Sept. 5, 1939. H. HOLMBOE ET AL 2,171,932

APPARATUS FOR ATOMIZING LIQUIDS

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Fig. 1.

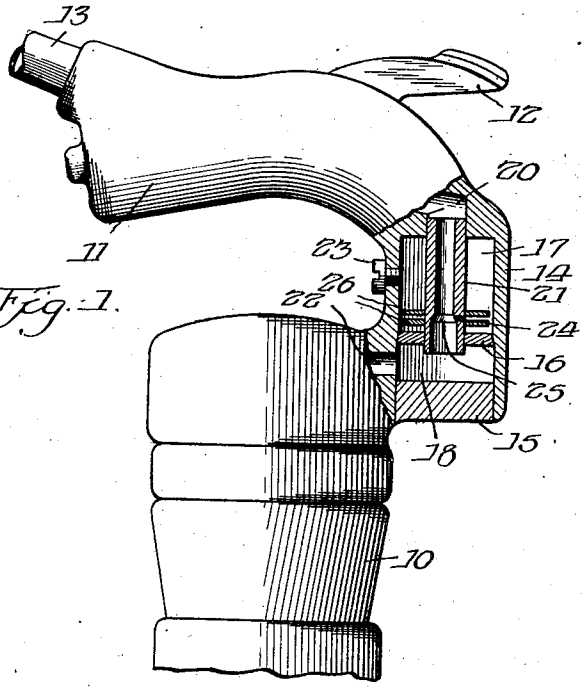


Fig. 2.

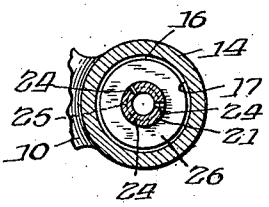


Fig. 3

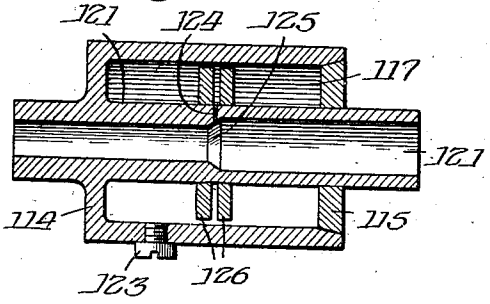


Fig. 4

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Fig. 5.

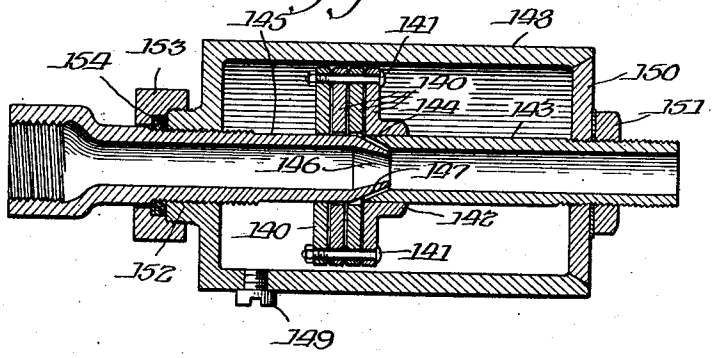


Fig. 6

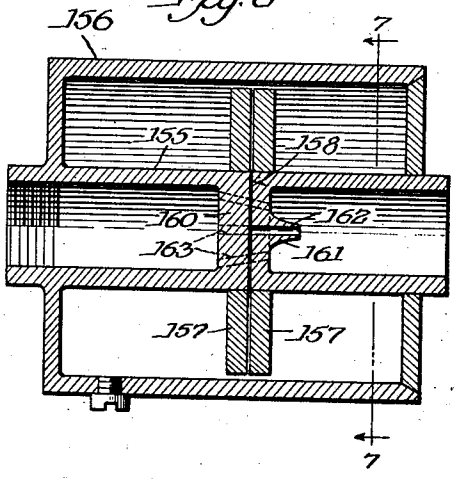
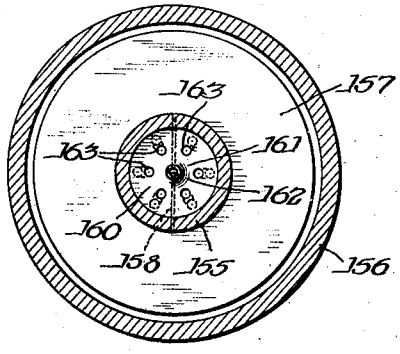


Fig. 7.



