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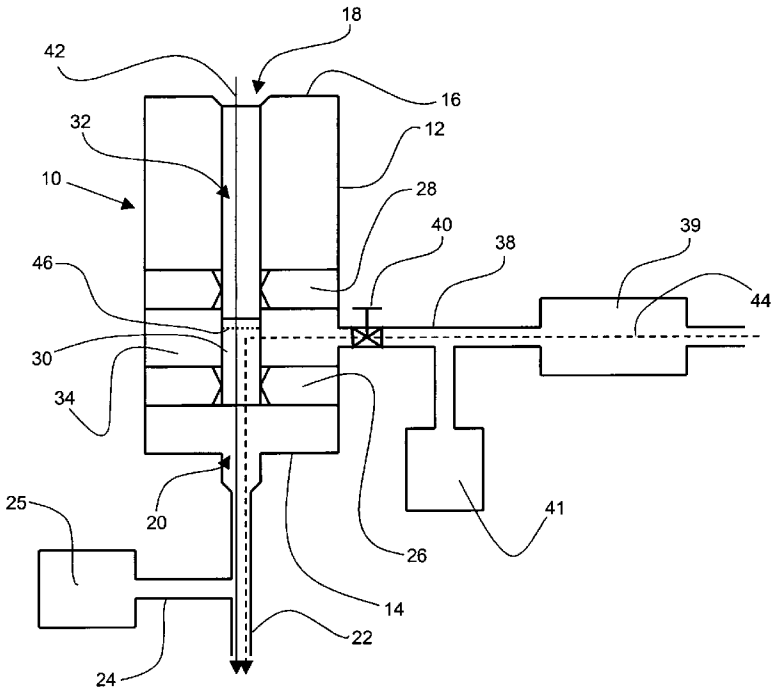


Figure 1

(57) Abstract: The invention relates to a device for measuring the resistance-to-draw of a smoking article having a rod end and a mouth end, the device comprising a chamber having an opening for receiving a smoking article, the opening being selectively closable to prevent air flow through the rod end of the smoking article, a first sleeve and a second sleeve for holding the smoking article and defining a space between the first sleeve and the second sleeve, a first aperture in a wall of the chamber for introduction of air into the space, a second aperture for extraction of air passed through the mouth end of the smoking article for determination of resistance-to-draw, and a block including the opening for receiving a smoking article, and arranged above the space between the first sleeve and the second sleeve, the block comprising a first passageway aligned with the opening for receiving a smoking article, and a second passageway, transverse to the first passageway and intersecting the first passageway, the second passageway housing a closure member selectively movable between an open position, and a closed position in which it closes the first passageway. This enables resistance-to-draw of a smoking article to be measured without flow of air along the entire length of the smoking article.

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RESISTANCE-TO-DRAW MEASURING DEVICE

This invention relates to devices for measuring parameters of smoking articles such as cigarettes, and in particular to measuring the resistance-to-draw of cigarettes.

Devices for measuring parameters of smoking articles such as cigarettes are well known in the art. Devices for measuring resistance-to-draw are provided by Cerulean, a division of Molins PLC of the United Kingdom and Heinrich Borgwaldt GmbH of Hamburg, Germany. Examples of known devices for measuring resistance-to-draw are disclosed in WO-A-96/04808 and DE-A-4112878.

Known resistance-to-draw measuring devices draw a constant air flow longitudinally from a rod end of a smoking article, through the tobacco rod, through the filter if present and out through the mouth end of the smoking article. Such conventional devices are not suitable for measuring the resistance-to-draw of smoking articles in which the air flow is not drawn from the rod end to the mouth end of the smoking article. An example of such a smoking article is an electrically heated smoking article as disclosed, for example, in EP-A-0822760 and EP-A-0615411.

An electrically heated smoking article is used with an electrical heating device. In use, the electrically heated smoking article is inserted partially inside the electrical heating device such that the rod end of the electrically heated smoking article is surrounded by the heating device. Inside the heating device, the electrically heated smoking article is heated by a set of electrical heating elements to evolve tobacco flavours from the electrically heated smoking article. The air flow in the electrically heated smoking article is such that air enters through the side of the electrically heated smoking article, for example, through perforations in the wrapper thereof. The air flow is drawn through the mouth end of the electrically heated smoking article that remains outside of the electrical heating device.

The present invention provides a device which is suitable for measuring resistance-to-draw of smoking articles in which the air flow is not drawn from the rod end to the mouth end of the smoking article and in particular for measuring resistance-to-draw of electrically heated smoking articles.

