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(54) Gas-operated apparatus for unblocking pipes.

(57) Gas-operated apparatus (2) for unblocking pipes, which apparatus (2) comprises first connector means (4) for connecting the apparatus (2) to a pipe which is blocked by a blockage, a gas chamber (6), a manually operable pump (8) for manually providing gas in the gas chamber (6), second connector means (10) for connecting the apparatus (2) to a source of compressed gas for providing gas in the chamber (6), and pressure operated valve means (12) which operates at a predetermined pressure automatically to allow gas under pressure in the gas chamber (6) to escape as a series of pulses into the pipe which is blocked thereby to subject the blockage in the pipe to a series of pressure pulses designed to shift the blockage, and a valve means (12) being such as to allow the automatic escape of the gas under pressure in the gas chamber (6).

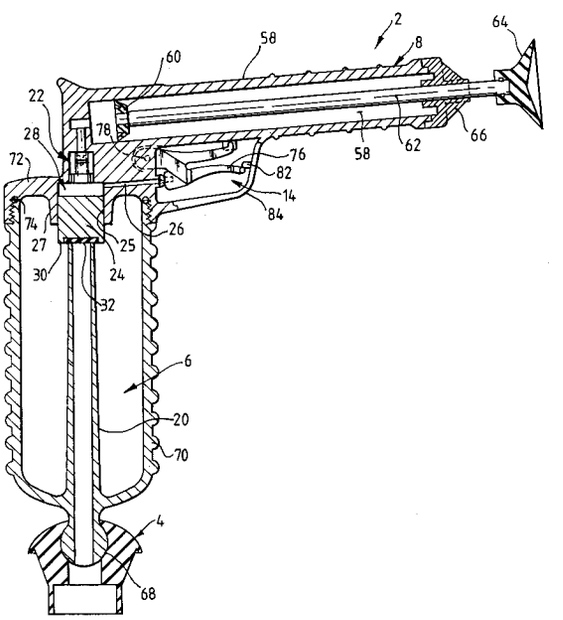

FIG.1.

EP 0 583 885 A1

This invention relates to gas-operated apparatus for unblocking pipes.

Gas-operated apparatus for unblocking pipes is known. There are various types of such known apparatus but they generally comprise first connector means for connecting the apparatus to a pipe which is blocked by a blockage, a gas chamber, and trigger means for releasing compressed gas from the gas chamber as a sudden single pulse which is designed to travel down the pipe which is blocked and to strike the blockage with a view to shifting it. Some of the known types of gas-operated apparatus provide the gas manually whilst others provide the gas from a source of compressed gas such as a compressor or carbon dioxide mini-bottles. French Patent No. 79-02151 discloses one such type of known gas-operated apparatus in which the gas for the gas chamber is provided by a manually operable pump.

The known types of gas-operated apparatus are not satisfactory in that the trigger means enables the apparatus only to provide the compressed air as a single pressure pulse. Often the pressure of this single pulse is too high and it tends to lead to fractured pipes and pipe joints, especially where the blocked pipes are made of plastics materials.

It is an aim of the present invention to obviate or reduce the above mentioned problem.

Accordingly, in one non-limiting embodiment of the present invention there is provided gas-operated apparatus for unblocking pipes, which apparatus comprises first connector means for connecting the apparatus to a pipe which is blocked by a blockage, a gas chamber, a manually operable pump for manually providing gas in the gas chamber, second connector means for connecting the apparatus to a source of compressed gas for providing gas in the chamber, and pressure-operated valve means which operates at a predetermined pressure automatically to allow gas under pressure in the gas chamber to escape as a series of pulses into the pipe which is blocked thereby to subject the blockage in the pipe to a series of pressure pulses designed to shift the blockage, and the valve means being such as to allow the automatic escape of the gas under pressure in the gas chamber.

