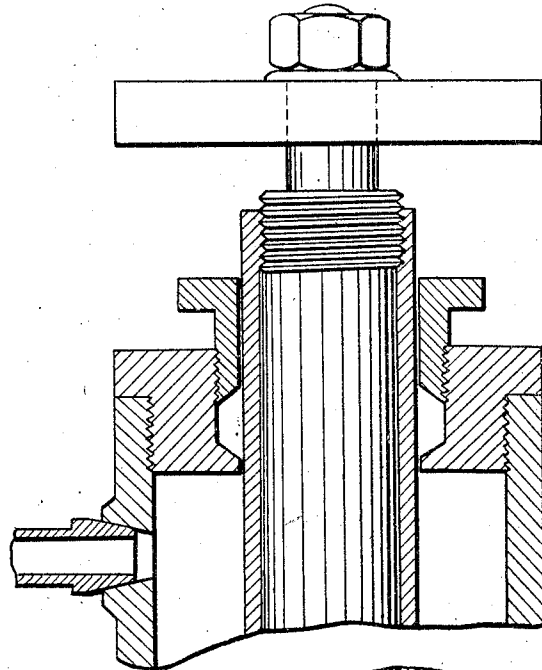


Fig. 1.

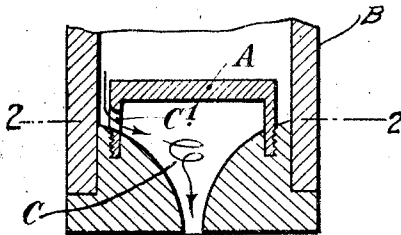
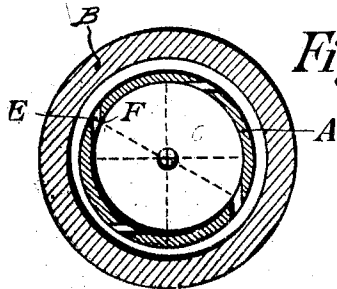
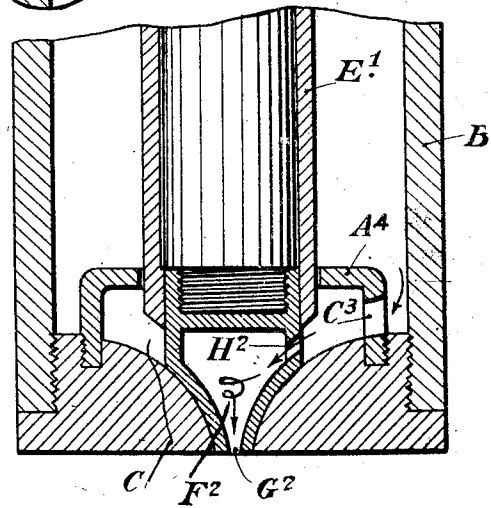


Fig. 2.



Inventor
Etienne Hugé
134
Maurice Cameron, Lewis & McKean
attorneys

Feb. 2, 1926.

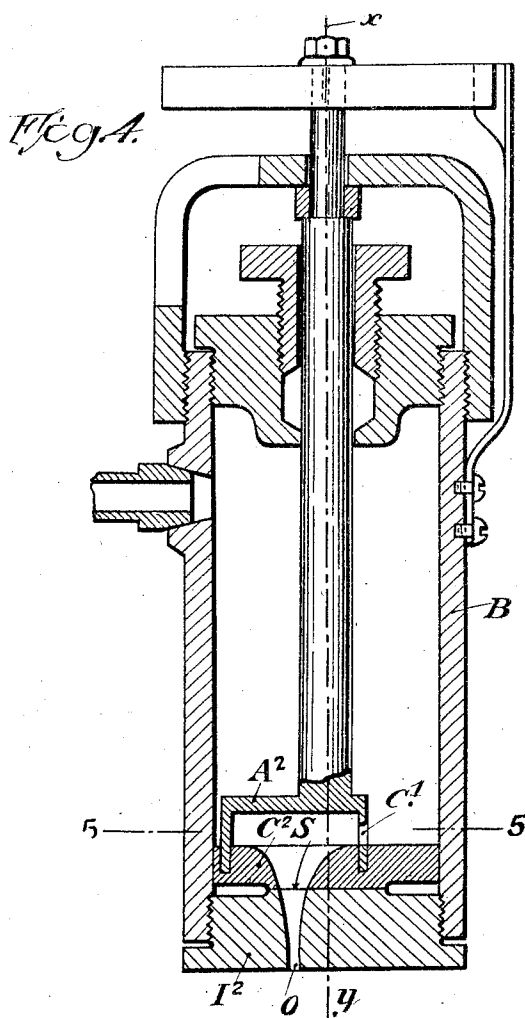
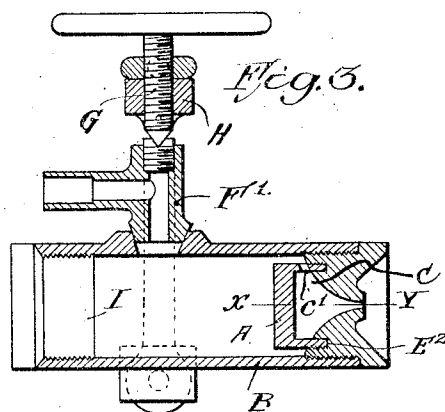
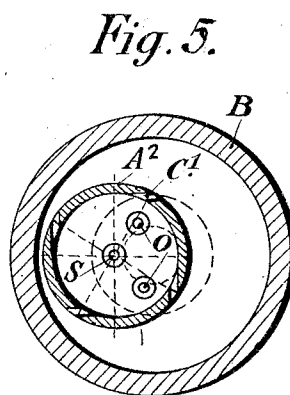
1,571,629