According to the invention there is provided a device for measuring the resistance-to-draw of a smoking article having a rod end and a mouth end, the device comprising a chamber having an opening for receiving a smoking article, the opening being selectively closable to prevent air flow through the rod end of the smoking article, a first sleeve and a second sleeve for holding the smoking article and defining a space between the first sleeve and the second sleeve. The chamber further comprises a first aperture in a wall of the chamber for introduction of air into the space, and a second aperture for extraction of air passed through the mouth end of the smoking article for the determination of resistance-to-draw. The chamber further

comprises a block including the opening for receiving a smoking article, and arranged above the space between the first sleeve and the second sleeve, the block comprising a first passageway aligned with the opening for receiving a smoking article, and a second passageway, transverse to the first passageway and intersecting the first passageway, the second passageway housing a closure member selectively movable between an open position, and a closed position in which it closes the first passageway.

The term "resistance-to-draw" is used throughout the specification to denote the difference in static pressure of a smoking article when a steady flow of air at 17.5 millilitres per second (ml/s) passes through the smoking article according to ISO9512. The resistance-to-draw is expressed in "mm water gauge" or "mmWG".

The term "ventilation" is used throughout the specification to denote the drawing of atmospheric air into the smoking article other than through its rod end. This results in the dilution of the air flow passing from the rod end to the mouth end of the smoking article. The ventilation is expressed in percent of the air flow passing from end to end of the smoking article. In an unventilated smoking article, the ventilation is essentially zero percent. In an electrically heated smoking article, the ventilation is essentially one hundred percent as basically no air flow from end to end of the smoking article is present.

The device according to the invention has the advantage that it may be used to measure resistance-to-draw with the opening closed so that there is no air flow from end to end of the smoking article. That is, it enables resistance-to-draw of a smoking article to be measured without flow of air along the entire length of the smoking article. Instead, air is drawn through ventilation perforations that are housed in the space between the first and second sleeves. This makes a device according to the invention suitable for use with electrically heated smoking articles or other smoking articles in which air is not drawn through the rod end of the smoking article.

The opening is selectively closable and the device may be operated with the opening open making it suitable for measuring resistance-to-draw of conventional smoking articles.

Preferably, the closure member is a piston head.

Preferably, the piston head has a frustoconical shape to facilitate closure of the passageway.

Preferably, the first passageway has a funnel portion at the opening for ease of insertion of smoking articles into the chamber.

Preferably, the block or the piston head or both the block and the piston head are made from a polymer, preferably from a polymer with good machinability and at the same time low frictional properties, without showing abrasion, and a high pressure tightness. An exemplary polymer is polyoxymethylen (POM). Where both the block and the piston head are made from

polyoxymethylen the pressure tightness between the meeting surfaces of the block and the piston head is particularly good.

Preferably, at least one of the first and second sleeves of the device according to the invention is movable inside the chamber along the smoking article in order to change the size of the space between the sleeves. Thus, to encompass ventilation holes in the smoking article, the outer surface area of the smoking article that contributes to the ventilation of the smoking article during measurement of resistance-to-draw may be advantageously adjusted.

Embodiments of the invention will now be described, by way of example only, and with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of a known resistance-to-draw measuring device including a conventional smoking article;

Figure 2 is a schematic view of an embodiment of a device according to the invention including an electrically heated smoking article;

Figure 1 shows a conventional device for measuring resistance-to-draw of a smoking article 32. A chamber 10 is provided which has a cylindrical side wall 12, a bottom wall 14 and a top wall 16. The top wall includes a circular aperture 18 at its centre through which a smoking article 32 may be inserted. The bottom wall 14 includes an aperture 20 that leads to a first duct 22.

The first duct 22 is connected to a second duct 24 that leads to a pressure sensor 25, which measures the pressure drop across the first duct 22.

Within the chamber 10 are a first lower sleeve 26 and a second upper sleeve 28. The first sleeve 26 and the second sleeve 28 may be moved between an open position and a closed position. In the open position, the smoking article 32 may be introduced through the top openings in the sleeves 26, 28. In the closed position, the sleeves 26, 28 fix the smoking article 32 in position within the chamber 10 forming an air-tight seal. The first lower sleeve 26 and the second upper sleeve 28 are made from latex. The sleeves 26, 28 are arranged so that the first lower sleeve 28 holds the mouth end of the filter 30 of the smoking article 32 and the second upper sleeve holds the tobacco rod of the smoking article 32 at a point adjacent to the filter 30.

The two sleeves 26, 28 define a space 34 between them. This space 34 is connected to a duct 38. The duct 38 has a valve 40 enabling the air flow to the space 34 to be controlled. A pneumatic resistor 39 is arranged in the duct 38 to create a pressure of 1 mmWG in the duct 38. This pressure in the duct 38 is measured by a pressure sensor 41.

