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Scragg

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[54] **METHOD OF LUBRICATING PNEUMATIC MACHINES AND APPARATUS THEREFOR**

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[51] **Int. Cl.** **F16n 7/30**

[58] **Field of Search** ..... 184/55, 55 A, 56, 56 A, 39; 239/323, 328; 222/386.5, 389, 541

[56] **References Cited**

UNITED STATES PATENTS

1,628,834	5/1927	Frank	222/389
2,981,449	4/1961	Perkins	222/541
3,221,947	12/1965	Penn	222/389 X
3,439,839	4/1969	Schumann et al.	222/389 X
3,166,096	1/1965	Lang	239/323 X
2,792,073	5/1957	Boss	184/55 A X
2,897,919	8/1959	Dellner	184/55 A
2,060,403	11/1936	Sweet	287/124 X
1,984,422	12/1934	Nell	184/55 A
2,604,189	7/1952	O'Farrell	184/55 A
1,323,432	12/1919	Zandecki	287/124 X

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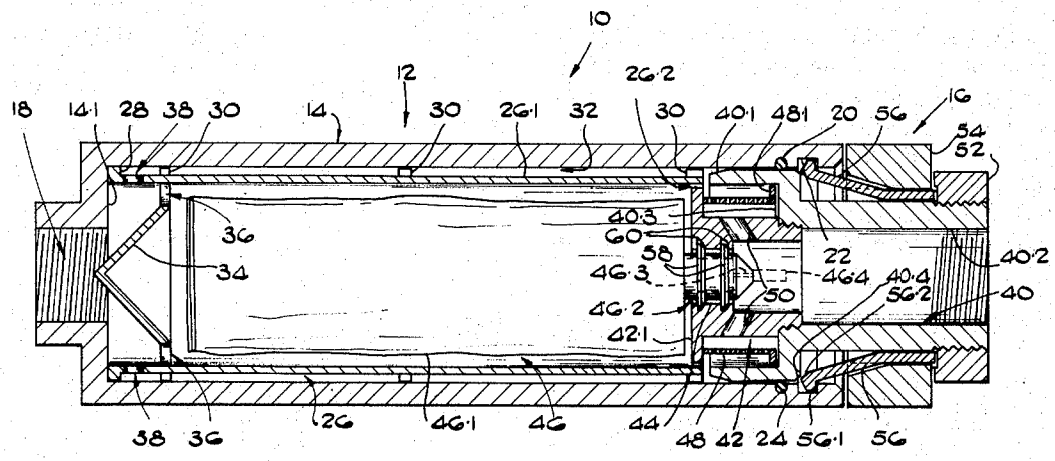
[57] **ABSTRACT**

A device and method are disclosed for dosing a flowing stream of fluid. The prime field of utility of the invention is the lubrication of pneumatic machines but it is not restricted to this. In its disclosed lubricator form the device includes a casing which is connected into a fluid (generally air) stream with a lubricant container in the casing. The container includes a bag of flexible material and the fluid stream is caused to impinge on the bag so as to flatten it and expel the lubricant through the nozzle into the stream. The air can be filtered while passing through the casing but prior to it being dosed.

