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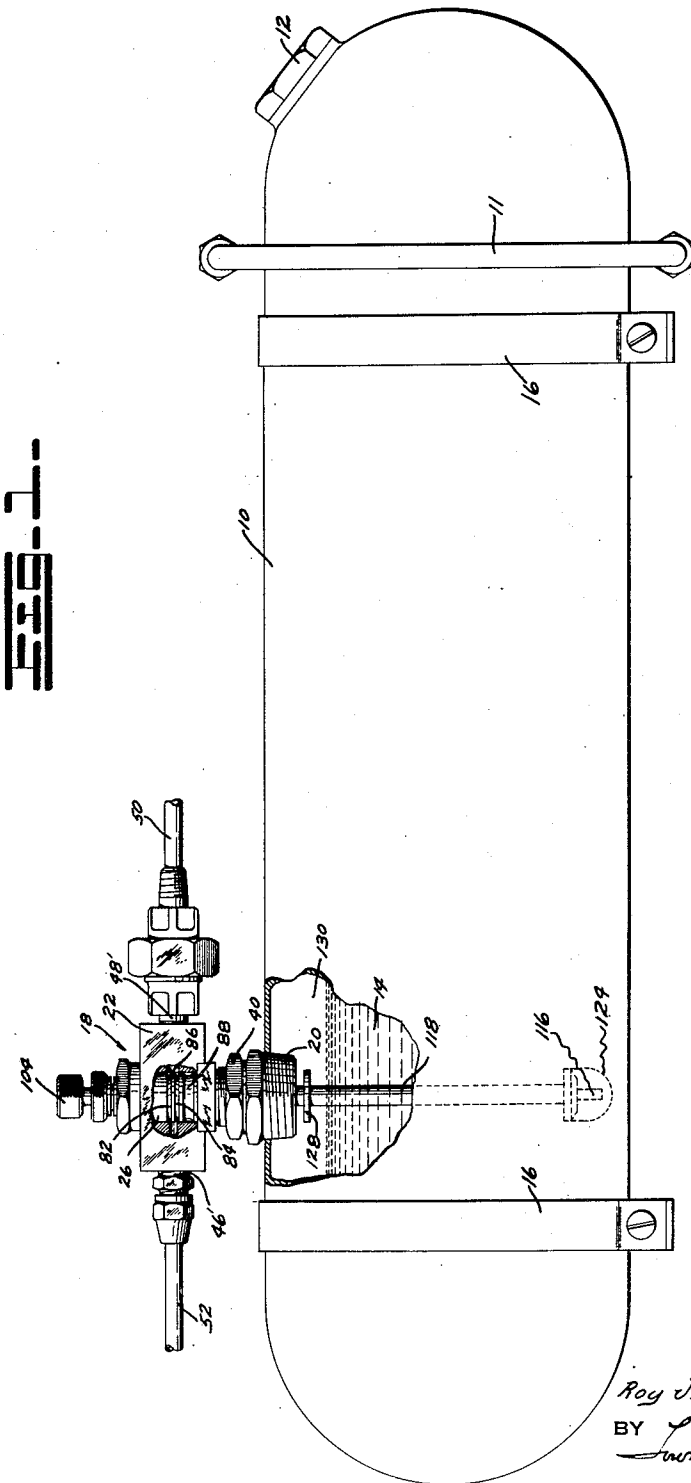
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MEANS FOR ATOMIZING FLUIDS

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1

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MEANS FOR ATOMIZING FLUIDS

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This invention relates to a means for supplying a liquid in the form of a finely controlled vapor or mist, such for instance, but not exclusively, as the coolant liquids employed in connection with machine tools, and for creating said vapor or mist.

In one aspect the invention may be considered as providing a combination proportioning and atomizing device with which it is possible to entrain a liquid with air or gas under pressure in a finely proportioned manner and to effect atomization of the liquid for delivery at a desired location to form, for example, a lubricating or cooling film, or some other coating, depending upon the liquid employed and the particular requirement involved.