In use, the resistance-to-draw of a smoking article 32 is measured as follows. The smoking article 32 is inserted into the chamber 10 as shown in Figure 1. The first sleeve 26 and the second sleeve 28 close around the smoking article 32. The valve 40 is closed to shut off the air flow into the space 34. Air is drawn through the smoking article 32, at a constant flow rate of 17.5 ml/s through the aperture 20 and through the first duct 22. This air flow is shown by

the solid arrow 42 in Figure 1. The pressure drop measured by the pressure sensor 25 corresponds to the resistance-to-draw of the unventilated smoking article 32.

In use, the ventilation of a smoking article 32 is measured as follows. The smoking article 32 is inserted into the chamber 10 as shown in Figure 1. The first sleeve 26 and the second sleeve 28 close around the smoking article 32. Valve 40 is opened and air is drawn into the space 34, through the ventilation holes 46 of the filter 30 into the smoking article 32 and into the first duct 22 as shown by the dashed arrow 44 in Figure 1. In the smoking article 32, this additional air flow 44 is joined by the air flow 42. Due to the additional air flow 44, the pressure drops at sensor 25 resulting in a reduced resistance-to-draw of the ventilated smoking article 32. From the difference between the resistance-to-draw with ventilation and the resistance-to-draw without ventilation, the percentage of the ventilation may be calculated.

Figure 2 shows an embodiment of a device according to the invention, which modifies the prior art device of Figure 1 to enable the measurement of the resistance-to-draw of a smoking article 132 where the air does not enter through the rod end of the smoking article 132, such as an electrically heated smoking article.

The majority of the components of the resistance-to-draw measuring device of Figure 2 are the same as those previously described with respect to Figure 1 and are shown using the same references numeral prefixed by 100. Thus, the chamber side wall, bottom wall, apertures and ducts are unchanged.

The electrically heated smoking article 132 shown in Figure 2 includes one or two rows of perforations 146 to allow air to enter into the electrically heated smoking article 132. These perforations 146 are spaced further towards the rod end of the electrically heated smoking article 132 than the perforations of a conventional smoking article. To encompass the perforations 146 within the space 134, the second upper sleeve 128 is movable into an upper position shown in Figure 2 such that the second upper sleeve 128 is above the perforations 146 when the electrically heated smoking article 132 is in position within the chamber 110. Thus, the space 134 between the first lower sleeve 126 and the second upper sleeve 128 is increased.

A block 150 is arranged above the top opening of the chamber 110. The block 150 comprises a vertical passage way 154 through which the smoking article 132 may be inserted into the chamber 110. The vertical passageway 154 is intersected by a horizontal passageway 158. The intersection of the vertical passageway 154 and the horizontal passageway may be blocked and sealed by a piston head 166. The piston head 166 is movable along the horizontal passageway 158 by means of a piston 172, which is pneumatically driven by a cylinder 174. As shown in Figure 2, the piston head 166 has a frustoconical shape. The frustoconical shape of the piston head 166 enhances the sealing of the intersection of the two passageways 154, 158.

The block 150 and the piston head 166 are made of any suitable material such as, for example, a polymer, for example polyoxymethylen.

The top wall 116 of the block 150 has a tapered opening 118 that defines a tunnel to assist in introducing the electrically heated smoking article 132 into the device.

Air flow through the rod end of the electrically heated smoking article 132 may be blocked by piston 170 such that no air flow equivalent to the arrow 42 in Figure 1 passes through the electrically heated smoking article 132.

In use, an electrically heated smoking article 132 is introduced into the chamber 110 through the tapered opening 118 in the block 150. The cylinder 174 then moves the piston head 166 to block the vertical passageway 154 as the sleeves 126, 128 fix the electrically heated smoking article 132 in position within the chamber 110. Valve 140 is opened and air is drawn through the electrically heated smoking article 132, at a constant flow rate of 17.5 ml/s along the path shown by the dashed arrow 144 in Figure 2. The air flow 144 passes through duct 138, into space 134, into the electrically heated smoking article 132 through the perforations 146, through the electrically heated smoking article 132 and out through ducts 122 and 124 for determination of resistance-to-draw by the pressure sensor 125.

The device illustrated in Figure 2 may be used to measure resistance-to-draw of smoking articles other than electrically heated smoking articles that require a blocked end. It may also be used to measure resistance-to-draw of conventional smoking articles by leaving the vertical passageway open. In which case, the resistance-to-draw and the ventilation may be measured in the same manner as previously described with respect to Figure 1.