E. HUGÉ

SPRAYER

Filed July 13, 1923

3 Sheets-Sheet 2



Inventor
Etienne Hugué
By
Maurice Cameron, Louis Merbaum
Attorneys

Feb. 2, 1926.

1,571,629

E. HUGÉ

SPRAYER

Filed July 13, 1923

3 Sheets-Sheet 3

Fig. 9.

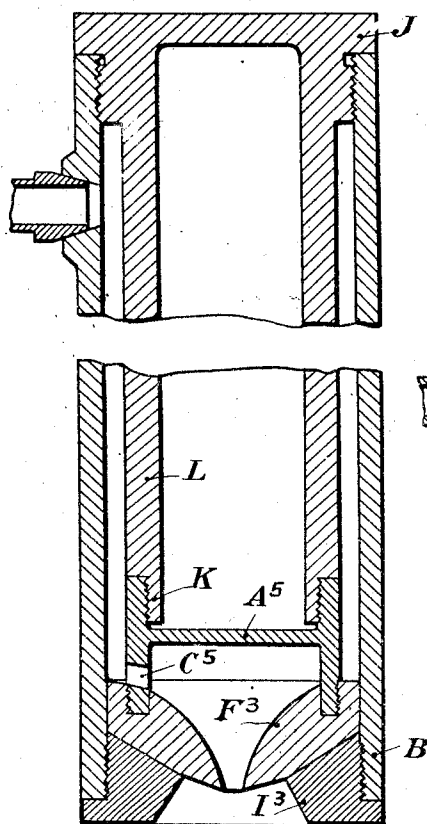
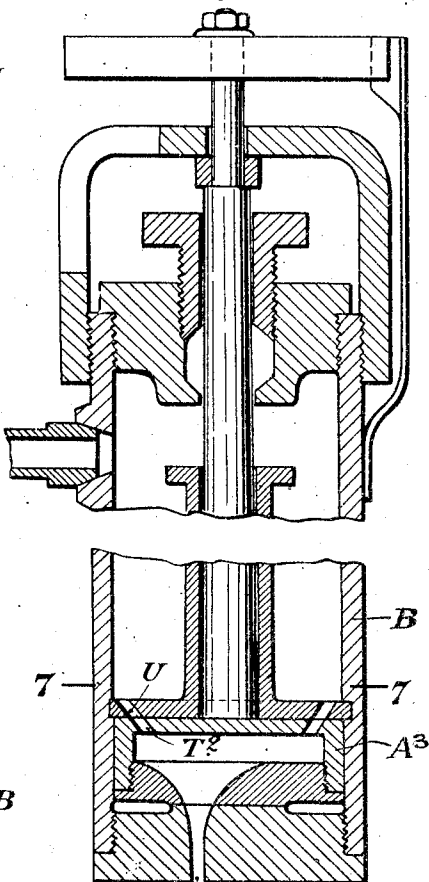
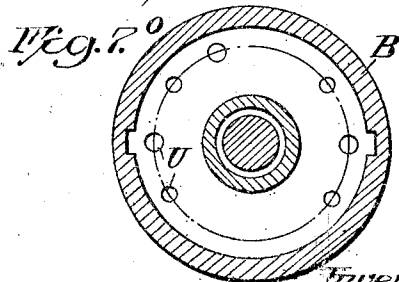


Fig. 6.