In connection with the present day machine shop practice, much waste and mess results from the use of cooling and lubricating liquids and this the present invention obviates by providing for the delivery of such liquids in the form of a finely controllable mist or vapor.

In another aspect the invention provides for the moistening of air or gas with a liquid for purposes of cooling, humidifying or dust control.

It is thus an object of the present invention to provide an apparatus by which a liquid, or an admixture thereof, can be entrained or blended with air or gas in a controlled and controllable manner and reduced to a fine mist or vapor.

Another object of the invention is to provide an apparatus by which one fluid can be blended with another fluid prior to atomization and in such manner that there is a reduction in liquid viscosity, so that atomization of relatively heavy liquids is possible.

Further objects and advantages of the invention will appear clear from consideration of the following detail description with reference to the accompanying drawings and from the appended claims.

In the drawings:

Fig. 1 is a side elevational view, with parts broken away and sectioned, illustrating one form of the invention installed in operative position upon a vessel containing a liquid which it is desired to blend with air or gas and deliver for use in the form of a controlled mist or vapor, and

Fig. 2 is an enlarged vertical section of the fluid proportioning and atomizing device.

Referring to the drawings, 10 indicates a vessel having a removable inlet closure 12 for a liquid 14 and provided with suitable means of support, such as the mounting straps 16, said vessel also having an associated liquid level indicator pipe 11.

Mounted upon the vessel there is the controllable blending and proportioning device, indicated generally at 18, which device is secured within an opening 20 in the top of the vessel and is seen in detail in Fig. 2.

The device 18 comprises a body part 22 having a vertical bore 24 in which a plug 26 is secured and tightened into position upon the body part by actuation of the nut 28, between which and the top of the vessel 10, a

2

pressure ring 30 is located for exerting pressure against the fluid sealing ring 32. The plug is pulled into firm engagement with an annular seating surface 34 in the body part by tightening the nut 28.

The opening 20 in the vessel 10 is fitted with an internally screw-threaded socket 36 into which the screw-threaded lower end of the plug is screwed and locked into adjusted position by the lock nut 40, which nut presses the seal ring 42 into firm fluid sealing engagement with respect to the nut and socket so as to prevent escape of fluid along the screw-threading 44.

Upon opposite sides of the bore 24 the body part 22 is formed with transversely extending composite bores 46 and 48 to which nipples 46' and 48' are fitted carrying fluid inlet and discharge lines 50 and 52, respectively. The line 52 is connected at its outer end, not shown, with a suitable discharge nozzle while the line 50 is adapted for connection with a source of compressed air or gas.

The nipple 46' is shown formed with a reduced inner end portion having a taper surface 46'' which seals against the correspondingly tapered surface of the bore portion 34 and prevents leakage of fluid at this point.

The plug 26 is formed with a central vertical bore 56, which bore extends throughout the length of the plug and terminates, at its upper end, in an enlarged bore portion 58 and, at its lower end, in screw-threaded portions 60 and 62 of successively increasing diameter. Upon one side of the bore 56 the plug has a second vertical bore 64 which terminates within the plug at its upper end but extends to the bottom of the plug at its lower end, where this bore 64, is fitted with a one-way check valve, shown as comprising the ball 66, annular seat 68 and spring 70. Upon the opposite side of the bore 56 the plug is formed with a third vertical bore 72 which terminates within the plug at its upper end but extends to the bottom of the plug at its lower end, where a stop plug 76 holds a spring 78 in position with respect to a movable valve element, for which element the lower end portion 72' of the bore 72 forms a seat and which valve element is shown as a ball 80.

The plug 26, besides having the said bores, is also formed with a series of circumferential annular grooves comprising two axially adjacent annular grooves 82 and 84 separated by an annular ridge 86 and a third annular groove 88. In the ridge 86, at diametrically opposite points, there are a pair of transverse ports 90 and 92. Port 90 communicates at its inner end with the central plug bore 56 and, at its outer end, with the bore 46. Port 92 provides communication between the plug bore 64 and the bore 48.

