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(54) TESTING OF SMOKING ARTICLES

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(73) Proprietor: **MOLINS PLC
Blakelands,
Milton Keynes MK14 5LU (GB)**

(72) Inventors:
• **WILSON, Ronald, Frederick 16 Edmonds Close
Buckingham MK18 1YR (GB)**

- **MASON, Timothy, James, Peter
Haddenham HP17 8AN (GB)**
- **JARMAN, Philip, Keith
Milton Keynes MK4 1DH (GB)**
- **TINDALL, Ian, Francis
Bournemouth BH9 2UJ (GB)**

(74) Representative: **Williams, Michael Ian
fj Cleveland
40-43 Chancery Lane
London WC2A 1JQ (GB)**

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Description

[0001] The present invention relates to techniques for occluding holes in a smoking article in order to enable testing of the smoking article.

[0002] Regular testing of cigarettes on a mechanical smoking apparatus, or smoking machine, is an important part of any cigarette manufacturing process. A smoking machine serves to create a repeatable standardised environment for the analytical smoking of cigarettes. International and national standards, including ISO standard 3308 (2000), have been put in place for standardising the operation of smoking machines.

[0003] A smoking machine typically comprises at least one holder for a cigarette, and a puffing means for drawing air in controlled fashion through the cigarette in regular short puffs in order to smoke the cigarette.

[0004] Filter tipped cigarettes are often designed with a number of ventilation holes made in the paper surrounding the filter area. The object of these ventilation holes is to dilute the smoke product drawn by the smoker into the mouth and lungs. When the holes are blocked the delivery of tar, carbon monoxide, nicotine and other products is usually increased.

[0005] When analysing the smoke products of cigarettes it may be necessary to occlude all or part of the ventilation holes placed in the filter area. When this occurs the method is known as "intensive smoking" as mechanisms used to reduce tar and nicotine delivery are defeated.

[0006] A known technique for occluding filter ventilation holes when intensive smoking is to be performed involves wrapping self adhesive tape about the whole filter area before the cigarette is placed into a smoking machine. However this method suffers from the disadvantages that it is not reliably reproducible, has potential for affecting the composition of the smoke constituents and has a tendency to give smoke composition results with a large scatter. An additional disadvantage is that the process is very labour intensive, repetitive and the final result depends upon the diligence and skill of the taper.

[0007] According to one aspect of the present invention there is provided a smoking machine for smoking a smoking article as recited in claim 1.

[0008] Such a machine can provide a simple and reproducible way of occluding the holes in the smoking article when performing intensive smoking tests.

[0009] Preferably the seal is made from an elastomeric material. This can allow the seal to expand or to contract, which can assist in the fitting of the seal. Furthermore an elastomeric material may provide good occlusion of the holes. Suitable materials for the seal include synthetic or natural rubber. The seal is preferably impermeable to gas, to prevent gas being drawn through the seal.

[0010] Preferably the seal is arranged such that the seal can expand and/or contract. This can allow the seal to adopt a first position in which a smoking article can be

inserted into the seal (i.e. in which there is a gap between the seal and the smoking article), and a second position in which the seal grips the smoking article. Preferably the seal does not require the use of release agents or lubricants between seal and smoking article in order to insert or remove the smoking article.

[0011] The seal may be part of an occluding device, and the occluding device may comprise a rigid part to which the seal is attached. This may assist in the fitting and handling of the seal. The rigid part may be tubular and at least part of the seal may be located inside the rigid part. In order to attach the seal to the rigid part, at least one end of the seal may have a lip which wraps around an end of the rigid part.

[0012] The occluding device may comprise a port for applying a pressure change to the seal. For example, the port may be couplable to a pump or venturi which may apply an increased pressure or a reduced pressure or a vacuum to the seal. The device may then be arranged such that the seal can expand or contract in response to the change in pressure. This can allow the seal to expand before a smoking article is inserted into the device, and to contract to fit or to grip the smoking article once it is inserted. This thus provides a simple and convenient way of fitting the seal to and removing it from the smoking article. If required, a releasable valve may be provided for holding the seal in the expanded or contracted state.

[0013] For example, an air gap may be provided between the rigid part and at least part of the seal, and the port may be coupled to the air gap. Applying a pressure change to the air gap via the port may then cause the seal to expand or to contract to allow fitting and removal of the seal.

[0014] Alternatively, other techniques may be used to expand or contract the seal; for example a mechanical actuator may be coupled to the seal to expand or contract the seal.

[0015] Any flexible seal may in time become worn or may develop leaks or faults. If a faulty seal is used in a smoking test this may compromise the results of the test. In order to detect leaks or faults in the seal material, the device may be coupled to a pressure, flow or vacuum sensing device. Any change in the pressure, flow or vacuum outside of certain thresholds may indicate that there is a leak or fault in the seal material. The faulty seal can then be replaced.

[0016] The seal is arranged (when fitted) to cover at least some filter holes in a filter of the smoking article, in order to allow intensive smoking tests to be carried out. The seal may cover the whole filter, or the seal may cover the at least some filter holes but not the whole filter. The filter holes may be totally occluded or partially occluded.

[0017] In some embodiments of the invention the seal is part of a holder for holding the smoking article in a smoking machine. In this way the holder itself can occlude the holes in the smoking article. This can provide a simple and reproducible technique for occluding the holes in the smoking article when performing intensive

smoking tests. The seal may be part of the smoking machine holder seals (which seals are provided in conventional smoking machines), or the seal may substitute the smoking machine holder seals.

[0018] In some other embodiments, the seal is removable from the smoking machine, and is arranged to be fitted to the smoking article before insertion of the smoking article into the smoking machine. For example, the seal may be fitted to the smoking article in a separate apparatus before the smoking article is inserted into the smoking machine. To assist in the fitting the seal may be part of an occluding device such as that described above.

[0019] The invention also provides a smoking arrangement comprising a smoking machine in any of the above forms, and a smoking article, wherein the seal is attached to the smoking article.

[0020] In some embodiments of the invention the seal is not part of the smoking machine as such, and is arranged to be fitted to the smoking article before insertion of the smoking article into the smoking machine, for example by means of a separate seal fitting apparatus.

[0021] Thus, according to another aspect of the invention, there is provided a smoking arrangement according to claim 19.

[0022] Any of the features of the first aspect of the invention may also be applied to the second aspect.

[0023] The smoking machine or arrangement in any of the above forms may further comprise means for applying a change in pressure to the seal. Furthermore, the smoking machine or arrangement may further comprise a pressure, flow, or vacuum sensing device to detect leaks or faults in the seal.

[0024] The smoking machine or arrangement may further comprise means for storing a desired value of pressure, means for comparing a sensed value of pressure with the stored value, and means for providing an indication of a fault in the seal in dependence on a result of the comparison. This can allow an operator to be warned should a fault develop in the seal.

[0025] Corresponding methods are also provided. Thus, according to another aspect of the invention, there is provided a method of automatically smoking a smoking article in a smoking machine as recited in claim 23.

[0026] The method may further comprise the step of applying a pressure change to the seal thereby causing the seal to expand or to contract. The method may further comprise the step of sensing pressure, flow or vacuum applied to the seal to detect leaks or faults in the seal material.

[0027] The method may comprise the step of fitting the seal to the smoking article prior to insertion of the smoking article into the smoking machine.

[0028] According to another aspect of the invention there is provided a method of automatically smoking a smoking article in a smoking machine as recited in claim 26.

[0029] Any feature of one aspect of the invention may be provided with any other aspect. Apparatus features

may be provided as method features and *vice versa*.

[0030] Preferred features of the present invention will now be described, purely by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows a cigarette holder according to a first embodiment of the invention;

Figure 2 shows a cigarette holder according to a second embodiment;

Figure 3 shows a cigarette holder and occluding seal according to a third embodiment;

Figure 4 shows in diagrammatic form a mechanism by which occluding devices in a fourth embodiment are inserted onto cigarettes;

Figure 5 shows a cigarette holder and occluding seal according to the fourth embodiment;

Figure 6 shows parts of a seal fitting mechanism; and Figure 7 shows an arrangement for detecting faulty seals.