Inventor
Etienne Hugé
By
Hugé, Emery, Lewis & McKean
Attorneys

UNITED STATES PATENT OFFICE.

ETIENNE HUGÉ, OF INDRET, FRANCE.

SPRAYER.

Application filed July 13, 1923. Serial No. 651,439.

To all whom it may concern:

Be it known that I, ETIENNE HUGÉ, resident of Indret, Loire-Inferieure, France, citizen of the French Republic, have invented new and useful Improvements in Sprayers, which are fully set forth in the following specification.

This invention relates to sprayers designed for projecting fluids in the form of fine drops. Such sprayers are used, for example, in oil burners, nozzles for injecting fuel or water into the cylinders or carburettors of internal combustion engines, sprinkling roses or heads for projecting water for horticultural or fire-fighting purposes, and for spraying paint, fire-extinguishing or disinfecting liquids, etc.

The essential factor of the spraying is the rotational velocities around the axis of the sprayer of the liquid delivered by the latter.

In sprayers as heretofore constructed the gyratory motion is imparted to the fluid by its own passage through the ducts or apertures which impart to it a velocity the direction of which does not meet the axis of the outlet or exit orifices of the liquid.

The present invention has for its object to provide an improved sprayer designed to produce a high gyratory velocity with a minimum pressure drop in the sprayer.

The description given hereinafter with reference to the accompanying drawings (which are given by way of example only) will make the nature of the invention and its advantages clearly understood.

In the drawings

Fig. 1 is a longitudinal central section through the nozzle end of a sprayer embodying the present invention;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a broken sectional view of a mazout burner constructed according to the present invention;

Fig. 4 is a central longitudinal section of a burner constructed according to the present invention and having a variable delivery under constant pressure;

Fig. 5 is a cross-sectional view on the line 5—5 of Fig. 4;

Fig. 6 is a longitudinal section through another burner nozzle embodying the invention;

Fig. 7 is a cross-section on the line 7—7 of Fig. 6;

Fig. 8 is a longitudinal section of still another burner embodying the invention;

Fig. 9 shows a modified form of the invention.

Referring to the drawings and first to Figs. 1 and 2, A is a recessed ferrule having an annular wall of small thickness and large diameter. This ferrule leaves at its circumference between itself and the body B only sufficient space to allow the fluid to have access to apertures C¹ which may be of any number and are pierced obliquely through the wall of said ferrule and inclined to the axis in such a manner that a surface limiting the contour of said apertures terminates or opens into the chamber C tangentially both to the said chamber and to the inner wall of the ferrule.

In principle, the difference between the interior radius of the body B and the exterior radius of the ferrule A will be equal to the height of the apertures C¹.

The thickness of the ferrule wall is just sufficient to ensure the direction of the fluid flowing through the tangential apertures. This result may be assumed to be attained when the straight line drawn from the sharp outer edge E, Fig. 2, of the aperture to the center of the transverse section of the ferrule meets the inner edge F of the said aperture.

Fig. 3 illustrates, by way of example, a mazout burner constructed according to the present invention. In this figure it will be seen that the ferrule A formed with the tangential apertures C¹ is connected by screwing it to the chamber C which allows of the provision at the bottom of the assembly of a joint for preventing the liquid from passing into the chamber except through the tangential apertures. The chamber C in which the cup is formed and which constitutes the plug nose of the sprayer is assembled with the body by means of an internal thread. This construction avoids the use of a nut, which in most sprayers is screwed on the outer surface of the sprayer body B.

The capacity of the apparatus can be utilized to the utmost extent, in that the difference between the external diameter of

the body and the internal diameter of the whirl chamber can be reduced to the smallest value since there is no necessity to reserve a space for an exteriorly applied nut.

Briefly stated, the improved sprayer is formed with a chamber of the greatest initial radius, with the object of utilizing to the fullest extent the increase in the rotational velocity in accordance with the principle of the conservation of kinetic momentum.

The connection between the burner and the mazout supply piping is effected by means of a union F¹ tightened by a screw G fixed to a yoke H. It is only necessary to slacken the screw in order to dismount the burner instantly, after closing the section of the piping in front of the burner.

