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AIRLINE LUBRICATOR

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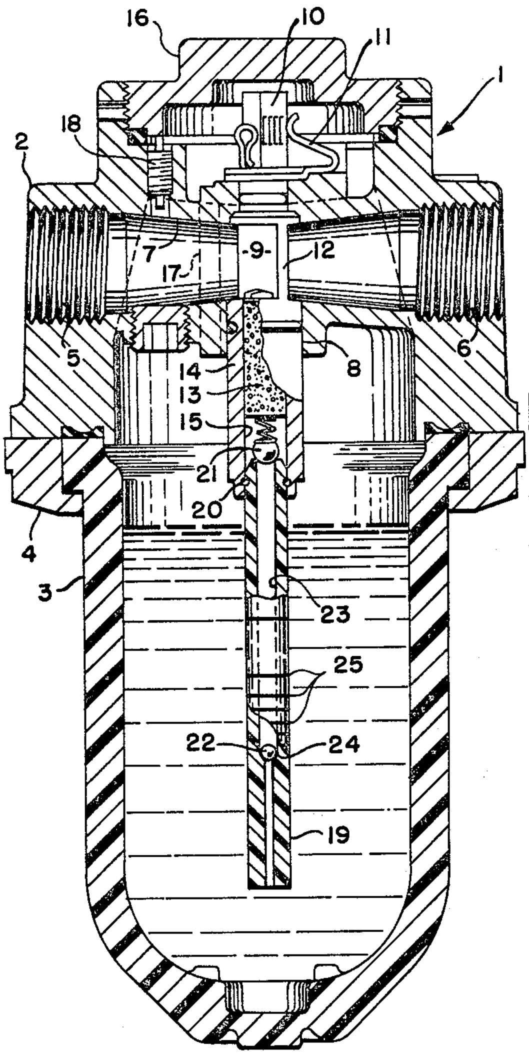