Thus the gas-operated apparatus of the present invention can be operated either manually for a single measured pulse via the manually operable pump or substantially automatically with repeated pulses simply by providing the source of compressed gas such for example as a compressor or a container of carbon dioxide. The blockage can be subjected to a series of pulses which can be generally at a lower pressure than is the case with the known gas-operated apparatus which applies only one single pulse of pressure. Thus the apparatus of the present invention is able to help to avoid damage in pipes and pipe joints caused by a single pressure pulse which is at too high a pressure for the pipe work. Still further, the application of a series of pulses can have a greater accumulative effect in shifting the blockage rather than the application of one single pulse at a higher pressure. The manually operable pump can also be used for test purposes.

The pressure-operated valve means is preferably adjustable so that it can be set to operate at different predetermined pressures.

The second connector means may be for connecting to any suitable and appropriate source of compressed gas, for example a source of compressed gas in the form of a compressor or in the form of a carbon dioxide mini-bottle or cylinder. Generally, any suitable and appropriate gas may be employed.

The first connector means is advantageously a frusto-conical device for fitting in different sizes of blocked pipe or in sink wastes forming the entrance to the blocked pipes.

If desired, the gas-operated apparatus of the present invention may include trigger means for causing operation of the apparatus in a single firing mode as opposed to the automatic pulsed firing mode.

An embodiment of the invention will now be described solely by way of example and with reference to the accompanying drawings in which:

Figure 1 is a cross section through gas-operated apparatus in a closed ready-for-use mode;

Figure 2 is a cross section through part of the apparatus shown in Figure 1 and shows the apparatus as it is operated;

Figure 3 shows in more detail the pressure-operated valve means using the apparatus shown in Figures 1 and 2;

Figure 4 is an enlarged detail of the pressure-operated valve means shown in Figure 3;

Figure 5 is an enlarged section through part of a valve associated with the manually-operable pump shown in Figure 1, the valve being shown in a closed position; and

Figure 6 shows the valve of Figure 5 in an open position.

Referring to the drawings, there is shown gas-operated apparatus 2 for unblocking pipes (not shown). The apparatus 2 comprises first connector means 4 for connecting the apparatus 2 to a pipe which is blocked by a blockage. The apparatus 2 also comprises a gas chamber 6 and a manually operable pump 8 for manually providing gas in the gas chamber 6. The apparatus 2 still further comprises second connector means 10 for connecting the apparatus 2 to a source of compressed gas for

providing gas in the gas chamber 6. The source of compressed gas may be a compressor (not shown) or a carbon dioxide mini-bottle (not shown).

The apparatus 2 further comprises pressure-operated valve means 12 which operates at a predetermined pressure automatically to allow gas under pressure in the gas chamber 6 to escape as a series of pulses into the pipe which is blocked, thereby to subject the blockage in the pipe to a series of pressure pulses designed to shift the blockage. The valve means 12 is such as to allow the automatic escape of the gas under pressure in the gas chamber 6. During use of the apparatus 2, the gas will normally be provided by a source of compressed gas. If desired, the function of the valve means 12 may be tested by manually testing the apparatus 2 to provide the required gas. The valve means 12 is adjustable so that it can be set to operate at different predetermined pressures.

The first connector means 4 is frusto-conical as shown in Figure 1 and 2 for ease of fitting in different sized blocked pipes or sink wastes forming the entrance to the blocked pipes.

As also shown in Figures 1 and 2, the apparatus 2 includes trigger means 14 causing operation of the apparatus 2 in a single firing mode in conjunction with the manually operated pump, as opposed to an automatic pulsed firing mode. While using compressed gas to operate the apparatus 2, the trigger means 14 acts as a stop to the automatic mode. So therefore the trigger means 14 acts in two ways. Firstly, the trigger means 14 acts to enable single shot use when the apparatus 2 is being manually pumped. Secondly, the trigger means 14 when pulled will stop the apparatus 2 from working in an automatic mode when the apparatus 2 is being continually powered by a compressor.