The internal space of the burner may be utilized for any purpose; for instance, there may be arranged therein a filter or a piston (not shown) provided with a compensating spring designed to diminish hammering in the delivery pipe of pumps. A plug I closes the rear end of the burner.

The profile of the chamber C is drawn in such a manner as to allow the liquid to be discharged wholly in contact with the wall of the chamber in accordance with the laws of hydraulics. There is therefore no space which can be the seat of eddies between the walls of the chamber and the exterior of the surface formed by the combining of the streams of liquid. This is one of the peculiarities of the present invention. This remarkable result, which does away with all dissipation of energy, is achieved by causing the radii of the cross-section of the chamber to gradually diminish, (in accordance with a special law) as a function of their distances from the initial cross-section of the inlet for the liquid into the chamber, so that the profile of the chamber will have the form of a curve extending in the general direction of the axis of the chamber such as a curve of a hyperbolic type that has as an asymptote the burner axis X—Y, (Fig. 3).

The above law is mathematically expressed by an equation between the co-ordinates r and z of the section of the chamber, which equation can be obtained by calculating the two derivatives

$$\frac{dp}{dr} \text{ and } \frac{dp}{dz}$$

of the pressure p at any point whatsoever, of co-ordinates r and z of the liquid vein and by writing the equation

$$\frac{d^2p}{dr dz} = \frac{d^2p}{dz dr}$$

An extremely interesting result of the profile of an axially curved chamber defined in this manner is that the guidance of the liquid is entirely assured by its bearing

upon the chamber wall. It is then possible to dispense with the internal guide that is provided in the majority of burners and which can never be satisfactorily centered.

By this means not only is all the disturbance of the discharge avoided which is prejudicial to proper spraying, but further, all slowing down of the gyratory velocity, due to the action of friction in contact with the internal guide, is avoided.

The shape adopted for the profile of the chamber allows of drawing tangents through a point situated in its interior. The apertures pierced in the wall of the ferrule may then be replaced by holes pierced in the cover of the chamber in a direction which, when continued, will be a tangent to the chamber wall.

The above described burner does not comprise any device for producing a variation of the delivery under constant pressure. Owing to the improvements due to the said burner, (suppression of shocks and eddies and the automatic multiplication of the gyratory velocity) it ensures an excellent spraying under very low pressure and thus allows of regulating the delivery to a great extent by the mere variation of the pressure of the liquid in the space comprised between the burner body B and the interior of the ferrule A.

The regulation of the delivery at constant pressure by means of one or the other of the two devices hereinafter described (forming part of the invention) may be effected irrespective of whether they are applied to sprayers of the ferrule-and-chamber type hereinbefore described or to sprayers of any other type.

Experience shows that an excellent sprayer effect may be obtained by a small orifice exit combined with a ferrule having apertures designed for much larger orifice. Thus an excellent burner, having a variable delivery under constant pressure, can be produced by arranging (Figs. 4 and 5) in the interior of the burner body B, a chamber-and-ferrule device C²—A² wherein the axis of the chamber does not coincide with the axis X—Y of the burner. The rotation of the chamber-and-ferrule device around the burner axis will bring the exit orifice S of the chamber successively at all points of a circle having as its radius the eccentricity of the chamber relatively to the burner body.

The end face of the chamber C² is pressed by any suitable means against the front plug I² of the burner. The latter is formed with a certain number of apertures O, of different diameters and of suitable contour, distributed over the circle just hereinbefore referred to, and by suitably adjusting the position of the chamber, it can be brought in front of the particular hole, O, which is of

a diameter corresponding to the desired volume of delivery.

It is to be understood that, without departing from the principle of the invention, the improved sprayer must be provided with means to position the chamber into exact register with the several holes, O, formed in the front plug, any suitable stop device being employed which will operate each time the axis of the chamber comes into coincidence with the axis of one of the holes. It is also evident that the holes, in front of which the chamber can be moved, can be provided in a member distinct from the plug with which it is to be mounted. In such a case the burner may be provided with a plurality of interchangeable members different from one another only in the diameter of the holes therein. Moreover, the arrangement may be made such that the dimension of the tangential channels for projecting the liquid into the chamber shall vary at the same time as the diameter of the exit orifice. For this purpose it would be sufficient, as above stated, to replace (Figs. 6 and 7) the apertures pierced in the ferrule by apertures T² pierced in the cover of the ferrule A⁴. The axis of these holes may, according to the directional position of the chamber, be brought into coincidence with the axis of holes U of different diameters pierced in a fixed plate bearing against the cover of the ferrule. The diameters of the holes U, which are less than those pierced in the cover, must be determined in such a manner as to correspond exactly with the diameter of the exit orifice O' corresponding to the same directional position of the chamber.