21 Claims, 2 Drawing Figures



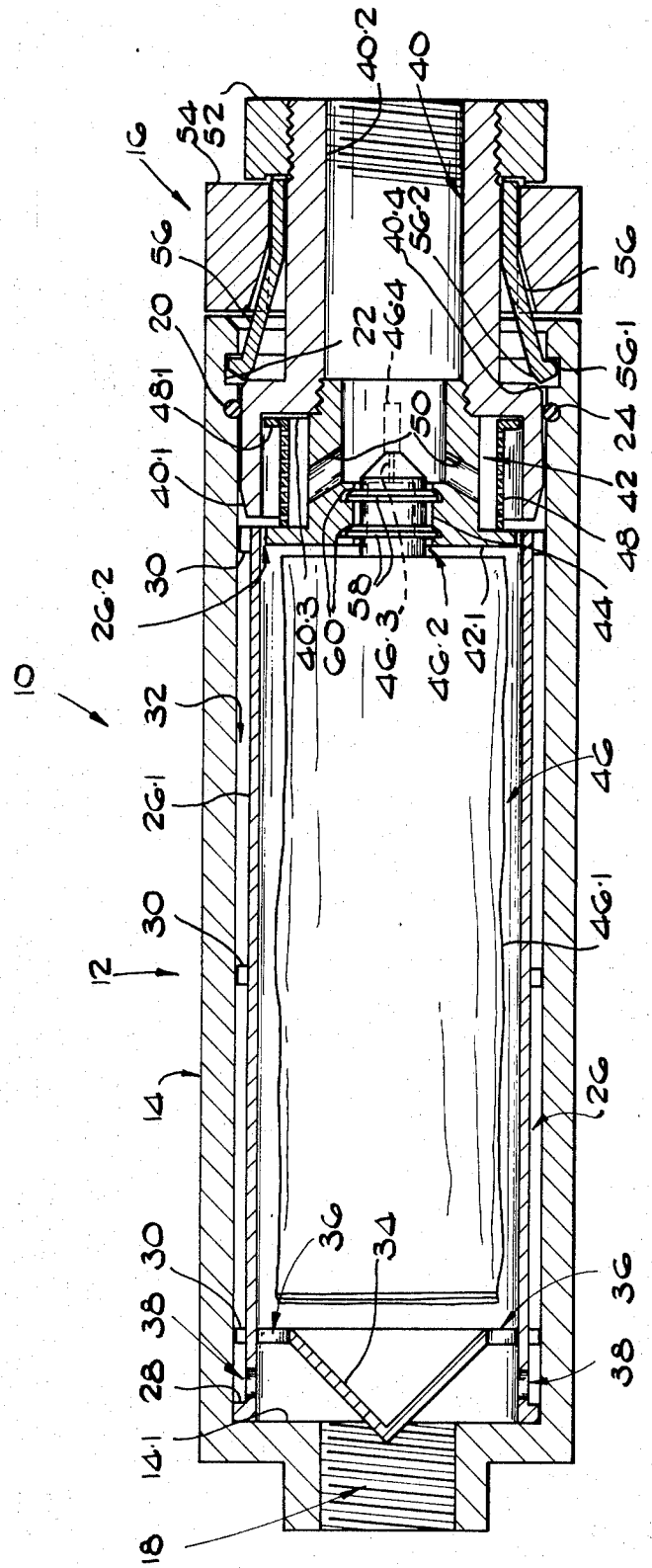


FIG. 1.

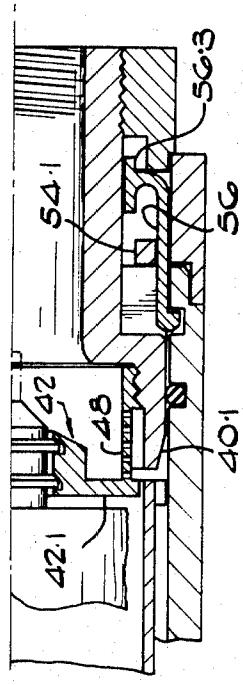


FIG. 2.

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METHOD OF LUBRICATING PNEUMATIC MACHINES AND APPARATUS THEREFOR

This invention relates generally to techniques for dosing a flowing fluid and has particular utility in the field of lubrication where a lubricant is to be added to a flowing air stream.

According to one aspect of the present invention there is provided a method of dosing a flowing fluid which comprises placing in the flowing fluid a bag containing an additive, the bag being of flexible material which is impervious to the additive contained therein, and causing the flowing fluid to impinge on the bag so as progressively to collapse the bag and expel the additive into the flowing fluid.

According to another aspect of the present invention there is provided a method of dosing a flowing fluid which method comprises placing in the flowing fluid an additive container which comprises a bag and a nozzle, the bag being of flexible material, and causing the flowing fluid to impinge on the bag so as progressively to collapse the bag and expel the additive into the flowing fluid through the nozzle, the fluid flow across said nozzle being such that a venturi effect is created, the resulting low pressure area being where additive emerges from the nozzle and enters the flowing fluid.

According to yet another aspect of the present invention there is provided a container having an additive therein, the container comprising a bag and a nozzle, the bag being of flexible material which is impervious to the additive contained therein, the bag further being such that when a flowing fluid impinges thereon with sufficient force it progressively collapses to expel additive therefrom through the nozzle.