The apparatus 2 is able to work such that water in a blocked pipe can be shocked to utilise kinetic energy. The apparatus 2 operates to cause the series of air pulses to strike the water rapidly and set up shock waves which travel along the pipe until they reach the blockage. The blockage is then jarred by the series of shock waves and the blockage may then be caused to shift and unblock the pipe. The series of shock wave pulses are able to provide considerably less strain on modern plumbing waste pipes than a single high pressure pulse as is employed in known devices. Damage to plumbing waste pipes and possible consequent flooding of homes is thus avoided or reduced.

Because the apparatus 2 is able to be connected to the source of compressed gas, much of the hard work of pumping the gas-operated apparatus by the manually operated pump can be avoided. If desired however, the apparatus 2 can be used manually with a measured single pulse capability, but operation times will then be appreciably slower than if the source of compressed gas is used. The use of the source of compressed gas is particularly useful for professional plumbers who will normally automatically have available an appropriate source of compressed gas. The pump 8 is however useful for testing the function of the valve means 12 in order to ensure that it is in good working order and therefore the apparatus 2 is safe for use. More specifically, the diameter ratios of the pump 8 and the gas chamber 6 may be chosen such that around twenty manual pumps. It may be difficult to pump more air into the gas chamber 6. The valve means 12 can be set to the equivalent of approximately eighteen pumps or 40 lbs per square inch as the highest pressure obtainable using the valve means 12. Thus, a user can pump air into the apparatus 2 by hand using the pump 8 and, if the apparatus 2 does not allow air to escape via the valve means 12, then this is an indication that the valve means 12 may need to be serviced.

The apparatus 2 of the present invention is advantageously injection moulded in a plastics material. The valve means 12 is advantageously adjustable so that it can be set to operate at different predetermined pressures as will be described hereinbelow. This enables a user to reduce or increase the working pressure of the apparatus 2 in order to most appropriately suit any particular plumbing system and the blockage encountered.

Once the valve means 12 has been set, it is able to function in two separate ways. Whilst manually pumping the apparatus 2 with the pump 8, when the required pressure is reached, any subsequently applied over-pressure can be automatically released, whereupon a slight pop might be heard. Thus the valve means 12 enables the apparatus 2 manually to be pumped to a preset pressure but not to be over-pumped. Still further, whilst using the apparatus 2 with the source of compressed gas, the valve means 12 is able to act due to the larger flow of air and to cause any potential over-pressure situation to lift an internal valve 16 faster than the compressed air can be supplied, and high enough to cause the apparatus 2 to vent to atmosphere through vent aperture 18.

As will be explained in more detail hereinbelow, the valve means 12 can be set to various desired predetermined pressures.

The apparatus 2 of the present invention is able to be used with all types of industrial and domestic pipe work including pipe work made of plastics materials, copper and cast iron.

Referring especially to Figures 1 and 2, as the apparatus 2 operates, the pulses of air pass from the gas chamber 6 into a pipe 20 and through the first connector means 4. The first connector means 4 is advantageously made of rubber or a similar

flexible material. Thus the first connector means 4 is able to form a seal in a blocked pipe so that air pressure is not lost. Also, by obtaining a good seal with the first connector means 4, water splashing back due to the air pulses is avoided.

Continuous air pulses are normally obtained as a result of using the source of compressed gas and the second connector means 10. The second connector means 10 may be a pneumatic valve connected to an air compressor (not shown). Whilst the air compressor is charging, the apparatus 2 will continue to receive the compressed air and discharge a train of air pulses in an automatic manner at a predetermined pressure. The operation of the apparatus 2 is easily stopped simply by pulling the trigger means 14 and holding the trigger means 14. This allows the compressed air passing into the gas chamber 6 to escape down the pipe 20, no matter what the pressure setting is on the valve means 12. Obviously if desired, an alternative way of stopping the operation of the apparatus 2 is to turn off the source of compressed gas or to disconnect it at the second connector means 10.