The advantage afforded by this construction is that it allows of a very wide regulation of the delivery without any dismantling of the parts, or stoppage of the working. The regulation of the delivery may moreover be affected without stopping the operation of the burner by means of the regulation of an inner member, the body of the burner proper remaining in place. A device of this kind will now be described.

It has been stated above that by suitably profiling the chamber, any internal guiding part was rendered unnecessary. As a matter of fact the liquid is caused by centrifugal action to bear in the form of a thin film or skin upon the wall of the chamber, and a space void of liquid is formed at the center of the said chamber.

Referring now to Fig. 8, a tube E¹ is arranged concentric to the burner body B and to the ferrule A⁴ provided with apertures C³ and extending into the region void of liquid. This tube E¹ may be left open at its inner end without thereby causing any leakage. Therefore there may be introduced into the said tube, without stopping the operation of the burner, an auxiliary chamber

F² having reduced orifice G², which, when pushed into contact with the main chamber C will serve as a substitute for the latter as regards operation. This chamber may be provided with a cylindrical wall formed with apertures H² determined as a function of the exit orifice G² of the said chamber.

Finally, if the condition of having to stop for a short moment the operation of the burner is accepted, the main chamber may be replaced by a simple seat I³ (Fig. 9), designed to receive the bearing of the chambered element F³ which would be introduced in the interior of the burner after having dismantled the closing plug J at the rear end, and likewise, if desired, changing the ferrule A⁵ formed with the aperture C⁵.

Fig. 9. illustrates, by way of example, a ferrule A⁵ screwed into the chambered element F³ and adapted to be assembled by means of a screw-threaded portion K, with a rod L formed in one piece with the plug J. The seat I³ is screwed internally into the front end of the body B of the burner. For the purpose of being centered, the chamber F³ is turned externally to the internal diameter of the body of the burner. It bears upon the seat I³ so that the liquid cannot pass between the two parts.

The constituent parts of the hereinbefore described improved sprayers may be constituted by as many removable parts as may be desired for the purpose of facilitating dismantling the parts and diminishing the weight and the bulk of the interchangeable parts.

Similarly, these parts may be assembled in any desired manner for instance by screwing or by means of a separate device (a screw or a nut). Other modifications may also be had without departing from the scope of the invention.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A liquid sprayer comprising a hollow body, a chambered outlet for said body having an axially curved surface, and means in said body for directing liquid into said outlet tangentially to the curvature of said surface in the direction of the axis.

2. A liquid sprayer comprising a hollow body having an outlet provided with a hyperbolically curved surface, and a device in said hollow body apertured to direct liquid into said outlet tangentially to the curvature of said surface in the direction of the axis.

3. A liquid sprayer, comprising a hollow body provided with a hyperboloidal outlet, and a hollow member in said body, said member having openings tangential to

its surface and to the hyperbolically curved surface of said outlet.

4. A liquid sprayer, comprising a hollow body having an axially curved outlet, and a cover or ferrule disposed within said body over the entrance end of said outlet, said cover or ferrule having one or more openings therein tangential to the interior surface of the cover and the curved surface of said outlet.

5. A liquid sprayer, comprising a hollow body having an outlet whose surface is hyperbolically curved, and a hollow cover for the outlet disposed within said body, said cover having one or more apertures therein tangential to the interior surface of the cover and to the hyperbolically curved surface of said outlet.

6. A liquid sprayer comprising a hollow body having an axially curved outlet, means at the entrance end of said outlet for directing liquid from the hollow body into the outlet tangentially to the interior surface thereof, and means controlling the flow of liquid from the hollow body through said outlet.

7. In a liquid sprayer, the combination of a hollow body, a member secured to said body having an outlet whose interior surface is axially curved, and means at the entrance end of said outlet for directing liquid from the hollow body into the outlet tangentially to the interior curved surface thereof.

8. In a liquid sprayer, the combination of a hollow body, a member secured to said body having an outlet whose interior surface is hyperbolically curved, and a cover for said outlet disposed within said body and apertured to direct liquid from the hollow body into said outlet tangentially to said hyperbolically curved interior surface.