Overview of the invention

[0031] Currently, when intensive smoking is to be performed, filter ventilation holes in the cigarette are occluded by wrapping self adhesive tape about the whole filter area before the cigarette is placed into the smoking machine. However the following problems have been identified in this technique:

- The self adhesive tape used may be supplied by any company that makes such products. The exact formulation may vary between companies and consistency in the efficacy of the various tapes may vary.
- The adhesive used on the tape may not fully bond with the filter tip and may create leakage paths through to the ventilation holes in a non-specific and random way. Unwanted dilution of the cigarette smoke may then occur.
- The adhesive used on such tapes usually requires pressure to fully form a seal. Applying pressure to the filter substrate may deform the filter under test and so influence the yield of smoke components as the fibres of the filter are closed up. This again introduces a variable to the analytical smoking process.
- The adhesive used may have volatile components that are drawn into the cigarette and contaminate the smoke stream that is being analysed. Moreover the process of smoking may also liberate elements of the adhesive which can effect the smoke composition. The potential differences in adhesive composition from various adhesive tape manufacturers introduce a random, and unquantifiable, element into the smoking process.
- The polymer tape used will also differ between manufacturers and so may the gas permeability of the various tapes. If gas can permeate through the tape, as some are designed to do, the degree of occlusion of the ventilation holes can vary in a non-specific

manner.

- Tapes are normally applied by hand and the reproducible application of such tapes is difficult, especially as for normal smoking experiments many cigarettes may require taping.
- In taping cigarettes there must be no overlap of the ends of the tape, otherwise, when fitted into a holder of a mechanical smoking device, a small gap may appear between holder and cigarette that allows air into the smoking machine, diluting the smoke stream and again giving inconsistent results.
- In attempting to produce perfect butt joints it is not unusual to leave small gaps between the ends of the tape, again providing a leakage path and a source of irreproducibility.
- Punctures in the tape are not easily detected, yet any hole in the occluding material will have a profound effect on the measured yields of smoke components.

[0032] In embodiments of the present invention, elastomeric seals are used to occlude the ventilation holes in cigarettes for intensive smoking. A vacuum method of fitting is used to ensure that the seals are leak and puncture free.

[0033] In embodiments of the invention, seals, made from silicone rubber, neoprene or any other suitable elastic material are placed in a holder either by hand or loaded via a machine interface. One end, or both ends, of the seal material is fitted to the holder by means of a clamp or through stretching over a suitable retaining lip. The gap between seal and holder is then evacuated pulling the seal material into a tube of greater diameter than in the relaxed state. The process of evacuating the gap between holder and seal not only expands the seal, but also by using a vacuum, ensures that the seal material is free from pin holes and leaks. As the seal is pulled by vacuum the natural leak rate can be monitored by a suitable commercial pressure gauge and the measured leak rate compared with a leak free sample. Any deviation from the ideal leak rate indicates that the seal material is faulty and would not produce a reproducible seal around the cigarette.

[0034] Once the seal is stretched, the cigarette is placed into the seal so that the seal material covers the tip area, or the part of the tip area that includes the ventilation holes. The vacuum is then released and the elastomer then relaxes about the filter forming a leak free seal.

[0035] It can be seen that the seals used should be selected of a diameter that closely matches or is best suitable to the filter diameter; however a suitable system can be devised that uses common holders and a range of suitable seal diameters.

First embodiment

[0036] In this embodiment the standard seal mecha-

nism recommended for smoking mechanically, which typically includes between 3 and 4 labyrinth seals, is replaced by a holder that is essentially tube like in construction. As part of this tube like holder there is a side evacuation port. The tube is approximately the same length as the filter to be occluded.

[0037] Figure 1 shows a cigarette holder according to the first embodiment. Referring to Figure 1, cigarette holder 10 comprises smoking machine interface 12 and o-ring seals 14 which are used to interface the holder to a smoking machine (not shown). Filter pad holder 16 is attached to smoking machine interface 12, and the join is sealed with o-ring seal 18. Filter pad holder 16 holds a filter pad 20 which is used to filter smoke drawn from a cigarette. Inserted into the filter pad holder 16 is a special holder 22 which is tube-like in construction. The internal diameter of the holder 22 is slightly larger than the diameter of a cigarette 28 which is to be tested. The holder is sealed to the filter pad holder 16 by o-ring 24. A rubber bumper 26 provides a step against which a cigarette abuts when it is fully inserted into the holder 22.

[0038] An elastomeric seal 30 is located inside the holder 22. The seal 30 is tubular for most of its length, and at either end has lips that wrap around the extremities of the holder 22. The lips grip the holder and provide a seal thereto. On the inside of the holder there is an air gap 32 between the seal and the holder. An evacuation port 34 is provided in the holder, and is in communication with the air gap 32. The port 34 is connected to a vacuum pump 35 by means of the tube 36. A pressure sensing device 38 is connected in the tube 36 to sense the pressure in the tube.

[0039] The vacuum pump 35 is connected to a control unit 42, which controls the operation of the pump in accordance with a required smoking operation. The pressure sensor 38 is also connected to the control unit 42, so that the control unit can indicate when a faulty seal is detected.

[0040] In operation, when it is desired to smoke a cigarette 28 having filter holes 40, a vacuum is first applied to the port 34, and the elastomeric seal 30 is pulled out towards the walls of the holder 22. If the seal 30 fails to expand to the walls of the holder then the seal has become compromised and requires replacement. Similarly the pressure sensing device 38 (or alternatively a gauge detecting flow or vacuum in line with the evacuation port) can determine the integrity of the seal by determining the pressure between the seal 30 and the holder 22. Leaks can then be located by inspection and faulty seals replaced.

[0041] The cigarette 28 is then placed inside the holder 22 until the end butts up against the rubber bumper 26 inside the holder. The vacuum is then released and the occluding seal 30 grips the filter of the cigarette to be tested. The location of the seal 30 with respect to the filter holes 40 is such that the filter holes are occluded by the seal when the vacuum is released.

[0042] The cigarette 28 is firmly gripped by the elasto-

meric seal 30 without deforming the filter, yet forming an air tight seal. The seal 30 thus performs the dual task of occluding filter holes and forming a seal with the instrument, which seal would usually be provided by a series of labyrinths seals.

[0043] The cigarette can then be smoked by the smoking machine in a known manner. On completion of the smoking run the vacuum is again applied to release the seal ready for use in the next run.

[0044] The control unit 42 may be part of the smoking machine, and may co-ordinate operation of the pump with other functions of the smoking apparatus. For example, if cigarettes are loaded automatically into the holder 10, then the control unit 42 may operate the pump 35 so as to expand the seal 30 at the appropriate moment before the cigarette is inserted into the holder 10.

Second embodiment

[0045] In this embodiment the occluding seal is molded in shape to include one of the prescribed seals used to hold the cigarette in place in the ISO style holder. The holder is modified to include an oversized diameter tube the approximate length of the filter with an evacuation port that can be connected to a source of vacuum. This vacuum can be generated by pump, venturi effect or similar.

[0046] Figure 2 shows a cigarette holder 50 according to the second embodiment. Parts of the holder 50 which are in common with the holder 10 in the first embodiment are given the same reference numerals and are not described further.

[0047] Referring to Figure 2, cigarette holder 50 includes a special holder 52 attached to filter pad holder 16 and sealed thereto by means of o-ring seals 54 and 56. The holder 52 includes at one end a plurality of labyrinth seals 58, as would be present in a conventional cigarette holder for holding the cigarette. The holder 52 also includes a tubular portion extending along the axis of the cigarette 28. The tubular portion of the holder 52 is provided with elastomeric seal 60.

[0048] As in the first embodiment, the seal 60 is tubular for most of its length, and at its furthest end has a lip 62 which wraps around the extremity of the holder 52 so as to grip the holder and provide a seal. The other end of the elastomeric seal 60 is formed integrally with one of the labyrinth seals 58.

[0049] The tubular portion of the holder 52 is provided with an evacuation port 64.

[0050] In operation, before insertion of the cigarette 28, the occluding seal 60 is fitted into the holder seal stack 58, and the special holder 52 is fitted. The end of the occluding seal 60, which may be plain or castellated, is rolled over the end of the holder 52. The seal material is held in place by the action of the seal material gripping into a recess or gripping a larger diameter of the holder.

[0051] Vacuum is then applied to the evacuation port 64 and the seal 60 is drawn out toward the sides of the

holder 52. The cigarette 28 is then inserted into the whole holder stack until it butts up against the bumper 26 at the inner face of the holder stack.