According to a further aspect of the present invention there is provided a device for dosing a flowing fluid, the device comprising a casing having an inlet and an outlet by means of which the device can be connected into a fluid flow line, an additive container in the casing, the container comprising a bag and a nozzle, the bag being of flexible material which is impervious to the additive contained therein, the bag further being such that when a flowing fluid impinges thereon with sufficient force it progressively collapses to expel additive therefrom through the nozzle, the fluid flow path within the casing being such that the fluid flowing therethrough impinges on said bag to collapse the same and expel additive which is then entrained in the flowing fluid.

Preferably said casing includes a main part and a closure part which are releasably connected together, said container being connected to the closure part but lying wholly or mainly within said main part, so that as said closure part is separated from the main part, said container is simultaneously withdrawn from the main part.

In a preferred construction said main part and said closure part are connected to one another by resiliently deformable fingers which are carried by said closure part and have their free ends engaged with an internal groove of said main part, said fingers being formed with cam surfaces which co-operate with cam surfaces of a cam ring, the arrangement being such that rotation of said cam ring causes the cam surface thereof to act on the cam surfaces of said fingers to deform them inwardly and disengage said free ends from said groove.

To enhance the attachment of the main part and the closure part it is possible for said fingers to be formed with further cam surfaces which co-operate with cam surfaces of a component of said closure part, the pressure of fluid flowing through said casing, in tending to separate said main and closure parts, causing said cam surfaces of said component to engage with the further cam surface of the fingers to urge the fingers outwardly into said groove.

In one constructional form said container can include a non-return valve for preventing flow of fluid into said bag through the nozzle.

According to a still further aspect of the present invention there is provided a connector for securing one component having an annular groove to a further component which includes a cam ring and a plurality of resiliently deformable fingers, free ends of said fingers, in the secured condition, being entered in said groove, the cam ring and fingers having co-operating cam surfaces arranged so that rotation of the ring causes said fingers to be deformed as said cam surfaces of the ring act on the cam surfaces of the fingers and relaxed as the cam surfaces of the ring disengage from the cam surfaces of said fingers, the action of the cam ring on said fingers causing said free ends to enter and leave said groove.

For a better understanding of the invention reference will now be made, by way of example, to the accompanying drawing in which:

FIG. 1 is a longitudinal section through a lubricator, and

FIG. 2 is a fragmentary section through a modified form of lubricator.

The lubricator of FIG. 1, generally referenced **10**, includes a generally cylindrical outer casing **12** which is in two parts, a main part thereof being referenced **14** and a closure part thereof being generally referenced **16**.

The main part **14** has one end thereof in the form of an internally threaded inlet **18** to which an air hose (not shown) can be connected. The other end of the main part **14** is open and two internal grooves **20** and **22** are formed adjacent this open end. The groove **20** serves to receive a seal **24** which can, as illustrated, be an O-ring and the groove **22** serves to receive locking elements as will be described in more detail hereinafter.

A generally cylindrical liner **26** is fitted into the main part **14**. The liner **26** includes an end ring **28** which is a tight fit in the part **14** and which abuts the internal shoulder **14.1** of the part **14**. Circumferential arrays of outwardly directed pads **30**, in conjunction with the ring **28**, center the liner **26** in the bore of the part **14**. By way of example three arrays of pads **30** can be provided and each array of pads can consist of three pads, the pads being relatively short in the circumferential direction so that they are widely spaced apart in this direction and thus do not hinder fluid flow in the cylindrical space referenced **32** which exists between the outer surface of the liner **26** and the bore of the part **14**.

At its left-hand end (as viewed in FIG. 1) the liner **26** includes a cone **34** the apex of which faces the inlet **18** and which almost completely closes that end of the generally cylindrical part **26.1** of the liner **26**. The cone **34**, as will be described, acts as a filter and a ring of apertures **36** is provided around the periphery of the

cone to form the entrance to the interior of the liner. A further ring of apertures 38 in the part 26.1 places the inlet 18 in communication with the space 32.

Turning now to the closure part 16, this includes a main component 40 having a cylindrical sealing portion 40.1 at one end and an internally screw-threaded connector portion 40.2 at the other end. This connector portion 40.2 forms an outlet and is intended for attachment to an air hose, or directly to a pneumatic machine, and the portion 40.1 co-operates with the seal 24.