9. In a liquid sprayer, the combination of a hollow body having an outlet whose interior surface is axially curved, and a cover for said outlet disposed within said body and having one or more apertures tangential to the interior surface of the cover and to the interior axially curved surface of said outlet.

10. In a liquid sprayer, the combination of a hollow body having an outlet whose interior surface is axially curved, an apertured cover for the entrance end of said outlet adapted to direct liquid from the hollow body into the outlet tangentially to its interior axially curved surface in the direction of the axis, and means controlling the flow of liquid through said axially curved outlet.

11. In a liquid sprayer, the combination of a hollow body having an outlet whose interior operative surface is hyperbolically curved, a cover for the entrance end of said outlet disposed within said body and hav-

ing one or more apertures tangential to the interior surface of the cover and to the hyperbolically curved surface of the outlet, and means controlling the flow of liquid from said hollow body to said outlet.

12. In a liquid sprayer, the combination of a hollow body, a hollow rotatable member within said hollow body having an interior hyperbolically curved surface eccentric to the axis of said body and an inlet tangential to the curve of said surface, and a member secured on the wall of said body having exit orifices of different diameters with which the outlet of said hollow member may be selectively registered.

13. In a liquid sprayer, the combination of a hollow body having a plurality of exit orifices, a hollow rotatable member having an outlet provided with a hyperbolically curved surface eccentric to the axis of said body and an inlet tangential to the curvature of said surface in the direction of the axis, and means for rotating said hollow member to register its outlet with said exit orifices.

14. In a liquid sprayer the combination of a hollow body having an exit orifice in the wall thereof, and a hollow rotatable member in said body having a hyperbolically curved outlet for registration with said exit orifice, and an inlet tangential to the hyperbolically curved surface of said outlet.

15. In a liquid sprayer, the combination of a tubular body, a plug fitted on one end of said body having an exit orifice therein, a hollow adjustable outlet member having a hyperbolically curved surface and an inlet tangential to said hyperbolically curved surface, and means for adjusting said hollow member to register the hyperboloidal outlet with said exit orifice.

16. In a liquid sprayer, the combination of a tubular body, a plug fitted on one end of said body having exit orifices of different diameters, a hollow rotatable member in said body having an outlet with a hyperbolically curved surface and an inlet tangential to the wall surface and to said hyperbolically curved surface, and means for rotating said hollow member whereby its outlet may be selectively registered with any one of said exit orifices.

17. In a liquid sprayer, the combination of a tubular body, a plug fitted on one end of said body having exit orifices of different diameters, a hollow member having a curved outlet and an inlet tangential to the member's surface and the curve of said outlet, and means on the axis of said tubular body for adjusting said hollow member whereby its outlet may be selectively registered with any one of said exit orifices.

18. In a liquid sprayer, a tubular body, a plug provided with exit orifices of dif-

ferent diameters, a hollow rotatable member having an outlet whose surface is that of a hyperboloidal curve eccentric to the axis of said tubular body, and an inlet tangential to said hyperbolically curved surface of said outlet, and means for rotating said hollow member whereby its outlet may be selectively registered with any one of said exit orifices.

19. In a liquid sprayer, the combination of a hollow body, an outlet member whose inner surface has a hyperbolic axial cross-section and a circular cross-section on a plane normal to its axis, means directing liquid into said outlet member tangential both to the hyperbolic and circular lines of said outlet member.

20. In a liquid sprayer, the combination of a hollow body and a chambered outlet to said body whose inner wall corresponds to a surface generated by the revolution of a hyperbola, said wall being provided with inlets directing liquid into said outlet cham-

ber tangential to the curvature of said surface in the direction of the axis, and tangential to the surface of said chamber in a sectional plane normal to the axis of said chamber.

21. In a liquid sprayer, relatively rotatable parts having openings formed to provide an outlet when the same are registered, one of said parts having an outlet chamber with hyperbolically curved interior wall, one of said parts having a passage therein tangential to the hyperbolically curved wall to said chamber.

22. In a liquid sprayer, relatively rotatable hollow parts having openings formed to provide a hyperbolically curved outlet when the openings in said parts are registered, the wall of one part having a passage therein tangential to the hyperbolically curved wall of said outlet.

In testimony whereof I have signed this specification.

ETIENNE HUGÉ.