Also at diametrically opposite points, the third annular groove 88 has ports 94 and 96, of which port 94 communicates groove 88 with the plug bore 72 and port 96 communicates the groove with the plug bore 64.

The enlarged upper end portion 58 of the plug bore 56 is screw-threaded and contains the screw-threaded regulator needle 98 having the tapered inner end portion 100 which extends downwardly from a constant diameter reduced portion 102 of the needle. The needle head 104 is accessible for adjustment and is capable of being locked in a set position of adjustment by lock nut 106 which nut through washer 108, exerts pressure against O-ring 110 to effect a fluid seal with respect to the screw-threading 112. This screw-threading is formed to provide a stop for preventing the needle from being screwed further inwardly than is seen in Fig. 2, whereby the annular space 114 will always prevail.

The screw-threaded lower end 60 of the plug 26 serves to receive the upper screw-threaded end of an inner riser tube (or line) 116 while the screw-threaded plug portion 62 receives the upper screw-threaded end of outer concentric tube 118. These tubes depend from the plug into

the liquid 14 so as to terminate as near as practicable to the bottom of the liquid.

The tubes 116 and 118 define an annular passage 120 between them, which passage communicates at its upper end with port 122. This port communicates with plug bore 72 by way of the one-way valve 80. The construction and arrangement is such that the lower end of the passage 120 terminates in upwardly spaced relation to the bottom end of inner tube 116, as is seen in Fig. 2.

124 indicates a cup screen by which foreign particles are prevented from gaining access to the tube 116. 126 indicates an air bleed orifice which may be present to prevent the building-up of excess pressure within the screen cup if this should tend to occur. 128 indicates an annular deflector plate which is arranged to be located above the liquid level as seen in Fig. 1 to prevent upward surging of the liquid against the valve 66 when the vessel space 130 is pressurised.

In operation, with the apparatus installed as shown in Fig. 1, and the pressure fluid supply to line 50 cut off, the vessel 10 is filled with liquid to a determined level as indicated on the indicator pipe 11, leaving the air space 130 at atmospheric pressure when cap 12 is closed. Upon the line 50 being opened to the supply of the pressure fluid, and with line 52 closed, the fluid will first operate to pressurise the vessel space 130 by the pressure fluid being constrained to flow through port 92, down through bore 64 to port 96, into annulus 88, through port 94 into bore 72, and down through this bore to ball valve 80, which valve is opened and admits the pressure fluid to flow through port 122 to the annular passage 120 between the pipes 116 and 118. From the lower end of passage 116 the pressure fluid will bubble upwardly through the liquid 130 and build up pressure in the space 130. During the time that this pressurising operation is taking place, and with line 52 still closed, there will also be a flow of the pressure fluid up the bore 64 from the port 92 into the annular space 114 and downwardly through the central plug bore 56 into the inner tube 116, from which the pressure fluid discharges into the liquid. Such flow will be possible since, with line 52 closed the port 90 will be out of action. With the space 130 pressurised, line 52 is opened and this will cause a pressure drop to occur in the bores 46 and 48, with an attendant rise of liquid in bore 56 to the inner end of port 90, where the liquid meets the pressure fluid discharging downwardly through the annular space 114 and results in an initial blending and partial atomization of the liquid and pressure fluid at this point, followed by further atomization upon arrival of the blended mixture at the outer end of the port 90, where the mixture will be encountered by the pressure fluid flowing around the annuli 82 and 84. The atomized mixture flows through bore 46 into line 52 and through the spray nozzle or control valve fitted at the end of said line and not shown. A pressure drop will also occur in bore 48, but to a lesser extent than at 46 at the point where port 90 opens into 46. This involves a differential pressure drop as between bore 64 and port 90, with the pressure being constantly greater in bore 64 than at the outer end of port 90, whereby to ensure that liquid will continue to rise in the tube 116 with the continuing dropping of the liquid level, it being appreciated that bore 64 is in constant communication with the vessel space 130.