A spigot 42 having a central aperture 44 for receiving a lubricant container 46 is screwed into the left hand end of the component 40. An air filter 48 of cylindrical form is held between the shoulder 40.3 of the component 40 and a collar 42.1 of the spigot 42. It will be noted that the collar 42.1 enters the left hand end of the liner 26 and substantially closes that end. Only a restricted circular exit 26.2 exists between the collar 42.1 and the liner 26.1.

The air filter 48 is centered by its collar 48.1 and can consist of a cylinder in which a plurality of narrow, circumferentially extending cuts have been made. Each cut is interrupted in three or four places, the effect of this being to provide a filter which includes three or four longitudinally extending ribs which are connected to one another by a large number of circumferentially extending, closely spaced filter elements.

A ring of bores 50 is formed in the spigot 42, the bores 50 being inclined with respect to axis of the spigot 42. These bores connect the space 32 to the outlet and it will be seen that the filter 48 is between these bores and the space 32.

A retaining ring 52 is screwed onto the component 40 and holds a cam ring 54 and a plurality of locking fingers 56 in place. The ring 54 is formed internally with a number of cam surfaces which co-operate with corresponding cam surfaces on the fingers 56.

The free end 56.1 of each finger 56 is, in the position illustrated, in the groove 22. The fingers 56 are of resilient material such as nylon. The main casing part 14, the component 40, the spigot 42, the air filter 48, the retaining ring 52 and the cam ring 54 can also be made of this material.

The component 40 is formed with a sloping, annular cam surface 40.4 which co-operates with a cam surface 56.2 formed on each finger 56 for the purpose to be described.

The fingers 56 are, at their right hand ends, integral with a ring which encircles the component 40 between it and the ring 54.

The lubricant container 46 includes a bag 46.1 which holds the lubricant and a nozzle 46.2 through which the lubricant feeds from the bag. The nature of the bag 46.1 will be dealt with subsequent to the description of the manner in which the lubricator operates. The lubricant can be a fluid or a particulate solid such as graphite or a grease.

It will be noted that the nozzle 46.2 is formed with two circumferential ribs 58 which co-operate with two circular grooves 60 formed in the aperture 44. The effect of the nozzle 46.2 will also be dealt with in more detail after the description of the manner in which the lubricator operates. It will, however, be noted at this stage that a non-return valve can be provided in the bore 46.3 of the nozzle which valve, while permitting lubricant to flow from the bag 46.1, prevents fluid flowing into the bag through the nozzle. Additionally, a grease nipple (not shown) can be provided for enabling the bag 46.1 to be refilled.

The inlet 18 intended, as described, to be connected to an air hose which itself leads to a source of air (not shown) under pressure. The connector portion 40.2 is connected by a further air hose to, or is screwed directly onto, the pneumatic apparatus which is to be driven and lubricated. Such apparatus can be, for example, a pneumatic hammer or drill.

Relatively large dirt particles contained in the incoming air impinge on the cone 34, are guided by its sloping surface to the ring of apertures 36 and collect in the space which exists between the cone 34 and the lubricant bag 46.1. The bulk of the flowing air passes through the ring of apertures 38 into the space 32 and then through the air filter 48 to the bores 50. The air filter 48 removes the finer contaminating particles.

The flowing air impinges on the left hand end of the bag 46.1, the kinetic energy of the air slowly collapsing the bag 46.1 so that the lubricant in the bag is squeezed through the bore 46.3 of the nozzle 46.2 and is entrained by the air stream. The position of the bores 40 is such that a venturi effect is created across the nozzle 46.2 and this in turn creates a low pressure area where lubricant emerges from the nozzle. However, the venturi effect is not essential and need only be created if the viscosity of the lubricant makes it necessary.

Experiments have shown that obstructing the flow of air through the lubricator in such manner as to change the static pressure existing within the liner 26 seems to have little effect on the rate at which lubricant emerges from the nozzle and it is therefore believed that the kinetic energy of the flowing air is the most important factor in causing the collapse of the bag 46.1.

Changes in static pressure can be obtained by varying the size of the exit 26.2. If this exist is completely eliminated then all the air must flow through the space 32. However, even in these circumstances the lubricator still functions as desired provided the cone 34 is removed or is so constructed as to permit the incoming air to impinge in a substantially unhindered manner on the bag 46.1. This step can only be taken if the incoming air is relatively clean and contains no particles which may puncture the bag.