[0052] If the sleeve is not drawn out by the vacuum then there is a hole in the sleeve and it will have to be discarded and a new seal fitted. In addition the presence of a gauge measuring pressure and/or vacuum can detect minor leaks which will indicate that an individual seal is faulty and should be replaced.

[0053] The vacuum is then released. The seal relaxes about the filter thus closing the ventilation holes. The smoking process can now take place.

[0054] On termination of the smoking run - a feature of the smoking machine - the vacuum can again be applied and the used cigarette removed. The seal is then available for further tests.

Third embodiment

[0055] In a third embodiment the occluding seals are fitted to the cigarette under test in a separate apparatus designed specifically for the purpose. The apparatus is set such that when a cigarette is placed in the machine it reaches a stop that presents the filter so that when the occluding seal is fitted it starts at the exact position where the normal smoking machine seals commence and forms a butt joint with the existing seal. The extent of the seal is determined by the overall length of the filter under test and seal length is chosen on this basis. This stop is independent of the brand of cigarette used.

[0056] Seals are loaded into the mechanism either automatically or manually and through use of vacuum expansion to create a greater diameter than in the relaxed state. The cigarette is loaded into the holder and the vacuum released allowing the seal to contract and fit snugly about the filter.

[0057] The nature of the mechanism is such that the vacuum can be monitored to discover minor or major leakage through the occluding seals and give warning that the seal should not be used and should be replaced.

[0058] The cigarettes are removed and fitted to a standard cigarette holder as used in a smoking machine.

[0059] Once the article has been smoked the seal is discarded.

[0060] Figure 3 shows a cigarette holder and occluding device in the third embodiment. In this embodiment the seal holder is of standard construction, and a separate occluding device is used to occlude the filter holes. In Figure 3 parts of the first or second embodiments are given the same reference numerals and are not described further.

[0061] Referring to Figure 3, a conventional cigarette holder 70 comprises a plurality of labyrinth seals 58 for gripping a cigarette 28 which has been inserted into the holder 70. A separate occluding device 72 which is essentially tubular in shape includes on the inside an elastomeric seal 74. The seal 74 is also tubular with lips at its extremity which wrap around and grip the ends of the

occluding device 72. The occluding device 72 is provided with an evacuation port 76, which is connected to a vacuum pump 35 in the same way as described above with reference to the first and second embodiments. Alternatively, the occluding device 72 is fitted to the cigarette off-line in a separate apparatus before fitting to the standard holder, in a similar way to the fourth embodiment described below.

Fourth embodiment

[0062] In a fourth embodiment the occluding seals are fitted to the cigarette under test in a separate apparatus designed specifically for the purpose. The position of the ventilation holes and extent of perforation is known and the length of seals that will cover the holes is chosen before fitment. In this design the holes are only covered and not the whole filter length. The apparatus is set such that when a cigarette is placed in the machine it reaches a stop that presents the filter ventilation holes such that when a seal is fitted it will cover all the holes. This stop is variable and can be set dependant upon the brand of cigarette used.

[0063] Figure 4 shows in diagrammatic form the mechanism by which occluding devices in accordance with the fourth embodiment are inserted onto cigarettes. Each occluding device 80 includes on its inside an elastomeric seal 82 having lips which wrap around and grip the ends of the occluding device. The occluding device also includes an evacuation port 84 which allows the device to be connected to a vacuum when the device is being fitted to the cigarette.

[0064] Occluding devices 80 are loaded into the mechanism either automatically or manually to form a column of devices ready to be fitted. A device which is to be fitted is expanded through use of vacuum to a greater diameter than in the relaxed state. The cigarette is loaded into the apparatus and the vacuum released allowing the seal to contract and fit snugly about the filter in the region of the ventilation holes.

[0065] The nature of the mechanism is such that the vacuum can be monitored to discover minor or major leakage through the occluding seals and give warning that the seal should not be used and should be replaced.

[0066] The cigarettes are then removed and fitted to a standard cigarette holder as used in a smoking machine.

[0067] Figure 5 shows a cigarette holder and occluding device once the cigarette has been inserted into the holder. Parts of the holder which are in common with previous embodiments are given the same reference numerals and are not described further.

[0068] Once the smoking run has been concluded the seals are discarded.

[0069] Figure 6 shows some parts of the seal fitting mechanism in more detail. Referring to Figure 6, a motor 90 is provided which can vary the position of variable stop 92 under control of control unit 94. Control unit 94 has a memory which stores the positions of ventilation

holes in different brands of cigarettes. Before a cigarette is placed in the machine, the operator enters the brand of cigarette by means of keypad 96. Alternatively, if the cigarette is not of a brand recognised by control unit 94, the operator may enter the position of ventilation holes in the cigarette. The control unit 94 then adjusts the position of the stop 92 by means of motor 90 so that a seal, when fitted, will cover some or all of the ventilation holes.

[0070] As an alternative, instead of adjusting the position of the stop 92, the position of the seal when it is fitted to the cigarette could be adjusted.

[0071] Control unit 94 also controls operation of pump 98. Pump 98 applies a vacuum to the seal so as to expand it before a cigarette is inserted. Once a cigarette has been inserted the vacuum is released allowing the seal to contract and fit about the filter in the region of the ventilation holes.

Detection of failed seals

[0072] The detection of pin holes and other faults in the occluding membranes is of importance for obtaining consistent results during the smoking process. In particular where the occlusion of ventilation holes is part of a so called "intensive smoking" regime any path for air to be drawn into the smoking article at the point of ventilation will reduce the measured yields and underestimate the quantity of substances in the main stream smoke commonly grouped together under the label of "tar". Overall this will result in high variability of results and doubt may be thrown on the validity of the results so obtained.

[0073] Figure 7 shows an arrangement which can provide a simple check for pin holes and other faults in order to ensure that a consistent seal is made about the ventilation holes. This arrangement can be used with any of the embodiments described above, or indeed with seals which are designed for other purposes such as measuring pressure drop.

[0074] Referring to Figure 7, occluding seal S 1 is placed in its former or holder which is connected to a valve V1, pump P1 and vacuum gauge VG by means of tubing. In order to allow the cigarette to be inserted into the seal, the pump P1 is started and the valve V1 opened. This evacuates the connecting tubing and the surrounding area of the occluding membrane. The membrane S1 is pulled outwards increasing the aperture it has formed about the former or holder. This larger aperture allows the cigarette to be fitted into the seal.

[0075] The vacuum gauge VG indicates the pressure between the pump P1 and the flexible seal S1. The pressure can be indicated by means of analogue or digital reading and this can be compared with the expected vacuum of the pump and perfect seal. If desired, this comparison could be carried out by the operator. However, in the arrangement shown in Figure 7, a failed seal detecting unit D is provided, which compares the actual pressure with a predetermined threshold value and provides an indication of a fault when the pressure is too

high. For example, a visual or audible indication of a fault may be provided to warn the operator that the seal has failed. This ensures that "gross" faults are detected before the cigarette is fitted to the seal. If the pressure detected is acceptable, the cigarette is inserted into the seal and the valve V1 is closed.

[0076] During smoking of the cigarette, the pressure in the line S1, VG, V1 is measured continuously or continually. Since no seal line and seal will be entirely vacuum tight, there will be a slow increase in pressure (loss of vacuum). The rate of change of pressure can be calculated and compared against an expected leak rate for a defect free seal. In Figure 7, this calculation is carried out by detecting unit D, and an indication of a fault is provided if the leak rate is too high. Again, a visual or audible indication may be provided to warn the operator that the seal has failed or is failing. In such a way the integrity of the occluding membrane can be verified to ensure that there is a more perfect smoking of the vent blocked cigarette.

[0077] While preferred embodiments have been described above, modifications are possible within the scope of the present invention. For example, in all of the above embodiments, rather than using a vacuum to withdraw the seal in order to allow insertion of a cigarette, the seal may have a relaxed state which is slightly larger than the cigarette, and an increased pressure may be applied to the seal so that it expands and occludes the filter holes. In this case the vacuum pump would be replaced by a pump which supplied an increased pressure.

[0078] For example, the seal may consist of a tube resembling a tyre inner tube having a valve connected to a pump. With a cigarette inserted into the holder, air is supplied to the tube via the valve. The tube then expands to block the filter holes while the cigarette is being smoked. Once the test is completed the valve is released to allow the air to escape, thereby causing the tube to contract to its relaxed state in which the cigarette can be removed.

[0079] The present invention may be used to test smoking articles other than cigarettes, such as cigars and cigarillos.