Fig. 1

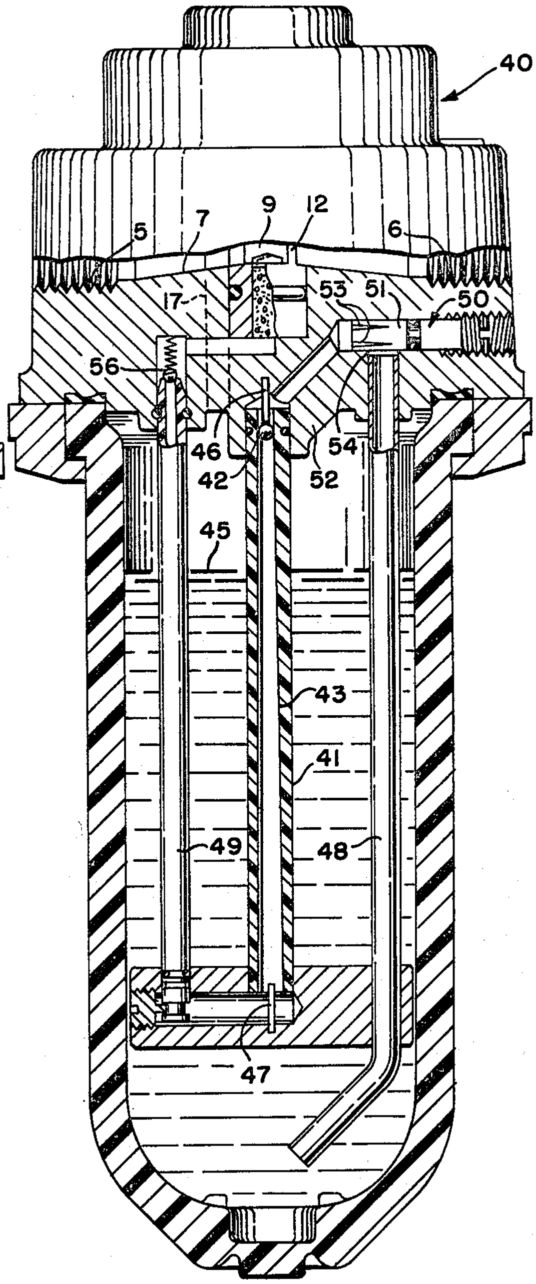

Fig. 3

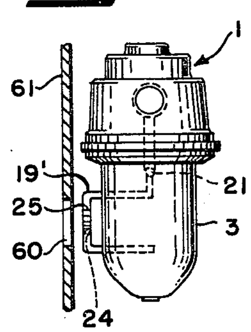

Fig. 4

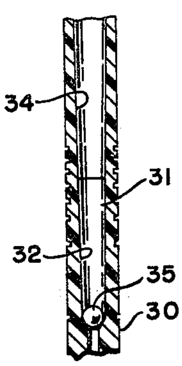

Fig. 2

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AIRLINE LUBRICATOR

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The present invention relates to devices for mixing two fluids by metering one into the other and has application, for example, to a lubricator for pneumatic systems in which air under pressure for operating a pneumatic unit passes through a lubricator housing and pressurizes a supply of lubricant therein to force the same into the air stream in finely divided form.

An object of the invention is to provide a visual indication of flow of the metered fluid and to provide for instantaneous feed of such fluid when pressurization of the same is low or intermittent.

It is another object to provide a device of the character indicated in which a visual flow indicator indicates an average metered flow when the actual flow varies due to pressure fluctuations.

It is another object of the invention to provide a device of the type described in which a flow indicator is located exteriorly of the device for visual observation but has connections to the interior of the device for conducting the metered fluid from a reservoir to the point of mixture with the other fluid.

It is another object to provide a device of a type described in which there is a visual flow indicator for the metered fluid with means associated with the flow indicator for varying the rate at which it responds to the metered flow.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

FIG. 1 is a central vertical cross-section view of one embodiment of this invention;

FIG. 2 is a fragmentary cross-section view of a modified form of oil flow indicator to extend the range of oil flow rates indicated thereby;

FIG. 3 is a cross-section view of modified form of air line lubricator embodying the present invention; and

FIG. 4 is a view showing the flow indicator located exteriorly of the device.

Referring now more particularly to the drawing, and first to FIG. 1, the lubricator **1** there shown comprises a housing **2** having a reservoir for oil in the form of a transparent bowl **3** detachably secured to the housing as by means of the clamp ring **4**. The housing **2** has an inlet port **5** for connection with an air pressure source and an outlet port **6** for connection with a pneumatically operated unit, the main air flow being through a venturi passage **7**. The throat of the venturi passage **7** is intersected by a passage **8** through which a rotary valve element **9** extends, said valve element **9** having a stem portion **10** at its upper end which is serrated and which cooperates with a spring detent member **11** which yieldably holds the valve element **9** at any desired rotatively adjusted position. The portion **12** of the valve element **9** that extends across the venturi throat is in the form of a narrow diametrically extending blade which, as apparent, increases or decreases the flow of air through the venturi passage **7** when the valve element **9** is rotatively adjusted in one direction or the other. The lower tubular end **14** of the valve element **9** has an inner bore **15** which intersects the blade portion **12** of the valve member and opens into the venturi passage **7** for mixing of oil from the bowl **3** with airstream flowing through the venturi passage **7**.

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Snugly fitted in the lower tubular end **14** of the valve element **9** is a feed control element **13** of porous material which not only meters the oil through the multiple openings thereof, but additionally, breaks up the oil into tiny droplets for uniform dispersal in the airstream, thus providing improved lubricating effectiveness at the pneumatically operated unit.

The housing **2** has a cap **16** removably secured thereto for periodic refilling of the bowl **3** with oil and as the cap **16** is being removed, the bowl is vented through passage **17** and a tire valve **18** engaged with the cap is permitted to be closed to maintain air pressure in the passage **7**. When the cap **16** is replaced, the tire valve **18** is opened thereby and air pressure enters through the tire valve **18** and the passage **17** in the housing **2** to pressurize the oil in the bowl **3** for feeding it under pressure through the transparent feed tube **19** which is secured as by means of the rubber like O-ring **20** to the lower end **14** of the valve element **9** and extends downwardly close to the bottom of the bowl **3**.

In the lubricator **1** shown in FIG. 1, the upper end of the feed tube **19** constitutes a seat for a spring biased check valve **21** which keeps the feed tube **19** filled with oil even though the level of the oil in the bowl **3** is below said check valve **21**. Said check valve **21** also prevents pressurizing of the oil in the bowl **3** when the cap **16** is being removed.