It will be noted that there is a tendency for the air flowing through the lubricator to urge the closure part 16 away from the main part 14. Separation of the parts 14 and 16 is prevented by the locking elements 56. However, the component 40 does tend to move to the right (as illustrated in the drawing) and the effect of this is to cause the cam surface 40.4 to engage with the cam surfaces 56.2 and urge the free ends 56.1 of the fingers 56 more firmly into the groove 22.

Once the lubricant bag 46.1 is empty, the cam ring 54 is turned so that its internal cam surfaces co-operate with the cam surfaces of the fingers 56 and resiliently deform these fingers inwardly. The free ends 56.1 are thus disengaged from the groove 22 and the closure part 16, together with the lubricant container 46, can be withdrawn from the main casing part 14. The liner 26 remains in the part 14 and any particles which have collected therein can be emptied out at this stage. It

will be noted that the air hoses, if two are used, remain connected to the parts **14** and **16**. If the portion **40.2** is screwed directly onto the machine then it remains so connected. The used lurbicant container **46** is then detached for refilling purposes (if a grease nipple is provided) or for disposal if the bag is not refillable. A fresh, or refilled, container is then inserted into the aperture **44** so that the rings **58** of its nozzle **46.2** engage in the grooves **60**. The fresh or refilled container **46** is then lowered into the liner **26** and this brings the lubricator back to the illustrated condition with the exception that the free ends **56.1** of the fingers **56** are spaced inwardly of the groove **22** and there is no locking action between the parts **14** and **16**. The cam ring **54** is then turned so that its cam surfaces cease to act on the cam surfaces of the fingers **56**. Once there ceases to be a deforming force on these fingers their inherent resilience permits them to spring back to the illustrated position and lock the casing parts **14** and **16** together.

The cam surfaces of the cam ring **54** are symmetrically arranged so that the ring can be turned in either direction to lock the casing parts together or to release them.

In bore hole drilling operations it is desirable to feed lubricant into the bore hole with the water. The illustrated lubricator can be used for this purpose by connecting the inlet **18** to the source of water and the connector portion **40.2** to the bore hole being drilled. When used for this purpose the non-return valve in the nozzle **46.2** is desirable for it prevents contamination of the contents of the bag **46.1** when, for any reason, flow of water through the lubricator ceases and under which circumstances there might be some reverse flow into the bag. Similarly, the non-return valve can prevent contamination of the bag's contents when a gas other than air is being fed through the lubricator which gas might, if it feeds into the bag **46.1**, have an adverse effect on the flow capabilities of the lubricant.

It is also possible to place in the bag **46.1** a substance e.g. calcium fluoride solution which is to be added to a water supply.

The bag **46.1** is of a flexible material which is impervious to the lubricant contained therein and which, preferably does not have any significant inherent resilience. The flexibility of the material of the bag enables it to collapse progressively under the influence of the air (or other fluid) which impinges thereon with sufficient force. If the material of the bag does have any significant inherent resilience then, when in its full condition, the material of the bag must not be stretched for if it is stretched then it tends to contract under the influence of the forces thus set and squeezes lubricant through the nozzle. As the bag progressively empties these forces decrease and it is thus impossible to ensure the requisite even flow. Thus if resilient material is used the bag should not be filled beyond its natural, unstretched volume.

Suitable materials for the bag **46.1** are paper of sufficient strength which is impervious to the lubricant, cotton or other fiber re-inforced sheet plastics material, sheet plastics material such as polythene, neoprene, rubber, or rubber re-inforced materials. Each of these materials is sufficiently flexible to be collapsed progressively by the air impinging of them. The illustrated bag is of sheet plastics material with the end remote from the nozzle closed by a transversed weld.

The length of the bore **46.3**, and its diameter, influences the rate at which lubricant feeds from the bag. The bore **46.3** is initially blocked by a solid spigot formation **46.4** which is cut off to open the bore **46.3** immediately before the nozzle **46.2** is inserted in the aperture **44**. In the illustrated arrangement the spigot **46.4** formation is cut off at its juncture with the main part of the nozzle and this ensures that the bore **46.3** always has the requisite length. If, however, this arrangement is not used then some other mark, such as a notch in the spigot, is employed to ensure that the spigot is always cut off at the same point and thus leaves behind a bore of standard length. With this arrangement the part of the spigot between the notch and the main part of the nozzle must be hollow.