If desired, the apparatus 2 may be operated using the pump 8, for example when the source of compressed gas is not available. In this case, the pump means 8 is operated to pass air through a one way valve 22 in order to charge the gas chamber 6 with compressed air. As soon as the first pump of air enters the gas chamber 6, the apparatus 2 is designed such that the valve 22 and also a valve 24 shut off. When the valve 24 is shut, part of its body is still in the bore 25 of a boss 27. The valve 24 is a loose fit in the bore 25 so that air can be pumped past the solid valve 24 and into the gas chamber 6. Once the gas chamber 6 has been appropriately pressurised, the trigger means 14 can be pulled to release a single pressure pulse of air. If the valve means 12 has been appropriately set, the continual pumping via the pump 8 will result in automatic operation of the valve means 12 and a series of pressure pulses of air to be emitted from the apparatus 2. Such continual pumping will normally be used for pump checking purposes only as it would normally be too difficult to hold the apparatus 2 in position to clear a sink and pump at the same time.

The action of pulling the trigger means 14 allows the higher pressure air in a vent passage 26 to escape as well as air within an area 28 above the valve 24, see Figure 1. In doing so, the pressure within the gas chamber 6 pushes up the valve 24 for a brief moment. The valve 24 thus acts as a differential pressure valve. The face area 30 of the valve 24 is greater than the area that it covers at the top of the pipe 20. Thus there is lower pressure in the vent passage 26 and the area 28 so that this lower pressure is vented to atmosphere as the valve 24 goes up, causing the air in the gas chamber 6 instantly to escape down the pipe 20.

As can be seen from Figures 1 and 2, the valve 24 is a solid valve which is provided with an inset rubber or plastics seal 32 which seals the top of the pipe 20.

Referring to Figures 3 and 4, the valve means 12 has a cap 34 which screws over a threaded portion 36 of a body 38. By screwing the cap 34 in or out, more or less pressure can be brought to bear on a spring 40 which is provided in the body 38. The spring 40 is guided by a valve stem 42. The valve stem 42 is connected to a piston 44 which has a frusto-conical member 46. The member 46 is provided with an O-ring seal 48 which seals a passage 50. The passage 50 is formed in a threaded boss part 52 which screws into an appropriate part of the apparatus 2 as shown in the drawings.

The valve stem 42 is not essential to the working of the valve means 12. The valve stem 42 is able to act as an override to the detected or chosen air pressure. More specifically, if an operator puts his or her thumb on the valve stem 42 while the apparatus 2 is being powered by a compressor, the operator can interrupt the pulses being given and get a higher single pressure pulse for clearing, for example, a really bad blockage. If desired, the overriding facility provided by the valve stem 42 may be omitted, for example to minimise on manufacturing costs.

As can be seen from Figure 3, a passage 54 is provided for allowing gas to pass from the second connector means 10 into the gas chamber 6.

As can be seen from Figure 1, the pump 8 comprises a body 56 having a bore 58. A leather washer 60 is provided on the end of a pump rod 62. The pump rod 62 is provided with a pump handle 64. The pump handle 64 is held in position by a screw threaded cap 66 which screws over the body 56 as shown in Figures 1 and 3. Removal of the cap 66 enables the leather washer 60 to be maintained and replaced as may be appropriate.

The pipe 20 ends in a ball portion 68. The first connector means 4 is thus able to swivel about the ball portion 68 in the manner of a universal joint. This facilitates good positioning of the apparatus 2 on a sink waste or pipe, with the apparatus 2 being able to be positioned at the most appropriate angle for easy operation of the apparatus 2.

When the cap 34 has been appropriately screwed to give a desired pressure, then the valve means 12 operates such that when the generated gas pressure on the seal 48 is greater than the pressure exerted by the spring 40, the piston 44 is forced to the right as shown in Figure 4. Sufficient movement of the piston 44 to the right as shown in Figure 4 uncovers the aperture 18 in the body 38.