The feed tube **19** has a check valve **22** therein which preferably comprises a lightweight ball of aluminum, for example, and the portion **23** of the bore above seat **24** is slightly tapered (¼" per foot, for example) so that when the lubricator **1** is in use the ball check **22** will rise in the feed tube in accordance with the rate of flow of oil upwardly through the feed tube **19**. Thus, with a transparent bowl **3** and transparent feed tube **19** it is possible for the operator to visually inspect the operation of the lubricator **1** and to determine the rate of flow of oil into the main airstream. There are provided suitable flow indicia **25** on the feed tube such as a series of grooves which are painted black or other color so as to be clearly visible.

In view of the pressure drops across the flow ball **22**, the check ball **21**, and the porous element **13**, the flow ball **22** will move slowly up or down to indicate the average flow rate of oil through the feed tube **19** and will not be subject to rapid movements as occasioned by pressure shocks, pulses or surges in the pneumatic circuit. When the pneumatically operated unit reaches the end of its stroke or its actuation is discontinued, the equalization of pressure at the venturi throat and in the bowl **3** will maintain the porous element **15** and the entire feed tube **19** filled with oil because of the seating of the check ball **21** and also of the flow ball **22**.

FIG. 2 illustrates a modification in which the feed tube **30** has a flow passage **31** calibrated for high and low rates of flow. In other words, the flow passage **31** has portions **32** and **34** of different taper and when the flow ball **35** is moved by low rates of flow it will be disposed in the portion **32** of smaller taper and each increment of movement will represent a smaller change in flow rate than when the flow ball **35** is within the portion **34** of greater taper in which case, a larger change in flow rate will be indicated by a smaller increment of movement to the flow ball **35**. It is to be understood that instead of two distinct tapers **32** and **34**, as shown in FIG. 2, the flow passage **31** may be of continuously varying taper to cover a wide range of flow rates along a relatively short length of the feed tube **30**. Furthermore, if greater sensitivity is desired at the higher rates of flow than at the lower rates of flow the taper **32** may be steeper than taper **34**.

As aforesaid, the flow balls **22** and **35** in FIGS. 1 and 2 are preferably of lightweight metal such as aluminum, and are heavier than the oil displaced thereby. As apparent, the flow rates of the lubricators shown in FIGS. 1 and 2 may readily be increased or decreased by substituting heavier or lighter flow balls **22** and **35**. Also, the flow rates denoted by the indicia **25** may further be varied by substituting flow balls **22** and **35** of larger or smaller diameter, thus to change the radial clearances between the flow passages and the flow balls.

Referring now to FIG. 3, the lubricator **40** there shown has an inverted feed tube **41** in which is disposed a flow ball **42** which is hollow and/or made of lightweight material such as plastic such that the weight thereof is less than that of the displaced lubricant. In this case, the center feed tube **41** is of transparent material and has a tapered bore **43** which is larger at its lower end than at its upper end, whereby as lubricant flows downwardly therethrough, the flow ball **42** will be forced downwardly a distance corresponding to the rate of flow of lubricant. The maximum oil level is indicated by the line **45** and therefore the flow ball **42** in FIG. 3 will be readily visible through the transparent bowl **46** and the transparent center feed tube **41**. At any rate, at relatively low rates of flow of lubricant, the flow ball **42** will be disposed at a position above the maximum oil level so that it will be more readily visible than at greater rates of flow when it may be disposed below the lubricant level. When the flow ball **42** is of effective specific gravity only slightly less than that of the lubricant and when the feed tube **41** has a long bore **43** of very slight taper, the flow characteristics are very sensitive that is, a small change in flow rate will be reflected by a relatively large change in the position of the ball **42** in said feed tube **41**. Suitable ball stops **46** and **47** are provided at the upper and lower ends of said feed tube **41**.

The inlet and outlet feed tubes **48** and **49** may be made of metal and at the upper end of the inlet feed tube there may be provided a lubricant flow control valve **50** comprising, as shown a cylindrical rod **51** having a relatively close sliding fit in the bore of the body **52** and preferably formed with a plurality of metering slots **53** through which the lubricant must flow at a rate depending on the axial position of the slotted end of the rod **51** with respect to the bore **54** which intersects the bore in said body.

The outlet feed tube **49** has at its upper end a suitable check valve **56** which prevents back flow of lubricant and thus maintains the lubricator feed tube **49**, **41**, and **48** filled with lubricant so that the next time there is air flow through the lubricator, lubricant will at once be introduced into the airstream at a rate indicated by the position of the flow ball **42**. The flow control valve rod **51** may be turned in either direction to increase or decrease such flow rate.