It will be understood that as the rate of lubricant flow is almost entirely dependent on the kinetic force exerted by the air or water on the bag, then the rate of flow of lubricant through the nozzle varies with the air or water flow. Consequently it is possible to achieve a substantially constant lubricant (or other additive): air (or water) ratio in the air (or water) which emerges from the lubricator.

Turning now to FIG. 2, the lubricator illustrated therein differs from that of FIG. **1** in three respects. Firstly, the spigot **42** is shorter and does not screw into the component **40**. Shortening the spigot **42** has the effect of eliminating the bores **50** so that the venturi effect discussed above is no longer obtained. Secondly the filter **48** is integral with the spigot **42** and screws into the sealing portion **40.1** to connect the spigot **42** and component **40**.

The third change is that the fingers **56** have the modified shape illustrated and are integral with the ring **56.3**. Each finger has associated therewith a single cam surface (not shown) and a circumferentially extending locking detent **54.1**, the detents **54.1** and cam surfaces being circumferentially spaced on the cam ring **54**. Each detent **54.1** has one of its circumferential ends fast with the ring **54**, the remainder of each detent and the inner surface of the ring **54** together defining an arcuate slot for receiving the associated finger **56**. When the fingers are in the illustrated position they pass through said slots and when the cam ring **54** is turned to unlock the casing parts, the detents move with it so that the fingers effectively move out of the slots and thereafter are engaged by the cam surfaces which force the fingers inwardly. In this constructional form the cam ring turns in one direction for locking purposes and the other direction for unlocking.

The detents **54.1**, in the locked position, prevent any inward motion of the fingers **56** and also act as end stops to limit the angle through which the cam ring **54** can turn.

We claim:

1. A device for dosing a flowing fluid, the device comprising a disposable additive container and a casing, the casing having an inlet and outlet by means of which it can be connected into a fluid flow line and having means therein for temporarily and releasably locating one of said containers, the casing being adapted to be opened to permit access to be had to said means, and the container comprising a bag and a noz-

zle, the bag being of flexible material which is impervious to the additive contained therein, and further being such that when impinged upon by a flowing fluid with sufficient force it progressively collapses to expel additive from the nozzle, and the nozzle including a bore leading from the interior of the bag and a removable formation blocking the end of the bore remote from the bag which formation, when removed, leaves behind a bore of predetermined length, said casing being so formed that the fluid flow path therein is such that the fluid flowing therethrough impinges on said bag to collapse the same and expel additive which is then entrained in the flowing fluid.

2. A device according to claim 1 in which said device includes a component having a central aperture into which the nozzle of the bag is pushed and temporarily retained.

3. A device according to claim 2 in which said nozzle includes outwardly projecting formations, and said aperture is formed with recesses for receiving said formations, the part of the aperture through which said formations are moved during removal of a container or insertion of a container being of lesser overall dimensions than the formations so that the formations are deformed inwardly.

4. A device according to claim 3 in which said formations are constituted by two annular, outwardly projecting ribs.

5. A device as claimed in claim 1, wherein said casing includes a main part and a closure part which are releasably connected together, said container being connected to the closure part but lying wholly or mainly within said main part, so that as said closure part is separated from the main part, said container is simultaneously withdrawn from the main part.

6. A device as claimed in claim 5, wherein a hollow liner is provided within said main part for receiving said container, there being a space between the liner and the main part through which space the inlet and the outlet are placed in communication, the liner itself having an entrance and a restricted exit so that the greater portion of the flowing fluid passes through said space with a minor portion flowing through said entrance into said liner to impinge on the bag and thereafter escaping to said outlet through said exit.

7. A device as claimed in claim 6, wherein that part of said liner which faces said inlet is in the form of a cone with its apex directed towards the inlet, said inlet and the interior of the liner being placed in communication with one another about the periphery of said cone.

8. A device as claimed in claim 7 with the modification that said liner has an entrance but no exit, and said cone permitting the flowing fluid to impinge in a substantially unhindered manner on said bag.

9. A device as claimed in claim 6, wherein said casing and liner are generally cylindrical and co-axial, said inlet being in one transverse end of the casing and the outlet being in the other transverse end.

10. A device as claimed in claim 9, wherein a filter is provided through which the fluid passes as it emerges from said space and flows towards said nozzle.

