Sept. 15, 1942. D. P. HUNTER 2,295,661

APPARATUS FOR SPRAYING LIQUID

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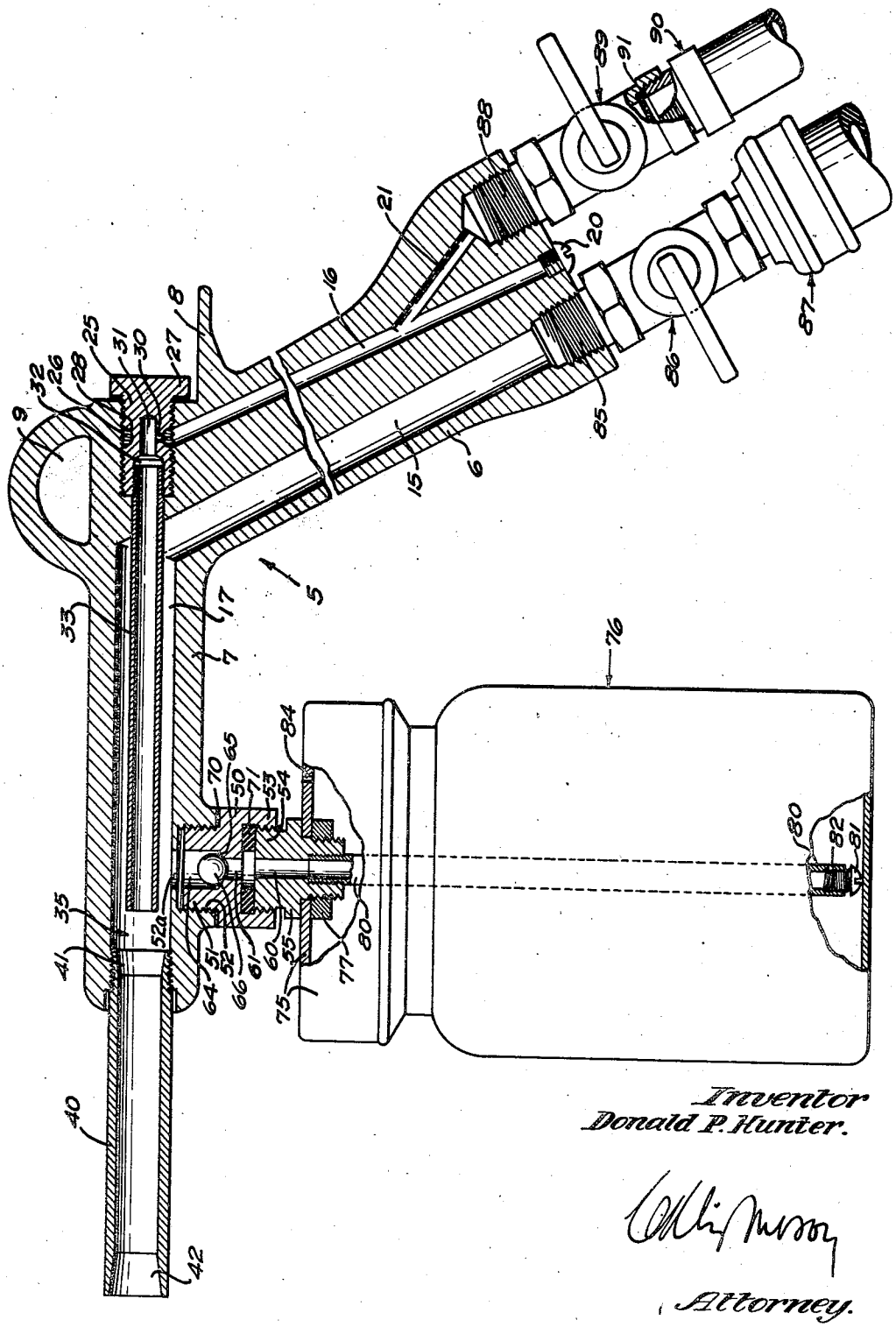

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## APPARATUS FOR SPRAYING LIQUID

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1 Claim. (Cl. 299—84)

My invention relates to liquid spray devices and methods of controlling the suction on an orifice in a fluid passing conduit and, more particularly, it has to do with spray devices in which a cleaning solution is formed by utilizing a structure wherein the main fluid streams—such as air and water—function to create a vacuum to siphon from a container a metered amount of cleaning solution for admixing with the fluid stream. In prior devices of this nature a shortcoming has been that with varying water pressures it is practically impossible to maintain a uniform and accurately proportioned solution because if sufficient pressure is maintained to properly atomize the spray, the cleaning fluid is too rapidly siphoned from its container. Another shortcoming of prior devices has been that without the use of manual control valves for the purpose, it is impossible to spray and properly atomize a rinsing spray free of cleaning solution.