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APPARATUS FOR ATOMIZING LIQUIDS

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Application February 21, 1936, Serial No. 65,156

6 Claims. (Cl. 299—88)

The invention relates to apparatus for atomizing liquids and has particular reference to an improved atomizer which, in addition to other uses, will have utility as a lubricator for pneumatic tools and the like.

An object of the invention is to provide apparatus for atomizing liquids which will embody novel means maintaining by capillary attraction a supply of liquid where the same may be drawn into the air stream and which will effectively regulate the quantity of liquid delivered to the air stream.

Another object of the invention is to provide apparatus for atomizing liquids embodying spaced capillary members which function to maintain an adequate supply of liquid for injection into the air stream in the form of a mist or finely divided spray, and which will automatically increase in quantity as the velocity of the air stream increases.

A further object is to provide an atomizer of improved but simple construction, consisting essentially of spaced capillary members, which permit adjustment in the spacing thereof so as to regulate the quantity of liquid supplied to a fluid stream.

Another and more specific object is to provide an atomizer that will have utility for supplying the proper amount of lubricant to the working parts of pneumatic tools and the like, and which will be operative regardless of the position in which the tool is held.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawings and claims appended hereto.

In the drawings which illustrate an embodiment of the invention and wherein like reference characters are used to designate like parts—

Figure 1 is an elevational view of a conventional pneumatic tool, parts of the handle being broken away to show a lubricator constructed in accordance with the invention;

Figure 2 is a transverse view taken through the lubricator between the disks and showing the openings for delivering oil to the air stream;

Figure 3 is a longitudinal sectional view taken through an atomizer constructed according to the invention and which is designed primarily for industrial purposes;

Figure 4 is an elevational view, parts being broken away showing the atomizer of the invention as applied to a device primarily designed for home use;

Figure 5 is a longitudinal sectional view of a modified form of industrial atomizer equipped with a plurality of capillary members and having an adjustable opening;

Figure 6 is a transverse sectional view of another form of industrial atomizer constructed in accordance with the invention; and

Figure 7 is a transverse sectional view taken substantially on the line 7—7 of Figure 6.

For purposes of illustration, the invention will be first described as a lubricator for pneumatic tools. As shown in Figure 1, a chipping hammer having a body portion 10 and a handle 11 is provided with a trigger or valve actuating lever 12 for regulating the supply of compressed air to the tool and which is delivered by the flexible hose 13 connecting with said handle. The handle 11 is joined to the body 10 of the pneumatic tool by a portion 14 which is hollow for substantially its entire length, providing a chamber closed at ts lower end by the plug 15. Said chamber is divided internally by a partition 16 forming an upper chamber 17 which is utilized as a reservoir for the lubricating oil and a lower air chamber 18. The air delivered to the pneumatic tool is conducted by the passage 20 in the handle 11 to the tube 21 of the lubricator, forming a continuation of said passage, and which extends through the oil reservoir 17, through partition 16, and terminates in the air chamber 18. From said air chamber the air is delivered by passage 22 to the pneumatic tool.

The oil reservoir 17 is supplied with lubricating oil through the inlet thereof which is normally closed by the threaded member 23 and said oil is delivered to the air stream flowing through tube 21 by one or more small openings 24 therein, located in the vicinity of the base of the reservoir. The bore of tube 21 is enlarged as at 25, the angular surfaces forming the enlargement of said bore coinciding with the small openings 24. Securely fastened to the exterior of the tube 21 above and below said openings 24 are a pair of members or discs 26. Said members are spaced relatively close to provide the necessary capillary attraction for maintaining a supply of oil for delivery through openings 24, it being observed that the space between said members is in communication with the openings 24. The diameter of said members is somewhat less than the internal diameter of the oil reservoir 17 which permits the oil to enter between said members.