This action in turn causes the valve 24 to go up, allowing air to escape down the pipe 20.

To hand pump the apparatus 2, the size tolerance between the valve 24 and the walls of the area 28 are arranged to be such that air can pass to pressurize the gas chamber 6 with sufficient restriction to give ease of action but at the same time sufficient that, when the valve means 12 is activated, the differential pressure causes the valve 24 to move upward and the apparatus 2 automatically to be triggered.

As can be seen from Figures 1 and 2, the gas chamber 6 has a body part 70 which screws into a housing 72. An O-ring seal 74 is trapped between the body part 70 and the housing 72 in order to ensure a good airtight connection at this point.

As can also be seen from Figures 1 and 2, the trigger means 14 comprises a trigger lever 76 which pivots about a pivot 78. The trigger lever 76 has a seal 80 which in the closed position shown in Figure 1 seals the vent passage 26. In the open position shown in Figure 2, the trigger lever 76 has been pivoted upwardly over a locater member 82 provided on a trigger guard 84, and the seal 80 has been moved away from making sealing contact with the vent passage 26.

Referring now to Figures 5 and 6, the valve 22 is shown in more detail. The valve 22 is a one way valve. There are no springs to stop air escaping from the gas chamber 6. The valve 22 has a valve spool 86 which slides up and down in a housing part 88. The housing part 88 is provided with an inward deformation 90 which acts as an abutment shoulder for an O-ring seal 92 mounted on the valve spool 86. The upper part of the valve spool 86 is provided with a slot 94 which allows air to pass as shown by the arrows 96 when the valve 22 is in the open position shown in Figure 6.

The valve spool 86 is very light and, in relation to one stroke of the pump 8, the pressure within the gas chamber 6 is such that this pressure will lift the valve spool 86 and seat the seal 92 in sealing engagement with the inward deformation or shoulder 90, and thus provide the required seal at this point. It will be noted that the seal 92 is smaller in diameter than the bore 98 of the housing part 88. Thus in the open position of the valve 22, air is able to pass when the pump 8 is actuated. Thus, as the air passes through the slot 94 as shown by the arrows 96, it is able to pass around the outside of the seal 92 and into the lower part of the bore 98.

It is to be appreciated that the embodiment of the invention described above with reference to the accompanying drawings has been given by way of example only and that modifications may be effected. Thus, for example, a different type of manual pump 8 may be employed. Also, the shape of the gas chamber 6 may be different to that shown. Further, different types of first connector means 4 and second connector means 10 may be employed.

The apparatus of the invention may normally be operated in an automatic pulsing mode. However, if an optional and different type of pulse action is required, a vent passage 100 may be provided. With the vent passage 100, the apparatus of the invention may be operated such that after it gives one pulse, the trigger has to be pulled to reset the valve.

In the apparatus of the invention, one or more of the various described and/or illustrated features may be omitted or combined in any combination.

Claims

1. Gas-operated apparatus for unblocking pipes, which apparatus comprises first connector means for connecting the apparatus to a pipe which is blocked by a blockage, a gas chamber, a manually operable pump for manually providing gas in the gas chamber, second connector means for connecting the apparatus to a source of compressed gas for providing gas in the chamber, and pressure-operated valve means which operates at a pre-determined pressure automatically to allow gas under pressure in the gas chamber to escape as a series of pulses into the pipe which is blocked thereby to subject the blockage in the pipe to a series of pressure pulses designed to shift the blockage, and the valve means being such as to allow the automatic escape of the gas under pressure in the gas chamber.

2. Gas-operated apparatus according to claim 1 in which the pressure-operated valve means is adjustable so that it can be set to operate at different predetermined pressures.

3. Gas-operated apparatus according claim 1 or claim 2 in which the second connector means is for connecting to a source of compressed gas.

4. Gas-operated apparatus according to any one of the preceding claims in which the first connector means is a frusto-conical device.