It is therefore among the principal objects of my invention to provide a spray device of this character in which a uniform and accurately proportioned cleaning solution is maintained. It is a further object to provide a device of this kind having automatic means for closing off the siphon line when desired.

Another object is the provision of a spray device which is economical of manufacture, simple to operate, which is readily disassembled for cleaning purposes and which provides proper atomization.

Another object is the provision of a device of this character wherein atmospheric air may be drawn into the device through the siphon line to increase the air volume for certain uses.

Other objects and corresponding accomplishments will become readily apparent from the following detailed description of one presently preferred adaptation of my invention, for which purpose I shall refer to the acompanying drawing, in which the single figure is a longitudinal sectional view partly in elevation.

In general, the foregoing objects are accomplished by utilizing the elements and the combinations and associations thereof now to be described.

Referring now to the drawing, I show at 5 a body having a handle portion 6 and a barrel portion 7, so designed as to be conveniently held in one hand by the operator, there being a projection 8 at the rear of the handle near the top for engagement by the top edge of the hand to act as a stop, that is, in use, the handle sometimes becomes wet and slippery but in my device, since the hand grips the handle between projection 8 and the enlarged bottom end of the handle, a firm grip is provided. An opening 9 on the top of the barrel serves for hanging purposes. Within the handle portion 5, I provide a longitudinal water passage 15 and a relatively smaller longitudinal air passage 16. Passageway 15 communicates at its discharge end with a passageway 17 extending longitudinally in the barrel, passageway 17 being of a relatively larger diameter than is the diameter of passageway 15. Passageways 15, 17 communicate with each other at an angle so that the water entering passageway 17 will be given a swirling motion.

In my preferred structure, passageway 15 has a diameter of the order of $\frac{3}{8}''$ and passageway 17 is of the order of $\frac{1}{2}''$ interior diameter. Air passageway 16 is closed at its lower end by a threaded plug 20, and an inlet passageway 21 of slightly smaller diameter communicates at its discharge end with passageway 16. In my preferred structure, passageway 21 has a diameter of the order of $\frac{3}{32}''$ while passageway 16 has a diameter of the order of $\frac{1}{8}''$.

A plug 25 is screwed into a threaded bore 26 in the body, said plug having a head 27 for the reception of a wrench or tool. Plug 25 has, in register with passageway 16, an annular groove 28 and from the bottom of this groove a reduced passageway 30 communicates with a relatively larger longitudinal central bore 31, which latter bore is enlarged at 32 at and adjacent its outer end and is internally threaded to receive an air passing tube 33. In my preferred construction, the relative diameters of passageways 30 and 31 are of the order of passageways 16 and 21 and the interior diameter of tube 33 is preferably of the order of $\frac{5}{32}''$. Tube 33 extends longitudinally and concentrically of passageway 17 and terminates short of the outer end of said passageway to provide an expansion chamber 35 for the purposes to be later described. Tube 33 reduces the cross-sectional area of passageway 17 inwardly from the chamber 35. Nozzle tube 40, which is tapered to flare outwardly at its inner end 41 and its outer end 42, is threaded into the discharge end of passageway 17, the inner end 41 terminating short of the discharge end of tube 33 to provide the expansion chamber 35 therebetween. The bore of tube 40 is relatively smaller in diameter than passageway 17 to provide sufficient restriction at the outer end of passageway 17 for the purposes to be hereinafter explained.

In my preferred construction, the bore of tube

40 is of the order of 3/8" and is substantially 3" in length, and the discharge end of tube 33 is spaced from nozzle tube end 41 a distance of substantially 3/8".