In the drawings the space between the members 26 has been necessarily exaggerated for clearness since in the physical embodiment of the present lubricator the distance between said member may be several thousandths of an inch. Said members, therefore, provide capillary attraction to draw the oil from the periphery to the openings 24. In operation a constant supply of oil is maintained between said members but at no time does the supply become excessive due to the narrow space therebetween. The device, therefore, effectively regulates the supply of lubricant that may enter the tube through openings 24 and functions irrespective of the position of the tool since the capillary attraction provided by said members does not depend on whether the same are horizontally, vertically or angularly disposed.

The oil is in effect injected into the air stream. To accomplish this the bore within the tube 21 is enlarged as at 25 and the openings 24 are located so as to coincide with this enlargement. The action of the air stream upon reaching the enlarged bore in said tube is to cause a suction effect in the vicinity of the angular surfaces 25 and since the openings 24 enter the bore at these surfaces, the oil is accordingly drawn into the air stream by suction.

In Figure 3 the invention is shown as comprising an atomizer suitable for industrial uses and which is connected in any approved manner to an air supply line. The reservoir 117 of said atomizer may contain any liquid which is desired to inject into the air stream in the form of a mist or finely divided spray. Said reservoir 117 is provided by the cylinder 114. Extending through said reservoir is a tube 121, having one or more small openings 124 formed therein, which openings coincide with the angular surfaces 125 forming an enlargement in the bore extending through said tube. The reservoir 117 is provided with an inlet closed by the threaded member 123. Similar to the device shown in Figure 1, spaced plates or discs 126 provide capillary means for maintaining a constant and adequate supply of liquid for delivery to the small openings 124. Said plates are suitably fixed to the exterior of the tube 121 and are located on the respective sides of the opening so that the space between said plates is in communication with said openings. Also, as explained with respect to Figure 1, the plates are relatively close to produce the necessary capillary attraction for drawing the liquid from the periphery to adjacent the openings 124.

In Figure 4 an atomizer for home use is disclosed and which consists of a jar or receptacle 130 closed at its upper end by the lid 131 through which extends the tube 132. Said tube at the left-hand end thereof has a downwardly extending portion to which is fitted, as at 133, the rubber bulb 134 provided with the conventional air valve 135 which prevents escape of the air within the bulb when the same is squeezed, causing the air to be forced through the tube 132. However, said valve opens when the bulb expands to fill said bulb with another charge of air. The tube 132 has a substantially horizontal portion 136 within the container 130, which is located adjacent the base of said container. This portion is equipped with the spaced discs 137 forming the atomizer of the invention. Small openings 138 connect the space between said discs with the interior of the tube to which point the bore of said tube is considerably enlarged to cause a suction effect in the vicinity of the openings 138, thus injecting into the air stream the liquid in the container. The invention contemplates any other structure which will have the effect of inducing a suction at the small openings 138.

In the operation of the present atomizer, the compressed air traveling through the bore of the tube 21, 121, or 132 creates a suction effect at the start of the enlargement of the bore and the liquid from the small openings is therefore injected into the air stream. The liquid enters the air stream in the form of a mist and is carried by the air which forms a vehicle for the liquid. In the device of Figure 1 the compressed air is finally admitted to the working parts of the tool for driving said parts and thus the oil carried by said air is supplied to the working surfaces thereof. A very minute quantity of liquid is injected into the air stream by reason of the small openings and also by reason of the fact that the supply of liquid is limited by the proximity of the spaced capillary members. However, the atomizer will function to constantly supply just the proper amount of liquid during operation of the same and, when used as a lubricator, the quantity of oil is just sufficient to lubricate the working parts of the tool and this supply is not dependent upon the position of the tool but continues irrespective of whether the tool is horizontally disposed or vertically disposed.