In the form of the invention as shown in FIG. 4, feed tube **19'**, corresponding to feed tube **19** of FIG. 1, passes through the side wall of reservoir **3** to the exterior thereof. In this case reservoir **3** need not be transparent. The portion of the feed tube in which flow indicator ball **22** is transparent and is opposite an opening **60** in a panel board through which the flow ball may be observed.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In a device for mixing two fluids, a housing having a first passage therethrough for flow of a first fluid under pressure, means for establishing a lower pressure of said fluid in the outlet end of the first passage than in the inlet end, a reservoir containing a second fluid, said housing having a second passage for conducting fluid from the first passage inlet to said reservoir for pressurizing the second fluid, a feed tube having an inlet end immersed in the second fluid and an outlet end connected to the first passage outlet whereby the greater pressure in the first passage inlet forces the second fluid from the reservoir through the feed tube to said first passage outlet, said tube having a visible transparent portion, a flow element in said transparent portion movable by the fluid flowing through said feed tube to different positions therein according to the rate of flow through said feed tube, and a check valve adjacent the outlet end of the tube that opens under force of fluid flowing through the tube toward the first passage outlet and that closes upon cessation of said flow through the tube to prevent draining of the second fluid from the feed tube to the reservoir.

2. The device of claim **1** wherein said transparent tube portion has a tapered bore to provide changing radial clearance around said flow element as the latter is moved in said tube.

3. The device of claim **1** wherein said flow element is non-buoyant in the second fluid and is moved upwardly in said tube under the influence of increasing rate of flow of said second fluid therearound.

4. The device of claim **1** wherein said reservoir is transparent and contains the transparent portion of the feed tube and movement of said flow element occurs above the level of the second fluid in said reservoir to facilitate viewing of the same through said reservoir.

5. In a device for mixing fluids, a housing having a first passage therethrough for flow of a first fluid under pressure, means for establishing a lower pressure of said fluid in the outlet end of said passage than in the inlet end, a reservoir containing a second fluid, passage means connecting said first passage inlet end with said reservoir to pressurize the fluid therein, a feed tube having an inlet immersed in said second fluid and having an outlet connected to said first passage outlet whereby the greater pressure in the first passage inlet forces the second fluid through the feed tube to said first passage outlet, said tube having a visible transparent portion containing a flow element movable by fluid flowing through the tube to different positions according to the rate of the flow through the feed tube, said transparent portion having bore sections of different tapers to provide different rates of change of radial clearance around said flow element as the latter is moved.

6. The device of claim **5** in which the downstream bore section has a taper greater than the taper of an upstream bore section whereby the rate of change of radial clearance around said flow element is greater than that in the upstream section.

7. In a device for mixing fluids, a housing having a first passage therethrough for flow of a first fluid under pressure, means for establishing a lower pressure of said fluid in the outlet end of said passage than in the inlet end, a reservoir containing a second fluid, passage means connecting said first passage inlet end with said reservoir to pressurize the fluid therein, a feed tube having an inlet immersed in said second fluid and having an outlet connected to said first passage outlet whereby the greater pressure in the first passage inlet forces the second fluid through the feed tube to said first passage outlet, said tube having a visible transparent portion oriented so that fluid flowing through said portion travels in a downward direction, a buoyant flow element in said transparent portion movable in a downward direction by fluid flowing through the feed tube to different positions according to the rate of such flow through the feed tube.

8. The device of claim 7 in which said feed tube comprises three separate but connected sections each connected to the housing and extending vertically into said reservoir.

9. In a device for mixing two fluids, a housing having a first passage therethrough for flow of a first fluid under pressure, means for establishing a lower pressure of said first fluid in the outlet end of said passage than in the inlet end, a reservoir containing a second fluid, passage means connecting the first passage inlet to said reservoir to pressurize the fluid therein, duct means having an inlet immersed in the second fluid and having an outlet connected to the first passage outlet whereby the greater pressure in the first passage inlet forces the second fluid through the tube to the first passage outlet, said duct means having a transparent portion located exteriorly of said reservoir for

visual observation, a flow element in said transparent portion movable by fluid flowing through said duct means to different positions according to the rate of flow through said duct means.

10. The device of claim 9 in which said duct means passes through a wall of said reservoir to the exterior thereof.

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