Claims

1. A smoking machine for smoking a smoking article, the smoking machine including a flexible seal (30; 60; 74) arranged to occlude at least some ventilation holes (40) in a filter of the smoking article (28), the smoking machine being arranged to smoke the smoking article while the ventilation holes (40) are occluded by the flexible seal (30; 60; 74).
2. A smoking machine according to claim 1 wherein the seal is made from an elastomeric material.
3. A smoking machine according to claim 1 or 2 wherein

the seal is made of synthetic or natural rubber.

4. A smoking machine according to any of the preceding claims, wherein the seal is impermeable to gas.
5. A smoking machine according to any of the preceding claims, wherein the seal can expand and/or contract.
6. A smoking machine according to claim 5 wherein the seal can adopt a first position in which a smoking article can be inserted into the seal, and a second position in which the seal grips the smoking article.
7. A smoking machine according to any of the preceding claims, wherein the seal does not require the use of release agents or lubricants between seal and smoking article.
8. A smoking machine according to any of the preceding claims, wherein the seal is part of an occluding device (72), and the occluding device comprises a rigid part to which the seal (74) is attached.
9. A smoking machine according to claim 8, wherein the rigid part is tubular and at least part of the seal (74) is located inside the rigid part.
10. A smoking machine according to claim 9 wherein at least one end of the seal (74) has a lip which wraps around an end of the rigid part.
11. A smoking machine according to any of claims 8 to 10, wherein the occluding device (72) comprises a port (76) for applying a pressure change to the seal.
12. A smoking machine according to claim 11, wherein the device (72) is arranged such that the seal can expand or contract in response to the change in pressure.
13. A smoking machine according to claim 11 or 12, wherein an air gap is provided between the rigid part and at least part of the seal, the port (74) being coupled to the air gap.
14. A smoking machine according to any of claims 11 to 13, wherein the device is coupled to a pressure, flow, or vacuum sensing device (38) to detect leaks or faults in the seal.
15. A smoking machine according to any of the preceding claims wherein the ventilation holes (40) are totally occluded or partially occluded.
16. A smoking machine according to any of the preceding claims, wherein the seal (30; 60) is part of a holder for holding the smoking article in the smoking ma-

chine.

17. A smoking machine according to claim 16 wherein the seal is part of the smoking machine holder seals.

18. A smoking machine according to claim 16 wherein the seal substitutes the smoking machine holder seals.

19. A smoking arrangement comprising:

a smoking machine;
a smoking article (28) placed in the smoking machine for smoking by the smoking machine; and
a flexible seal (82) attached to the smoking article for occluding ventilation holes (40) in a filter of the smoking article (28) while the smoking article is smoked,

characterised in that the seal is part of an occluding device (80), and the occluding device (80) comprises a rigid part to which the seal (82) is attached.

20. A smoking machine or arrangement according to any of the preceding claims, further comprising means (35) for applying a change in pressure to the seal.

21. A smoking machine or arrangement according to any of the preceding claims, further comprising a pressure, flow, or vacuum sensing device (38) to detect leaks or faults in the seal.

22. A smoking machine or arrangement according to claim 21, further comprising means (42) for storing a desired value of pressure, for comparing a sensed value of pressure with the stored value, and for providing an indication of a fault in the seal in dependence on a result of the comparison.

23. A method of automatically smoking a smoking article in a smoking machine, the smoking machine including a flexible seal (30; 60; 74), the method comprising occluding ventilation holes (40) in a filter of the smoking article (28) by means of the flexible seal (30; 60; 74), while the smoking article is being smoked.

24. A method according to claim 23, further comprising the step of applying a pressure change to the seal thereby causing the seal to expand or to contract.

25. A method according to claim 23 or 24, further comprising the step of sensing pressure, flow or vacuum applied to the seal to detect leaks or faults in the seal material.

26. A method of automatically smoking a smoking article in a smoking machine, the method comprising the steps of:

fitting an occluding device (80) to the smoking article so as to occlude ventilation holes (40) in a filter of the smoking article (28), the occluding device comprising a rigid part and a flexible seal (82); and
smoking the smoking article while the ventilation holes (40) are occluded by the occluding device (80).

Patentansprüche

1. Eine Rauchmaschine zum Rauchen eines Rauchartikels, wobei die Rauchmaschine eine flexible Dichtung (30; 60; 74) umfasst, die angeordnet ist, um mindestens einige Belüftungslöcher (40) in einem Filter des Rauchartikels (28) zu verschließen, und die Rauchmaschine ist angeordnet, um die Rauchartikel zu rauchen, während die Belüftungslöcher (40) durch die flexible Dichtung (30; 60; 74) verdeckt sind.
2. Eine Rauchmaschine gemäß Anspruch 1, in der die Dichtung aus einem elastomeren Material hergestellt ist.
3. Eine Rauchmaschine gemäß Anspruch 1 oder 2, in der die Dichtung aus einem synthetischen oder natürlichen Kautschuk hergestellt ist.
4. Eine Rauchmaschine gemäß einem der vorhergehenden Ansprüche, in der die Dichtung für Gas undurchlässig ist.
5. Eine Rauchmaschine gemäß einem der vorhergehenden Ansprüche, in der die Dichtung sich ausdehnen und/oder zusammenziehen kann.
6. Eine Rauchmaschine gemäß Anspruch 5, in der die Dichtung eine erste Position einnehmen kann, in der ein Rauchartikel in die Dichtung eingeführt werden kann, sowie eine zweite Position, in der die Dichtung den Rauchartikel erfasst.
7. Eine Rauchmaschine gemäß einem der vorhergehenden Ansprüche, in der die Dichtung die Verwendung von Trennmitteln oder Schmiermitteln zwischen Dichtung und Rauchartikel nicht benötigt.
8. Eine Rauchmaschine gemäß einem der vorhergehenden Ansprüche, in der die Dichtung ein Teil einer Verschlussvorrichtung (72) ist, wobei die Verschlussvorrichtung einen starren Teil umfasst, an dem die Dichtung (74) angebracht ist.
9. Eine Rauchmaschine gemäß Anspruch 8, in der der starre Teil rohrförmig ist und mindestens ein Teil der Dichtung (74) innerhalb des starren Teils angeordnet

net ist.

10. Eine Rauchmaschine gemäß Anspruch 9, in der mindestens ein Ende der Dichtung (74) eine Lippe aufweist, die ein Ende des starren Teils umhüllt. 5
11. Eine Rauchmaschine gemäß einem der Ansprüche 8 bis 10, in der die Verschlussvorrichtung (72) eine Öffnung (76) zum Anwenden eines Druckwechsels auf die Dichtung umfasst. 10
12. Eine Rauchmaschine gemäß Anspruch 11, in der die Vorrichtung (72) so angeordnet ist, dass die Dichtung sich ausdehnen oder zusammenziehen kann, als Antwort auf den Druckwechsel. 15
13. Eine Rauchmaschine gemäß Anspruch 11 oder 12, in der ein Luftspalt zwischen dem starren Teil und mindestens einem Teil der Dichtung bereitgestellt ist, während die Öffnung (74) mit dem Luftspalt verbunden ist. 20
14. Eine Rauchmaschine gemäß einem der Ansprüche 11 bis 13, in der die Vorrichtung mit einer Druck-, Durchfluss- oder Vakuumerfassungsvorrichtung (38) verbunden ist, um Leckagen oder Fehler in der Dichtung zu erkennen. 25
15. Eine Rauchmaschine gemäß einem der vorhergehenden Ansprüche, in der die Belüftungslöcher (40) vollständig oder teilweise verdeckt sind. 30
16. Eine Rauchmaschine gemäß einem der vorhergehenden Ansprüche, in der die Dichtung (30; 60) Teil eines Halters zum Halten des Rauchartikels in der Rauchmaschine ist. 35
17. Eine Rauchmaschine gemäß Anspruch 16, in der die Dichtung ein Teil der Halterdichtungen der Rauchmaschine ist. 40
18. Eine Rauchmaschine gemäß Anspruch 16, in der die Dichtung die Halterdichtungen der Rauchmaschine ersetzt. 45
19. Eine Rauchanordnung umfassend:
 - eine Rauchmaschine,
 - einen Rauchartikel (28), der in der Rauchmaschine zum Rauchen durch die Rauchmaschine angeordnet ist, und 50
 - eine flexible Dichtung (82), die an dem Rauchartikel zum Verschließen von Belüftungslöchern (40) in einem Filter des Rauchartikels (28) angeordnet ist, während der Rauchartikel geraucht wird, **dadurch gekennzeichnet, dass** die Dichtung Teil einer Verschlussvorrichtung (80) ist und die Verschlussvorrichtung (80) eine starren 55

Teil umfasst, an dem die Dichtung (82) befestigt ist.