In Figure 5 the atomizer is modified in that a plurality of capillary members or disks 140 are provided which are held together as a unit in spaced relation by the securing bolts 141. One of said disks is provided with a boss 142 which is securely fitted to the end of tube 143, having a bevelled end 144. The passage through the reservoir is continued by tube 145, which tube is provided with a tapering end 146, the exterior surfaces 147 of which have association with bevel 144 of the tube 143.

The tubes 143 and 145 extend through the reservoir provided by the housing 148 which has an opening normally closed by the plug 149. The tube 143 is threaded to member 150 and is secured in adjusted position on said member by nut 151. The member is then suitably secured as by welding to the cylindrical portion of the reservoir to form a fluid tight connection therewith. Tube 145 has threaded engagement with a boss 152 integral with the housing. Therefore, by rotating tube 145 the tapered end 147 can be adjusted to secure the desired spacing between the tubes. When proper adjustment has been secured the packing ring 153 is rotated to compress the packing 154 to thereby seal the tube 145 with respect to the housing.

The association of the bevelled end 144 with the reduced portion 146 provides an annular opening which as shown has communication with the space between the disks 140. This annular opening is adjustable as to size by merely rotating tube 145 as above explained and thus the quantity of oil injected into the fluid stream flowing through the tubes is accordingly varied. The oil or liquid from the reservoir is injected in the same manner as previously described since sub-atmospheric presure is induced around the annular opening in tube 143 due to the reduced end of tube 145. It will be understood that the space shown between the discs 140 and also the space between the exterior of tube 145 and the opening through the disks has been exaggerated. In an actual device the space between the disks 140 may be reduced to one-thousandth of an inch and the clearance between the tube 145 and

the disks is just sufficient to permit movement of the tube.

The atomizer shown in Figures 6 and 7 is similar in many respects to the industrial atomizer of Figure 3. The tube 155 extends through a reservoir provided by a container 156. Spaced capilliary members or disks 157 are suitably fixed to the exterior of the tube and positioned substantially centrally of the reservoir, with the space between the members in alignment with a capillary bore 158 running transversely of the tube and passing through an integral partition 160. Said partition is provided with a boss 161 on one side thereof, which is concentric with a passage 162 communicating with the capillary bore 158 so that the oil or liquid in the reservoir which finds its way between the capillary member 157 is discharged to the capillary bore 158 and from said bore to the passage 162.

The air or fluid stream flowing through the tube 155 passes through the openings 163 in the partition 160, said opening being angularly disposed with respect to the horizontal and tending to converge in a direction toward the boss 161. The air or fluid streams issuing from said openings will therefore converge at a point in advance of the boss 161 and as a result a subatmospheric pressure is generated so as to produce a suction in passage 162. Therefore, the liquid or oil from the reservoir is in effect injected from passage 162 into the air or fluid stream flowing through the tube.

The atomizer of Figures 6 and 7 will therefore perform in much the same manner as previously described with respect to the devices of Figures 1 and 3. For certain industrial uses it is desirable to prevent the oil or liquid injected into the fluid stream from adhering to the walls of the tube. The atomizer of Figure 6 has accordingly been designed to meet this need and little or none of the oil or liquid from the reservoir adheres to the walls of the tube due to the fact that the same is delivered centrally of said tube and is discharged into the center of the air or fluid stream flowing through said tube.

From the above description of the several preferred forms of the present invention, it will be understood that the atomizer is adjustable in a number of respects. The amount of liquid injected into the fluid stream will vary as the velocity of the said fluid stream varies, since the suction induced by said fluid stream varies directly as the velocity. Also the size of the spacing between the capillary members will have the effect of varying the quantity of liquid supplied. Regulation can also be effected by adjusting the size of the opening and this is accomplished in the device of Figure 5 by rendering one section of the tube axially adjustable with respect to the other section, the annular opening formed thereby having direct communication with the space between the capillary members. When the present atomizer is used as a lubricator it can be incorporated in the tool as as integral part of the same or can be located in the compressed air supply line, in which case a device such as shown in Figure 3 would be used. For spraying paints and other liquids a device similar to Figure 4 can be used and it is optional whether the device is connected to a pressure bulb or to other sources of air under pressure. In the devices shown the structure is not necessarily limited to the injection of liquid into an air stream or other elastic medium, but on the other hand, satisfactory operation has resulted when water or other liquid is used as a vehicle. The atomizer therefore has commercial application in those cases where it is desired to inject a small quantity of liquid such as a fertilizer into another liquid as water. As an example, reference may be made to the practice of mixing a small quantity of concentrated liquid fertilizer with the water being sprayed on a lawn.