5. Gas-operated apparatus according to any one of the preceding claims and including trigger means for causing operation of the apparatus in a single firing mode.

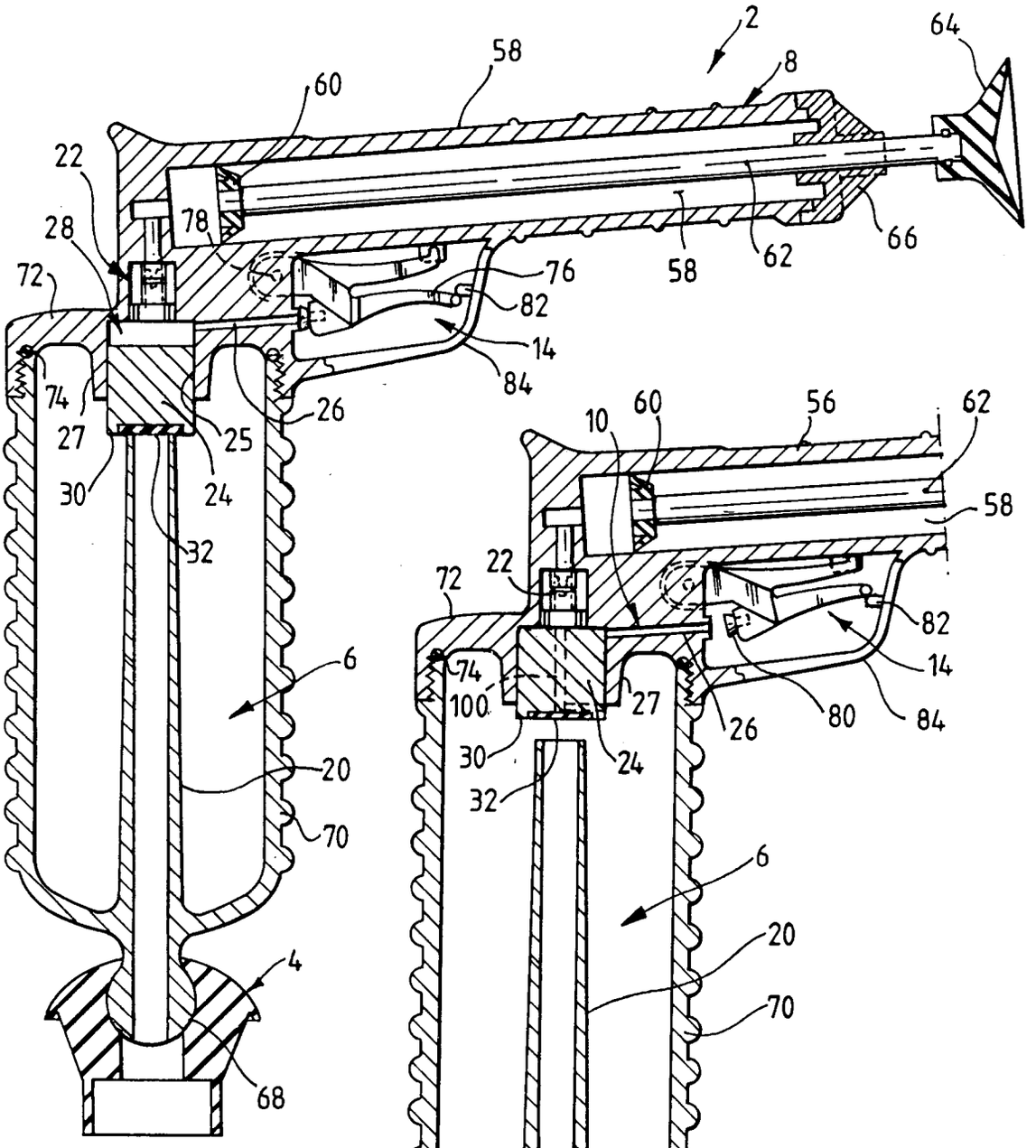
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FIG.1.