20. Eine Rauchmaschine oder Anordnung gemäß einem der vorhergehenden Ansprüche, die weiterhin ein Mittel (35) zum Anwenden eines Druckwechsels auf die Dichtung umfasst.
21. Eine Rauchmaschine oder Anordnung gemäß einem der vorhergehenden Ansprüche, die weiterhin eine Druck-, Durchfluss- oder Vakuumerfassungsvorrichtung (38) aufweist, um Leckagen oder Fehler in der Dichtung zu erkennen.
22. Eine Rauchmaschine oder Anordnung gemäß Anspruch 21, die weiterhin Mittel (42) zum Speichern eines gewünschten Druckwertes, Mittel zum Vergleichen eines erfassten Druckwertes mit dem gespeicherten Wert sowie Mittel zum Bereitstellen eines Anzeigens eines Fehlers in der Dichtung in Abhängigkeit von einem Ergebnis des Vergleichs umfasst.
23. Ein Verfahren zum automatischen Rauchen eines Rauchartikels in einer Rauchmaschine, wobei die Rauchmaschine eine flexible Dichtung (30; 60; 74) umfasst, während das Verfahren das Verschließen von Belüftungslöchern (40) in einem Filter des Rauchartikels (28) mittels der flexiblen Dichtung (30; 60; 74) umfasst, während der Rauchartikel geraucht wird.
24. Ein Verfahren gemäß Anspruch 23, das weiterhin den Schritt umfasst: Anwenden eines Druckwechsels auf die Dichtung, wodurch ein Ausdehnen oder Zusammenziehen der Dichtung verursacht wird.
25. Ein Verfahren gemäß Anspruch 23 oder 24, das weiterhin den Schritt aufweist: Erfassen von Druck, Durchfluss oder einem Vakuum, das auf die Dichtung angewendet wird, um Leckagen oder Fehler in dem Dichtungsmaterial zu erkennen.
26. Ein Verfahren zum automatischen Rauchen eines Rauchartikels in einer Rauchmaschine, wobei das Verfahren die Schritte umfasst:

Anpassen einer Verschlussvorrichtung (80) an den Rauchartikel, um die Belüftungslöcher (40) in einem Filter des Rauchartikels (28) zu verschließen, wobei die Verschlussvorrichtung einen starren Teil und eine flexible Dichtung (82) umfasst, und
 Rauchen des Rauchartikels während die Belüftungslöcher (40) durch die Verschlussvorrichtung (80) verschlossen sind.

Revendications

1. Machine à fumer servant à fumer un article à fumer, la machine à fumer comportant un joint étanche souple (30 ; 60 ; 74) disposé en vue de fermer une partie au moins des trous de ventilation (40) dans un filtre de la machine à fumer (28), la machine à fumer étant agencée pour fumer l'article à fumer tandis que les trous de ventilation (40) sont obturés par le joint étanche souple (30 ; 60 ; 74).
2. Machine à fumer selon la revendication 1, dans laquelle le joint étanche est constitué d'un matériau élastomère.
3. Machine à fumer selon la revendication 1 ou 2, dans laquelle le joint étanche est constitué de caoutchouc naturel ou synthétique.
4. Machine à fumer selon l'une quelconque des revendications précédentes, dans laquelle le joint étanche est imperméable au gaz.
5. Machine à fumer selon l'une quelconque des revendications précédentes, dans laquelle le joint étanche se dilate et/ou se contracte.
6. Machine à fumer selon la revendication 5, dans laquelle le joint étanche peut adopter une première position dans laquelle un article à fumer peut être inséré dans le joint étanche, et une seconde position dans laquelle le joint étanche enserre l'article à fumer.
7. Machine à fumer selon l'une quelconque des revendications précédentes, dans laquelle le joint étanche ne requiert pas d'utilisation des agents de libération et des lubrifiants entre le joint étanche et l'article à fumer.
8. Machine à fumer selon l'une quelconque des revendications précédentes, dans laquelle le joint étanche fait partie d'un dispositif d'obturation (72), et dans laquelle le dispositif d'obturation comporte une partie rigide à laquelle le joint étanche (74) est fixé.
9. Machine à fumer selon la revendication 8, dans laquelle la partie rigide est tubulaire et dans laquelle une partie au moins du joint étanche (74) est placée à l'intérieur de la partie rigide.
10. Machine à fumer selon la revendication 9 dans laquelle au moins une extrémité du joint étanche (74) possède une lèvre qui s'enroule autour d'une extrémité de la partie rigide.
11. Machine à fumer selon l'une quelconque des revendications 8 à 10, dans laquelle le dispositif d'obtura-

tion (72) comporte un orifice (76) permettant d'appliquer un changement de pression sur le joint étanche.

12. Machine à fumer selon la revendication 11, dans laquelle le dispositif (72) est agencé de telle sorte que le joint étanche peut se dilater ou se contracter en réponse à la variation de la pression.
13. Machine à fumer selon la revendication 11 ou 12, dans laquelle un intervalle d'air est prévu entre la partie rigide et au moins une partie du joint étanche, l'orifice (76) étant couplé à l'intervalle d'air.
14. Machine à fumer selon l'une quelconque des revendications 11 à 13, dans laquelle le dispositif est couplé à un dispositif de détection de pression, de flux ou de vide (38) afin de détecter des fuites ou des défauts dans le joint étanche.
15. Machine à fumer selon l'une quelconque des revendications précédentes, dans laquelle les trous de ventilation (40) sont obturés totalement ou obturés partiellement.
16. Machine à fumer selon l'une quelconque des revendications précédentes, dans laquelle le joint étanche (30 ; 60 ;) fait partie d'un support permettant de soutenir l'article à fumer dans la machine à fumer.
17. Machine à fumer selon la revendication 16 dans laquelle le joint étanche fait partie des joints étanches du support de la machine à fumer.
18. Machine à fumer selon la revendication 16, dans laquelle le joint étanche se substitue aux joints étanches du support de la machine à fumer.
19. Dispositif à fumer comportant :
une machine à fumer ;
un article à fumer (28) placé dans la machine à fumer pour être fumé par la machine à fumer ; et
un joint étanche souple (82) fixé à l'article à fumer pour obturer des trous de ventilation (40) dans un filtre de l'article à fumer (28) alors que l'article à fumer est en train d'être fumé,
caractérisée en ce que le joint étanche fait partie d'un dispositif d'obturation (80), et **en ce que** le dispositif d'obturation (80) comprend une partie rigide à laquelle le joint étanche (82) est fixé.
20. Dispositif ou machine à fumer selon l'une quelconque des revendications précédentes, comportant, de plus, des moyens (35) permettant d'appliquer une variation de pression sur le joint.

21. Dispositif ou machine à fumer selon l'une quelconque des revendications précédentes, comprenant, de plus, un dispositif de détection de pression, de flux ou de vide (38) pour détecter des fuites ou des défauts dans le joint étanche. 5
22. Dispositif ou machine à fumer selon la revendication 21, comprenant, de plus, des moyens (42) permettant d'enregistrer une valeur de pression souhaitée, en vue de comparer une valeur détectée de pression avec la valeur enregistrée et de fournir une indication de défaut dans le joint étanche en fonction du résultat de la comparaison. 10
23. Procédé consistant à fumer de façon automatique un article à fumer dans une machine à fumer, la machine à fumer comportant un joint étanche souple (30 ; 60 ; 74), le procédé consistant à obturer des trous de ventilation (40) dans un filtre de l'article à fumer (28) au moyen du joint étanche souple (30 ; 60 ; 74), alors que l'article à fumer est en train d'être fumé. 15 20
24. Procédé selon la revendication 23 comprenant, de plus, l'étape consistant à appliquer une variation de pression sur le joint étanche de façon à entraîner le joint étanche à se dilater ou à se contracter. 25
25. Procédé selon la revendication 23 ou 24 comprenant, de plus, l'étape consistant à détecter une pression, un flux ou un vide appliqué sur le joint étanche en vue de détecter des fuites ou des défauts dans le matériau d'étanchéité. 30
26. Procédé consistant à fumer de façon automatique un article à fumer dans une machine à fumer, le procédé comprenant les étapes consistant à : 35
- ajuster un dispositif d'obturation (80) sur l'article à fumer de façon à obturer des trous de ventilation (40) dans un filtre de l'article à fumer (28), le dispositif d'obturation comportant une partie rigide et un joint étanche souple (82) ; et 40
- fumer l'article à fumer alors que les trous de ventilation (40) sont obturés par le dispositif d'obturation (80). 45