This application is a continuation in part of our co-pending aplication, Serial No. 48,918, filed November 8, 1935, which has since become abandoned.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings, as various other forms of the device will of course be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. An atomizer including a reservoir adapted to contain a liquid to be atomized, a tubular member extending through the reservoir from end to end and adapted to conduct a fluid, said member having an opening therein leading to the bore of the member, spaced members fixed to said tubular member on the respective sides of said opening to provide a capillary space associated with the opening, said capillary space maintaining a constant but limited supply of liquid for delivery to the opening, and an enlargement in the bore of said member to produce a suction effect at the opening by the flow of the fluid therethrough, whereby the liquid is injected into the fluid from said opening.

2. An atomizer including a reservoir adapted to contain a liquid to be atomized, a tubular member extending through the reservoir from end to end and adapted to conduct a fluid, said member having an opening therein leading to the bore of the member, spaced members supported by said tubular member and having substantially parallel surfaces providing a capillary space, said spaced members being positioned to locate the capillary space in communication with the opening, and said capillary space providing a path for conducting the liquid in the reservoir from the periphery of the members to the opening, thereby maintaining a constant but limited supply of liquid for delivery to said opening, whereby liquid is discharged by said opening into the fluid flowing through the tubular member.

3. An atomizer including a reservoir adapted to contain a liquid to be atomized, a tubular member extending through the reservoir from end to end and adapted to conduct a fluid, said member having a small opening therein leading to the bore of the member, spaced members fixed to said tubular member and having substantially parallel surfaces providing a capillary space, said spaced members being positioned to locate the capillary space in communication with said small opening, and said capillary space providing a path for conducting the liquid in the reservoir from the periphery of the members to the small opening, and the bore of said tubular member being constructed to produce a suction effect at the small opening by the flow of the fluid therethrough, whereby said liquid is injected into the fluid from the small opening.

4. An atomizer including a reservoir for a liquid to be atomized, a tube extending through the reservoir from end to end and adapted to conduct an elastic fluid, said tube having a small opening

leading to the bore of the tube, capillary means including spaced discs fixed to said tube and providing a capillary space associated with the opening for maintaining a constant but limited supply of liquid for delivery to said opening, said spaced discs having parallel planar surfaces forming said capillary space, and an enlargement in the bore of said tube at the opening to produce a suction effect by the flow of the elastic fluid through the tube, whereby the liquid is injected into the elastic fluid from the small opening.

5. An atomizer including a reservoir for a liquid to be atomized, a tube extending through the reservoir from end to end and adapted to conduct a fluid medium, a wall in the bore of said tube having a plurality of longitudinal passages extending therethrough, whereby the fluid medium flowing through the tube is caused to flow through said passages, a transverse passage in said integral wall having communication with a center opening in said wall in one side thereof, and capillary means fixed to the exterior of the tube and associated with said transverse passage for maintaining a constant but limited supply of liquid for delivery to said transverse passage, whereby said liquid is discharged from the center opening into the fluid medium flowing through the tube.

6. An atomizer including a reservoir for a liquid to be atomized, tubular means extending through the reservoir from end to end and adapted to conduct a fluid medium, a wall within the bore of said tubular means having a plurality of longitudinal passages through which said fluid medium must flow, a central opening in one side of said wall, a transverse passage in said wall extending to the periphery of said tubular means and communicating with said opening, and spaced capillary members fixed to said tubular means and having the space therebetween in communication with said transverse passage, said capillary members maintaining a constant but limited supply of liquid for delivery to said transverse passage, and which is eventually discharged from said opening, said longitudinal passages in the wall being constructed and arranged to produce a suction effect in advance of the center opening by the flow of fluid medium therethrough.

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