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FIG.2.

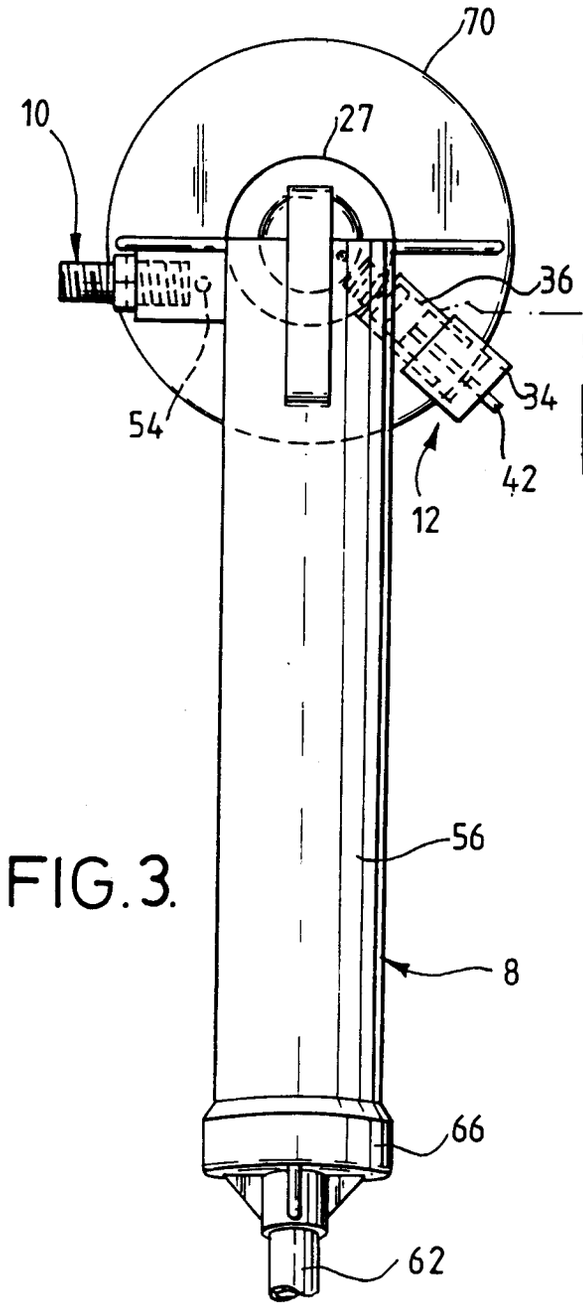

FIG.3.

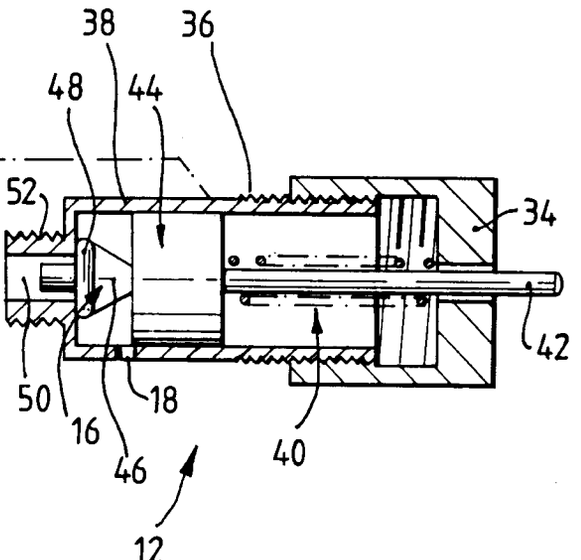

FIG.4.