11. A device as claimed in claim 1, wherein said container includes a non-return valve for preventing flow into said bag through the nozzle.

12. A device for dosing a flowing fluid, the device comprising a disposable additive container and a casing, the casing having an inlet and outlet by means of which it can be connected into a fluid flow line and surfaces for guiding the flowing fluid in a converging pattern such as to create a zone of reduced pressure and a region of turbulence, the casing further having means therein for temporarily and releasably locating one of said containers, and being adapted to be opened to permit access to be had to said means, and the container comprising a bag and a nozzle, the bag being of flexible material which is impervious to the additive contained therein, and further being such that when impinged upon by a flowing fluid with sufficient force it progressively collapses to expel additive from the nozzle, and the nozzle including a bore leading from the interior of the bag and a removable formation blocking the end of the bore remote from the bag which formation, when removed, leaves behind an open-ended bore of predetermined length, said casing being so formed that the fluid flow path therein is such that the fluid flowing therethrough impinges on said bag to collapse the same and expel additive through the open end of the bore, and the relationship between the casing and the container being such that said open end of the bore is in said zone of reduced pressure into which zone the additive is expelled from the bore thereafter being drawn into said region of turbulence.

13. A device as claimed in claim 12, in which the outer surface of the nozzle is generally frusto-conical in form, and the container is positioned so that said outer surface complements said surfaces of the casing to promote formation of said converging pattern.

14. A device as claimed in claim 13, in which said surfaces of the casing define a converging ring of bores.

15. A device as claimed in claim 13, in which said frusto-conical surfaces of the nozzle merges with the outer surface of a forwardly directed spigot, the nozzle being cut where said spigot and nozzle surfaces merge to leave a flat face through which the bore opens.

16. A method of dosing a flowing fluid which comprises the steps of:

a. packaging the additive with which the fluid is to be dosed in a disposable container comprising a bag and a nozzle, the bag being of flexible material which is impervious to the additive contained therein, and the nozzle including a bore leading from the interior of the bag and a formation blocking the end of the bore remote from the bag;
b. Connecting in the line through which said fluid flows a casing having an inlet and an outlet and which can be opened to permit access to be had to means within the casing for temporarily and releasably locating one of said container;
c. Removing said formation to open said bore and leave behind a bore of predetermined length;
d. Opening said casing;
e. Removably locating the container with the open bore in the casing;
f. Re-closing the casing; and
g. Feeding said fluid through the container so that it impinges on the bag so as progressively to collapse the bag and expel additive through said bore into said flowing fluid.

17. A method as claimed in claim 16, wherein said fluid is gaseous and the method includes filtering the gas to remove solid particles before the additive is added to the gas.

18. A method according to claim 16, and further including the step of providing on the nozzle a mark to indicate where the nozzle should be cut, and cutting the nozzle at said mark to open the bore.

19. A method according to claim 16, and further including the step of forming the nozzle with a change of profile to indicate where the nozzle should be cut, and cutting the nozzle at said change of profile.

20. A method of dosing a flowing fluid which comprises the steps of:

a. packaging the additive with which the fluid is to be dosed in a disposable container comprising a bag and a nozzle, the bag being of flexible material which is impervious to the additive contained therein, and the nozzle including a bore leading from the interior of the bag and a formation blocking the end of the bore remote from the bag;

b. Connecting in the line through which said fluid flows a casing having an inlet and an outlet and which can be opened to permit access to be had to means within the casing for temporarily and releasably locating one of said containers, the casing being formed with surfaces to guide the flowing fluid in a converging pattern for creating a zone of reduced pressure and a region of turbulance;

c. Removing said formation to open said bore and leave behind a bore of predetermined length;

d. Opening said casing;

e. Removably locating the container with the open bore in the casing with the outlet from the bore positioned where said zone of reduced pressure is created in use;

f. Re-closing the casing; and

g. Feeding said fluid through the container so that it impinges on the bag so as progressively to collapse the bag and expel additive through said bore into said flowing fluid, expulsion of additive from the container being aided by the creation of said zone of reduced pressure, and the dispensed additive being drawn from said zone into said region of turbulence.

21. A method as claimed in claim 20 and including the step of shaping the outer surface of the nozzle so that it is generally frusto-conical in form, and positioning the container so that said outer surface complements said surface of the casing to promote formation of said converging pattern.

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