An adapter 50 has a reduced top end 51 threaded into a correspondingly threaded opening 52 in the body, said opening 52 communicating at its reduced top end 52a with passageway 17, and adapter 50 has an internally threaded lower end 53 to receive the threaded upper end 54 of a container cap adapter 55, there being a central bore 60 through adapter 55 and a communicating bore 61 leading through adapter 50. Bore 61 is enlarged at its top end 64 to provide a conical seat 65 for a downwardly seating ball valve 66. A gasket 70 is provided between the body and the shoulder portion of adapter 50 and another gasket 71 is provided between the adapter 50 and the top end of the adapter 55. The lower end of adapter 55 is reduced in diameter and threaded into the top 75 of a jar or other cleaning solution container 76, a lock nut 77 being screwed onto the lower threaded end of the adapter 55. A feed tube 80 is threadedly connected at its upper end in the bore 60, with which it communicates, and is closed at its lower end by threaded plug 81, there being a restricted opening 82 through the side wall of the tube adjacent the upper end of the plug 81 so that by screwing plug 81 into and out of the bore of tube 80 the entry of cleaning solution into the tube through the opening 82 may be variably controlled. In my preferred device, the interior diameter of tube 80 is of the order of 5/32". Container 76 is exposed to atmosphere by means of opening 84.

Into the threaded inlet end of passageway 15 a nipple 85 is threaded to connect thereto a hand operated valve 86 of conventional structure and to the inlet end of the valve a suitable hose connection 87 is provided. The inlet end of passageway 21 is enlarged and internally threaded to receive a nipple 88 to connect thereto a hand operated valve 89 of conventional structure and at the inlet end of the valve member a suitable hose connection 90 is provided. In each of the hose connections 87 and 90, a suitable gasket 91 (only the gasket for connection 90 being shown) is provided.

From the foregoing description, it will be observed that I so proportion and position the parts that with a substantially constant air velocity through tube 33 it will expand somewhat in chamber 35 and pass out freely through the concentric discharge tube 40 creating a suction on orifice 52a. Then by manual control of the water valve 86, a relatively small amount of water is flowed through passageway 17 into chamber 35 where it is picked up by the air stream of relatively greater velocity—a velocity sufficient to properly atomize the stream. Assuming, for instance, that it is desired to admix say an ounce of cleaning material with each two gallons of water, discharge tube 40 is so proportioned as to length or internal diameter or both as to provide such a resistance that when the water stream through passageway 17 reaches proportions greater than is desired for the mixture, a back pressure will be created on orifice 52a sufficient to seat valve 66 and close off the entry of cleaning material so long as the water volume remains at or above that point. When this happens, if it is desired to continue the admixing of cleaning material with the spray, the operator simply operates valve 86 to reduce the water stream to a point at which no back pressure takes place. Also, if the operator then wishes a rinsing spray free of cleaning material, he simply opens valve 86 to a point sufficient to create back pressure on valve 66 to seat that valve.

Using the relative proportions of parts above described and air pressure of the order of 125 lbs. and water pressure of the order of 40 lbs., my device will deliver approximately one ounce of cleaning solution per minute so long as no more than approximately two gallons of water per minute is being delivered to passageway 17.

When it is desired to use the air stream alone to "blow off" the vehicle or the like being washed, the volume of air stream can be materially increased by removing adapter 50 or adapter 55, or both, thus exposing the inlet side of orifice 52a to atmosphere, from which additional air is sucked in to be admixed with the air passing from tube 33.

Of course with a given capacity of passageway 17, the point at which back pressure on orifice 52a will take place may be varied by varying the length or internal diameter of the discharge tube 40.

While in the foregoing I have described specific proportions and associations of parts which I have found desirable for particular uses, I wish it understood that various modifications and adaptations may be made therein within the broader scope and spirit of my invention as defined by the appended claim.

I claim:

A device for mixing and spraying fluids comprising a body having a fluid passageway therein, a fluid inlet discharging tangentially into the inlet end of said fluid passageway, a restricted outlet tube detachably mounted in and concentric with the discharge end of the fluid passageway, a fluid passing tube mounted concentrically in the fluid passageway and having its discharge end adjacent to but spaced inwardly from the restricted outlet whereby to provide a mixing chamber therebetween, an aspirating passageway in the body communicating with the fluid passageway at a point adjacent the mixture chamber, a solution reservoir, means establishing communication between the solution reservoir and the aspirating passageway, a ball check valve in the aspirating passageway adapted to be actuated by pressure differential between the discharge end of the aspirating passageway and the reservoir, and means for regulating flow of fluid through said fluid passageway whereby to vary said pressure differential.

DONALD P. HUNTER.