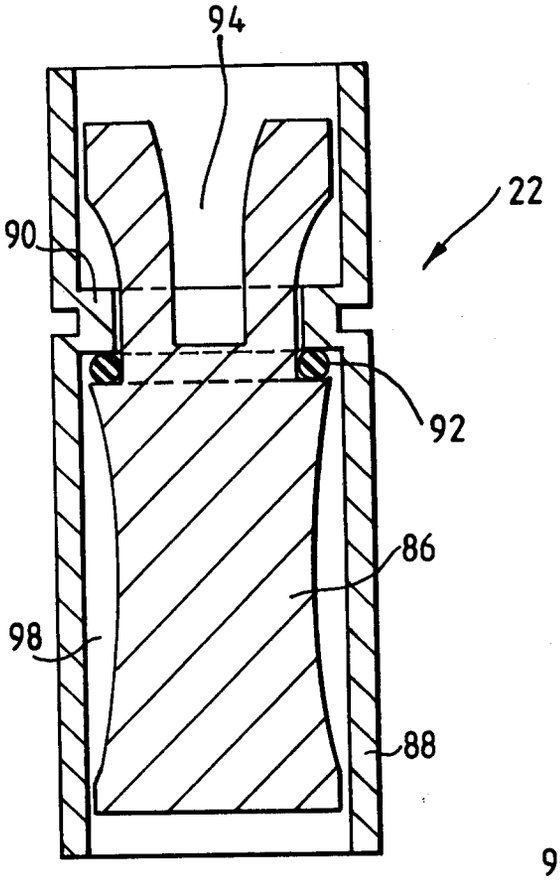

FIG.5.

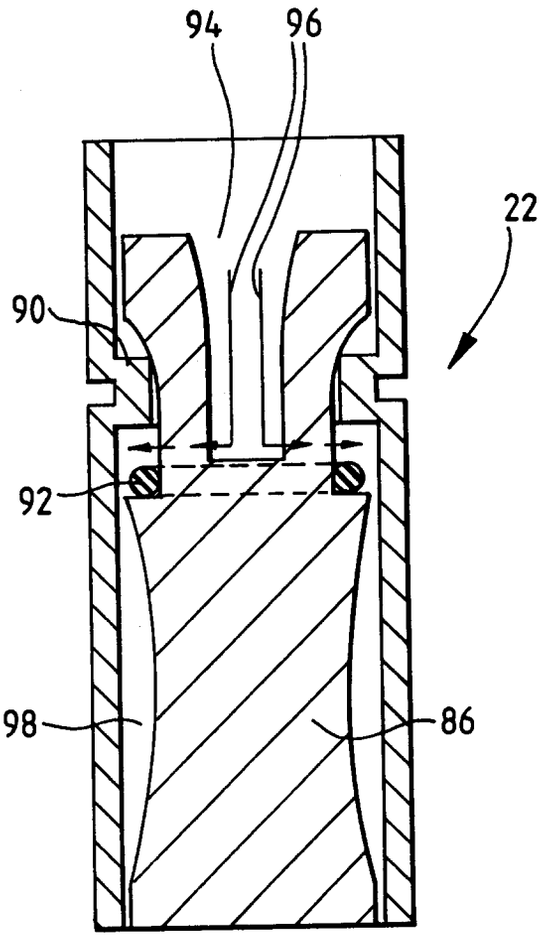

FIG.6.

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EUROPEAN SEARCH REPORT

Application Number
EP 93 30 5657

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
Y,D A	FR-A-2 417 347 (FRATI) * the whole document *	1,3,4 2,5	E03C1/304
Y	GB-A-686 842 (AIRNESCO PRODUCTS LTD) * page 2, line 67 - line 106 *	1,3,4	
A	US-A-4 542 543 (IRWIN) * column 1, line 46 - line 51 *	1	
A	US-A-2 386 870 (LAWTON) * page 1, right column, line 5 - line 16; figures *	1,2	
A	US-A-3 426 774 (CONN.) * figures 1,2 *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

E03C
B08B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 November 1993	VAN BEURDEN, J

CATEGORY OF CITED DOCUMENTS

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