CLAIMS:

1. A device for measuring the resistance-to-draw of a smoking article having a rod end and a mouth end, the device comprising a chamber having:

an opening for receiving a smoking article, the opening being selectively closable to prevent air flow through the rod end of the smoking article;

a first sleeve and a second sleeve for holding the smoking article and defining a space between the first sleeve and the second sleeve;

a first aperture in a wall of the chamber for introduction of air into the space;

a second aperture for extraction of air passed through the mouth end of the smoking article for determination of resistance-to-draw; and

a block including the opening for receiving a smoking article, and arranged above the space between the first sleeve and the second sleeve, the block comprising a first passageway aligned with the opening for receiving a smoking article, and a second passageway, transverse to the first passageway and intersecting the first passageway, the second passageway housing a closure member selectively movable between an open position, and a closed position in which it closes the first passageway.

2. A device according to claim 1, wherein the closure member comprises a piston head.

3. A device according to claim 2, wherein the piston head has a frustoconical shape.

4. A device according to any of the preceding claims, wherein a mouth of the first passageway is funnel-shaped.

5. A device according to any of the preceding claims, characterised in that at least one of the first and second sleeves are movable along the smoking article in order to change the size of the space between the sleeves.

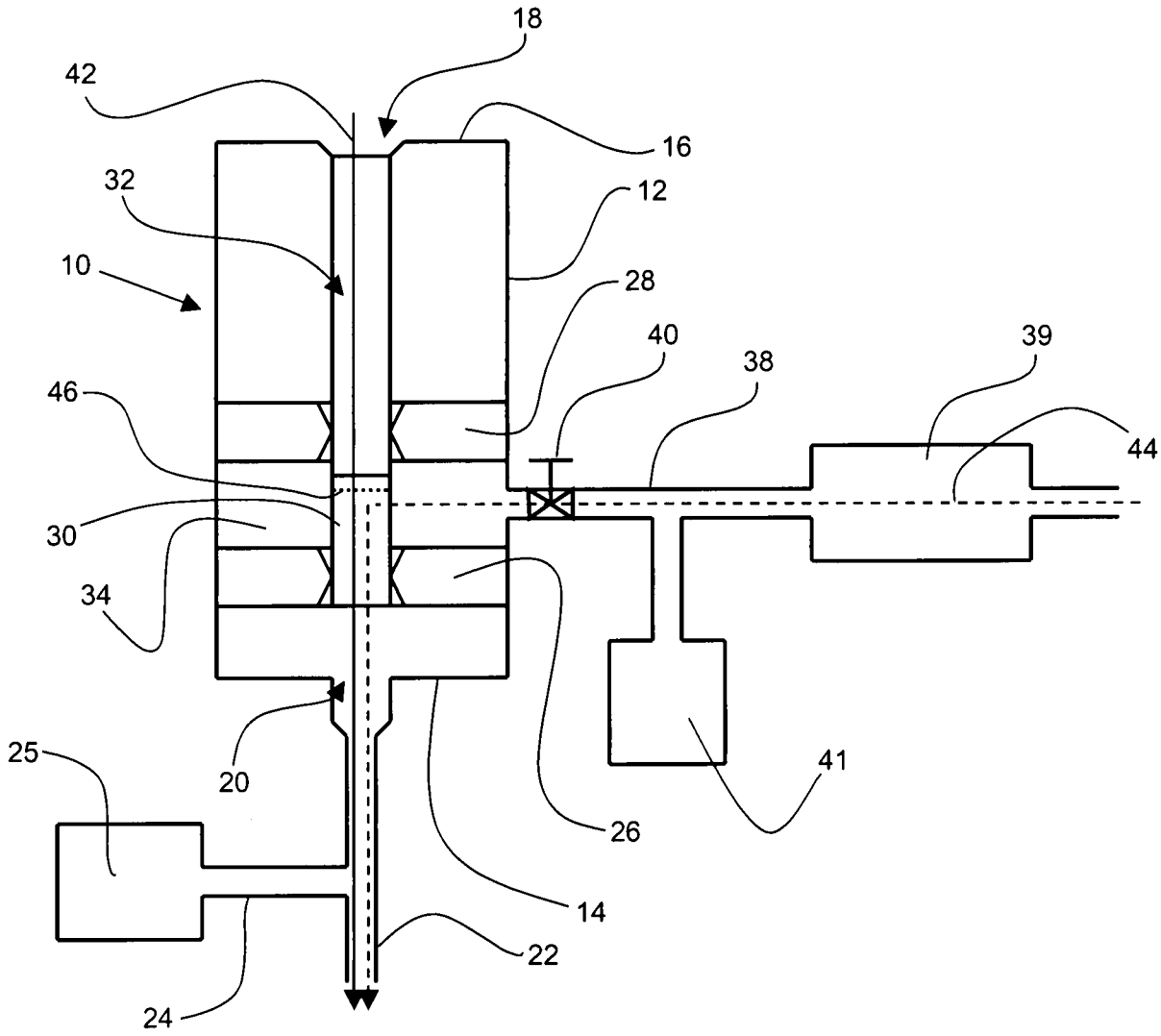


Figure 1

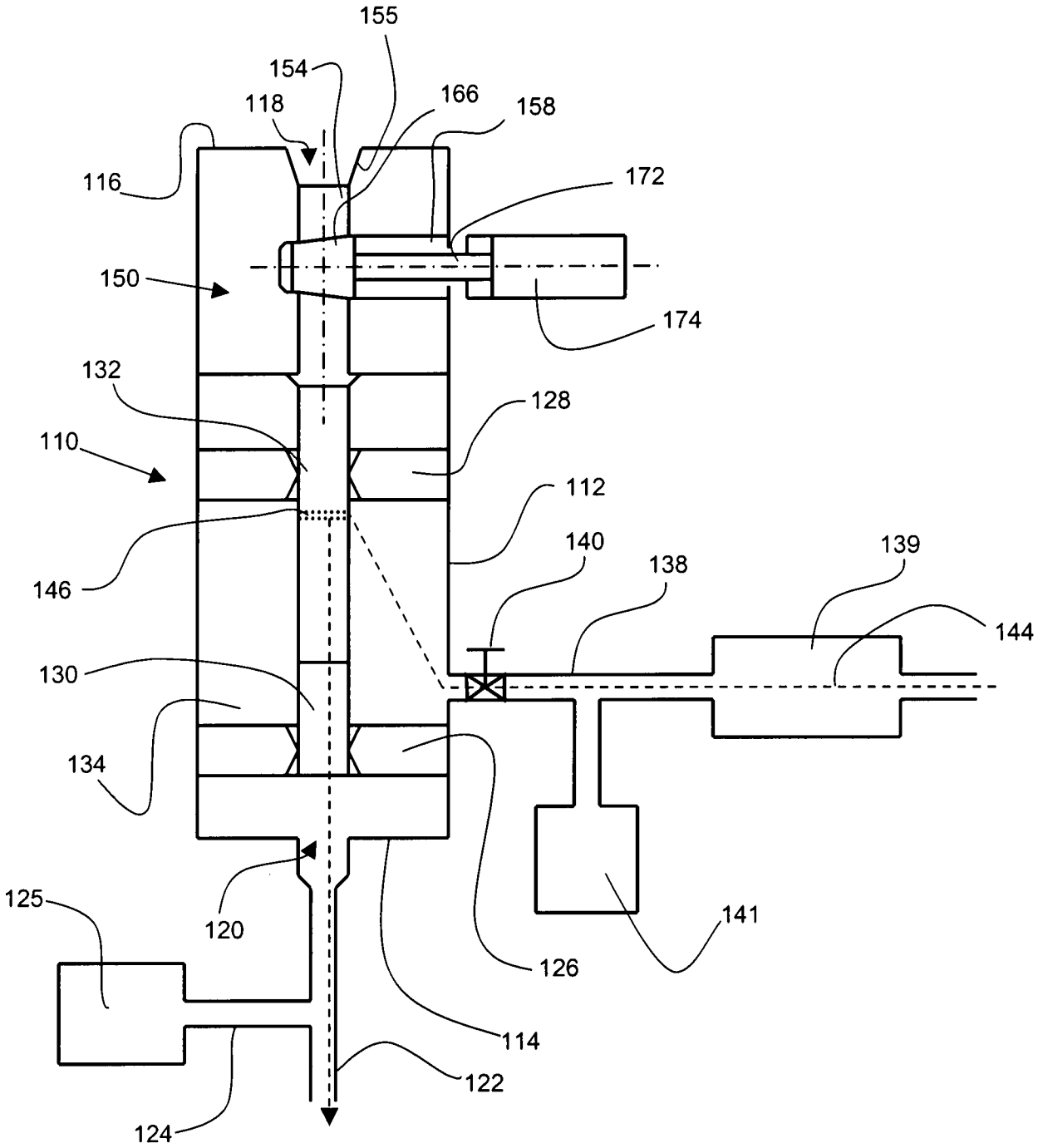

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Figure 2