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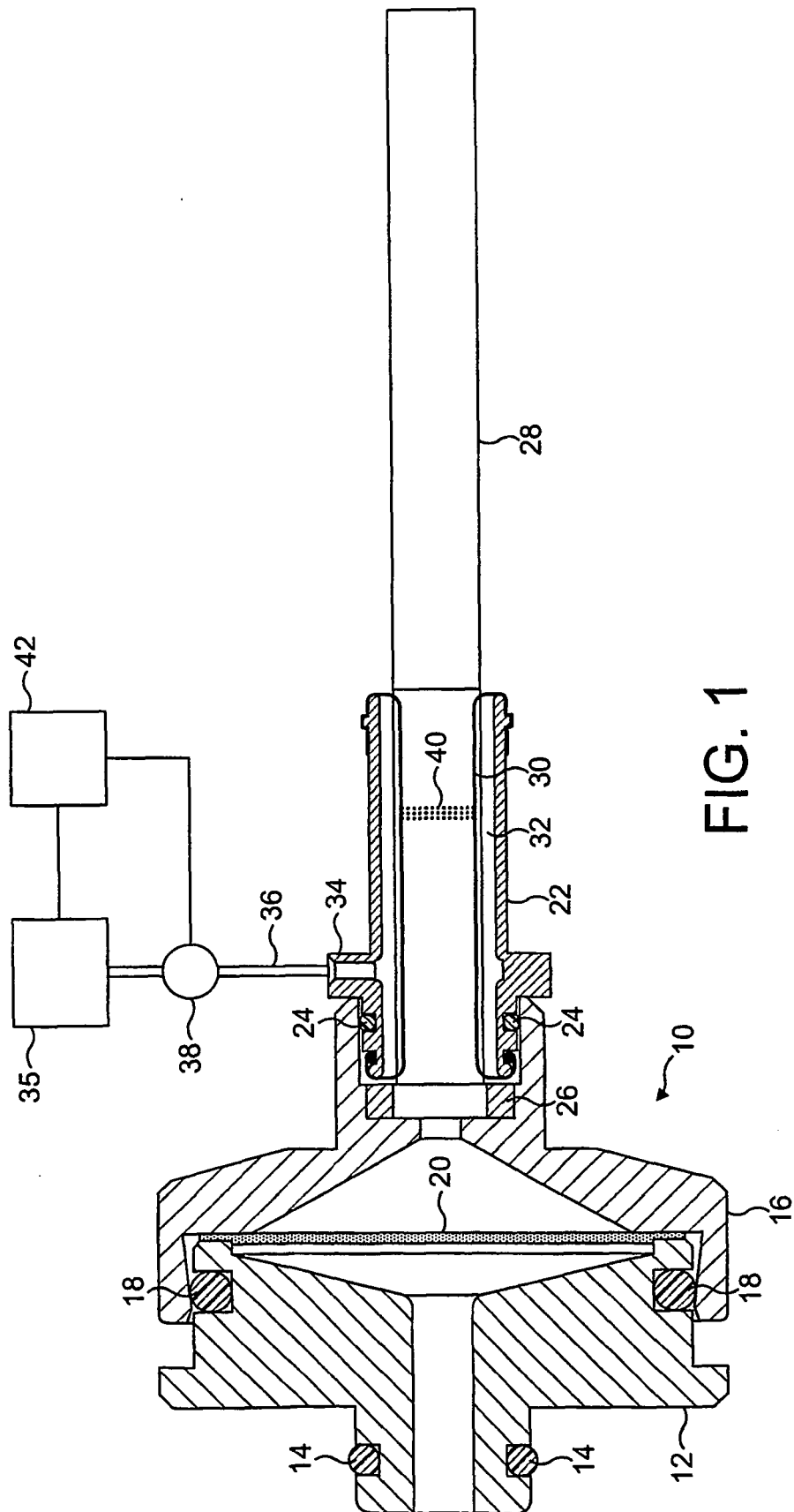