It will be appreciated that when the space 130 has been pressurised, and prior to opening the line 52, the fluid pressure in the space 130 and the bores 46 and 48 and their associated passages will be substantially the same but greater than that which will prevail at 46 and 48 when line 52 is opened. The ball valve 66 opens to the pressure in the space 130 and enables a balancing of the pressure therein and in bores 64 and 48 to take place, while any tendency for liquid to escape up the passage-way 120 during the time that there is excess pressure in

space 130 is prevented by such pressure closing the valve 80.

With the line 52 open and liquid rising in the tube 116 the liquid will be met at the inner end of port 90 with the pressure fluid which flows downwards through the passage 114 and the two will become blended and partially atomized at this point i. e. at the inner end of port 90. It is to be noted that port 90 forms, in effect, a constant orifice. However, a variation in the degree of such blending and atomization is capable of being controlled within fine limits by adjustment of the needle 98 to thereby vary the effective size of the passage 114.

In some instances it may be necessary, or preferable to make provision whereby the air control provided by adjustment of the needle 104 should be made possible for remote control or at a remote position (in which case the needle 104 would be omitted). Further provision may be made whereby the pressure air or gas is supplied to the outer end of the orifice 90 from a separate source, compared with the pressure fluid in the vessel space 130.

Having thus disclosed my invention what I wish to claim as novel and secure by Letters Patent is as follows:

1. A liquid and air blending and proportioning head for use in atomizing liquids of relatively high viscosity in a finely proportioned manner comprising a body part having a liquid passage defined therein and adapted for connection with the supply of liquid, an inlet passage defined in said body part and adapted for connection with a supply of air pressure, a blending and proportioning air passage also defined in said body and communicating with said air inlet passage, an orifice passage defined in said body for blended air and liquid, the discharge ends of said blending and proportioning air passage and said liquid passage being common to the inlet end of said orifice passage and laterally disposed thereto, said discharge ends of said air and liquid passages being in directly opposed relation to each other to effect blending of the air and liquid with the air flow in said blending and proportioning air passage acting to proportion the liquid flow from said liquid passage into said orifice passage, and an orifice defined in the discharge end of said orifice passage.

2. A liquid and air blending and proportioning head for use in atomizing liquids of relatively high viscosity in a finely proportioned manner comprising a body part having a liquid passage defined therein and adapted for connection with the supply of liquid, an inlet passage defined in said body part and adapted for connection with a supply of air pressure, a blending and proportioning air passage also defined in said body and communicating with said air inlet passage, an orifice passage defined in said body for blended air and liquid, the discharge ends of said blending and proportioning air passage and said liquid passage being common to the inlet end of said orifice passage and laterally disposed thereto, said discharge ends of said air and liquid passages being in directly opposed relation to each other to effect blending of the air and liquid with the air flow in said blending and proportioning air passage acting to proportion the liquid flow from said liquid passage into said orifice passage, an orifice defined in the discharge end of said orifice passage, air passage means adapted to communicate with said air pressure supply and having a discharge in embracing relation to said orifice to discharge air pressure immediately in front of said orifice to atomize the blended air and liquid flowing in said orifice passage.

3. A liquid and air blending and proportioning head as defined in claim 1 wherein said blending and proportioning air passage embodies means for adjusting the amount of air flow therein to vary the proportion of liquid flowing into said orifice passage.

4. A liquid and air blending and proportioning head as defined in claim 2 wherein said air passage means is in the form of separate annuli disposed on each side of said orifice and discharging upon opposite sides of said orifice.

5

5. A liquid and air blending and proportioning head as defined in claim 1 wherein said liquid, air blending and proportioning and orifice passages collectively form a T-junction.

6. A liquid and air blending and proportioning head 5 as defined in claim 5 wherein an adjustable flow valve is provided in the air blending and proportioning branch of the T-junction to regulate the volume of air flow therein toward said common discharge ends.

7. A liquid and air blending and proportioning head 10 as defined in claim 5 wherein the cross-section of said passages for the liquid and for the blending and proportioning air are of similar area at the common discharge

6

end and constitute the directly opposed branches of the T-junction.

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