FIG. 1

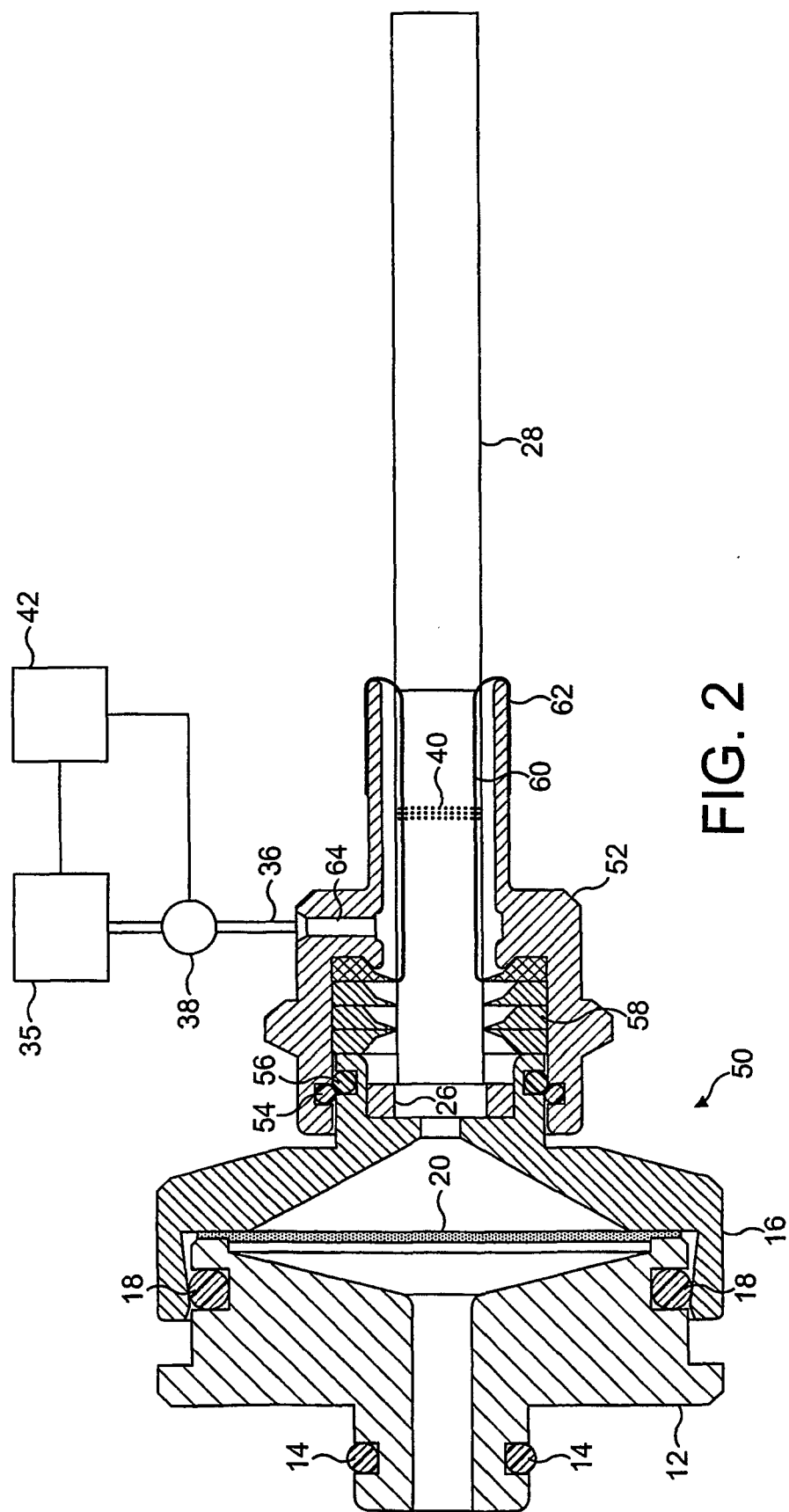


FIG. 2

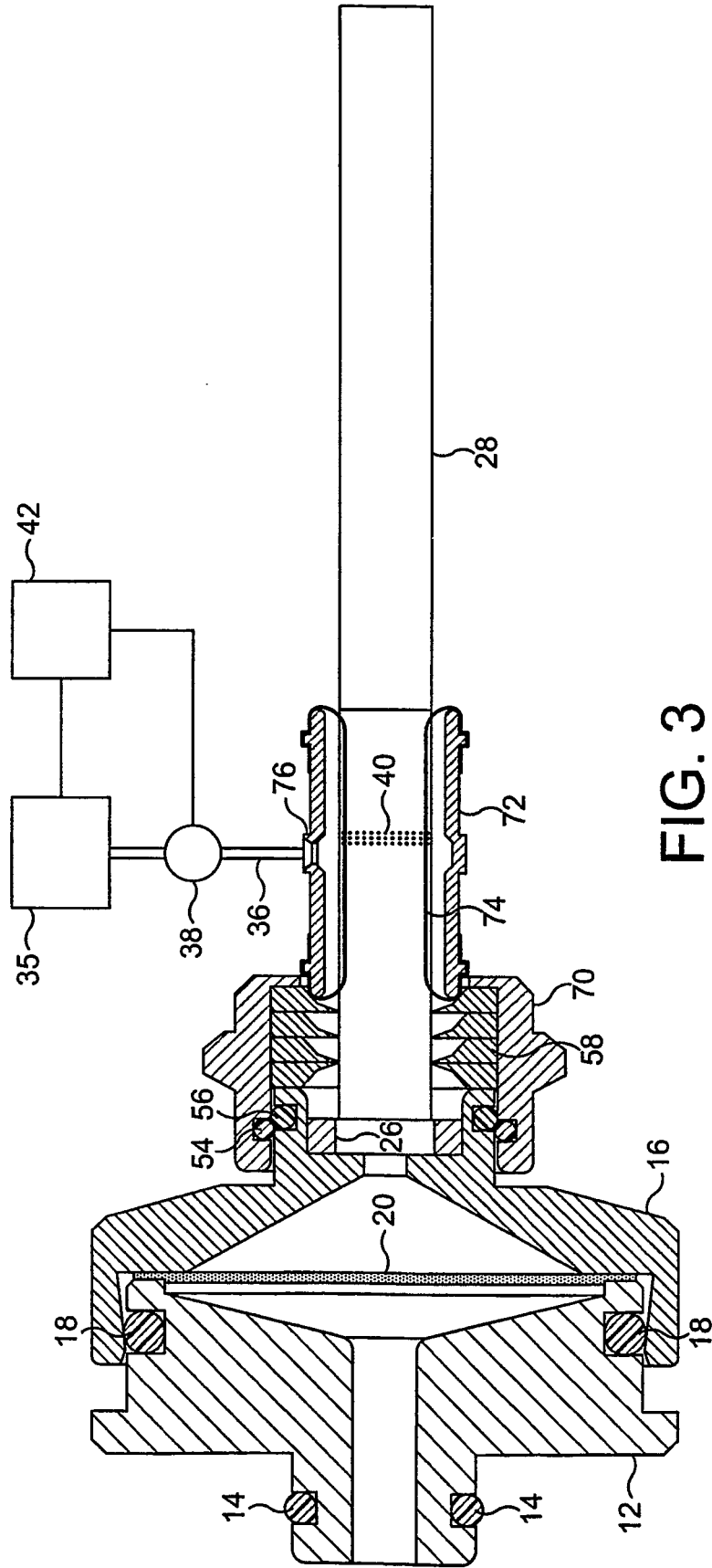
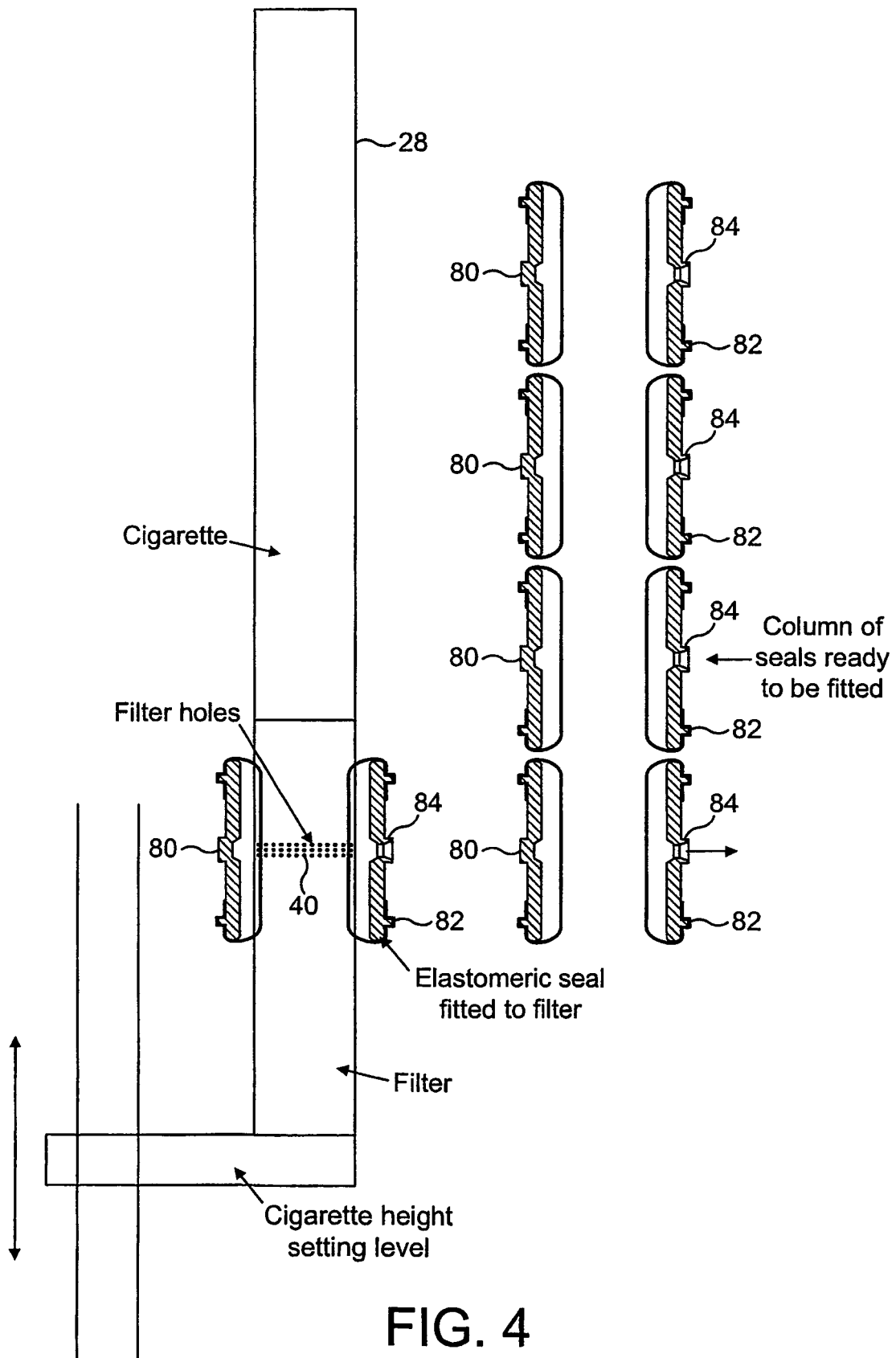


FIG. 3



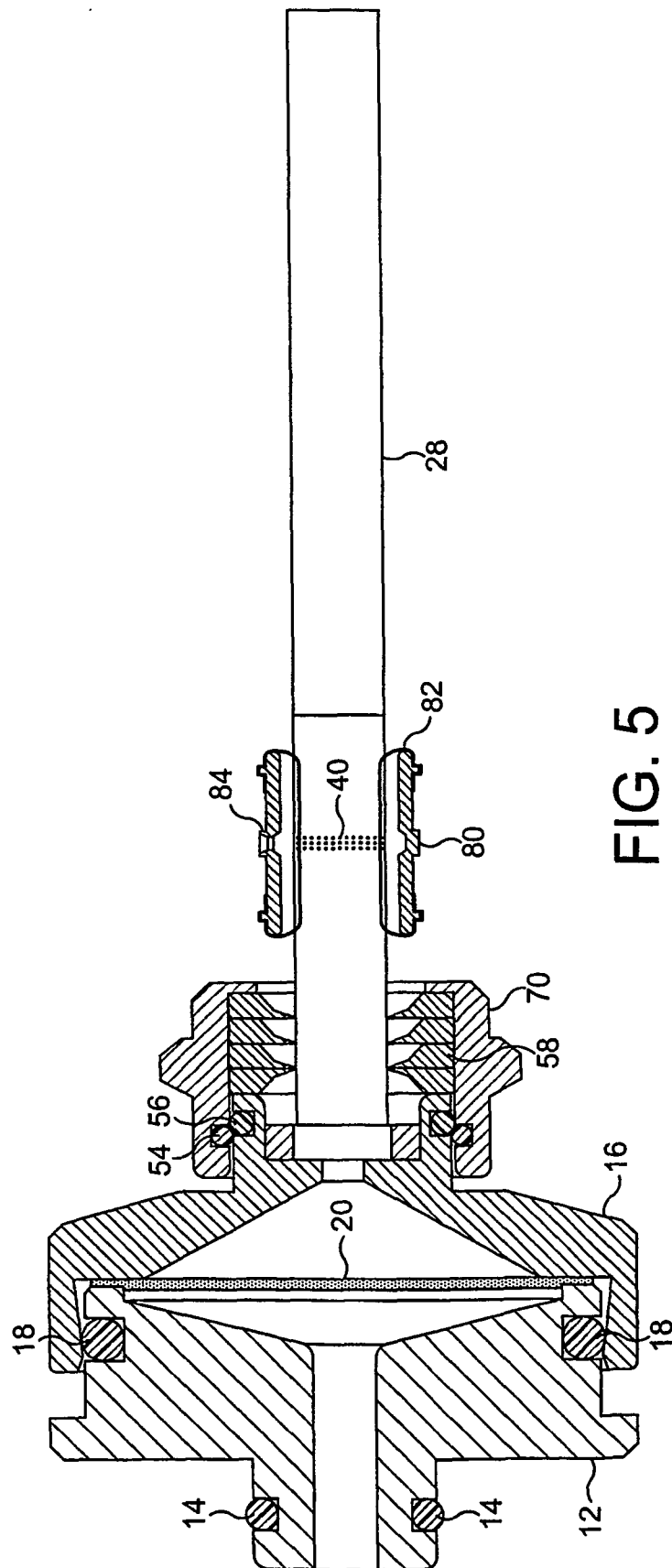


FIG. 5

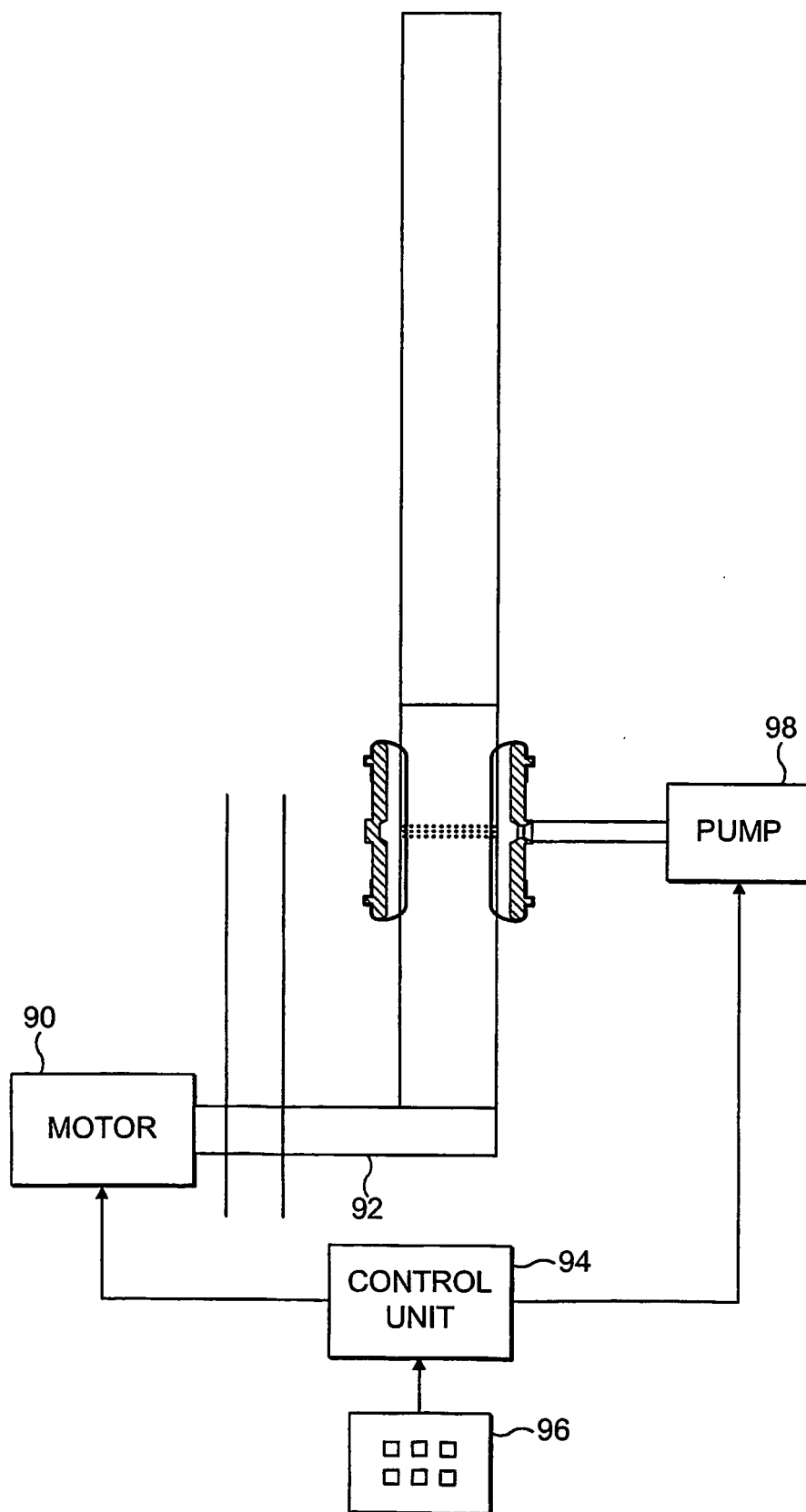


FIG. 6

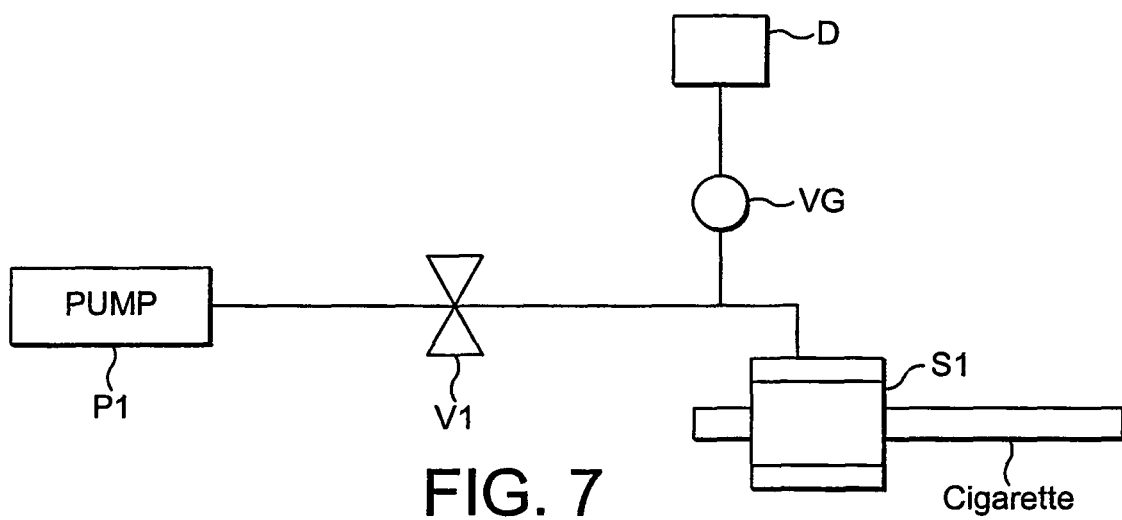


FIG. 7