

SPECIFICATION

Writing instrument

This invention relates to a writing instrument.

It has been proposed to provide a writing instrument which has a tubular member or pen element holding in its front end a writing point and having an internal bore the rear end of which is connected or connectable with a writing liquid reservoir and which communicates with the rear end of the writing point or into which the rear portion of the writing point extends, whilst near the front end the bore is connected with an internal compensation chamber which at the rear end is connected to an external compensation chamber connected at the front end with the ambient air, an axially disposed groove being provided in the internal bore.

In this writing instrument which may be in the form of a tube-point pen or felt-tip pen, in other words a pen which has either a writing tube or a suitable felt insert as the writing point, there is provided in the internal bore a kind of drop weight which is movable axially to a limited extent and can rotate about its longitudinal axis. As a result there is formed in the internal bore between its external wall and the drop weight an annular space, and at the rear end of the internal bore there is a reduction in the cross-section thereof and also in the cross-section of the drop weight correspondingly. The annular space thus formed presents considerable resistance to the entry of an air bubble from the internal compensation chamber because of its capillary dimensions. In addition, an air bubble entering the internal bore can also stick in the annular space, more particularly in the region with reduced cross-section. Thus pressure compensation can be made considerably more difficult, and the supply of writing liquid from the writing liquid reservoir to the writing point may become blocked. In order to eliminate these difficulties, in the previously proposed writing instrument, there is provided in the drop weight an axially disposed groove which is open towards the annular chamber and which is intended to ensure the supplying of writing liquid to the writing tip. However, this groove does not facilitate the entry of an air bubble to the internal compensation chamber and its passage along the chamber since, owing to the rotatability of the drop weight about its longitudinal axis, it is not in a defined position and therefore is often remote from the connecting bore of the internal compensation chamber and internal bore.

It is an object of the invention to improve a writing instrument by facilitating the passage of an air bubble, which enters the internal bore for pressure compensation through the internal bore and into the writing liquid supply compartment, with reduced hindrance and

substantially without risk of sticking in one position.

According to the present invention there is provided a writing instrument, wherein a tubular member holding a writing point is formed with an internal bore which at its rear end (remote from the intended point of application of the writing point) is in communication with a reservoir for writing liquid and which at its front end (near the intended point of application of the writing point) is in communication with a compensation chamber comprising an internal compensation chamber extending to the rear of the tubular member where it is connected to an external compensation chamber which extends to the front and which, at its front end, is in communication with the ambient atmosphere, and wherein a groove is formed in the internal bore and extends from its communication with the compensation chamber rearwardly throughout the remaining length of the internal bore which extends without any reduction in cross-section throughout said length.

Thus, in the present writing instrument the groove formed in the outer wall of the internal bore directly connects the internal compensation chamber with the writing liquid reservoir i.e., an air bubble getting into the internal bore from the internal compensation chamber moves without hindrance from capillary forces and the like along the groove into the writing liquid reservoir, for which purpose the groove of course is given a non-capillary cross-section, and the air bubble can also pass without difficulty and without risk of sticking from the region of the internal bore into the writing liquid reservoir since the cross-section of the internal bore does not reduce, in other words there is no obstacle to the movement of the air bubble.

In order to avoid having to deflect the air bubble at the transition from the internal compensation chamber into the groove, which could impede the further movement of the air bubble, the forward end to the groove preferably ends in the internal compensation chamber.

The groove preferably has a square or rectangular cross-section.

If the internal compensation chamber extends in known manner in a zig-zag or meandering fashion from front to rear, the substantially radially disposed external surfaces of the walls of the groove can in each case limit pairs of circumferentially disposed flow paths of the internal compensation chamber. In a similar manner, the external compensation chamber can extend in a zig-zag or meandering position from rear to front externally of and coaxial with the internal compensation chamber.

In order to enable the invention to be more readily understood, reference will now be made to the accompanying drawings, which

illustrate diagrammatically and by way of example an embodiment thereof, and in which:—

Figure 1 shows, partly in section, partly in elevation and partly in fragmentary fashion, a writing instrument in the form of a felt-tip pen.

Figure 2 is a section taken along the line II-II in Fig. 1, and

Figure 3 is a section along the line III-III in Fig. 1.

Referring now to the drawings, there is shown a writing instrument in the form of a so-called felt-tip pen, in other words a writing instrument in which the writing point 1' is part of a felt-like insert 1 to which writing liquid, generally ink, is supplied. This insert 1 has a circular cross-section and is situated in the internal bore of a tubular member or pen element 2, being in contact over almost its entire circumference with the wall of the internal bore. Near the rear end of the pen element 2 there is formed an outwardly directed annular shoulder 3, and, as Fig. 1 shows, the insert 1 extends rearwardly beyond this annular shoulder. The wall of the pen element 2 is so constructed that, as shown at the left hand side in Fig. 1, a groove 5 is provided which is of substantially rectangular cross-section and is open towards the internal bore of the element 2. The groove is bounded by two wall portions extending parallel to a diametral plane of the internal bore and a circumferential wall portion of the pen element 2, and the external surface 8 of the circumferentially disposed wall portion is in contact with the internal surface of an intermediate element 10 which will be described later. Circumferentially extending ribs are formed on the external surface of the pen element 2 and form a labyrinthin or meandering compensation chamber 4. Each two adjacent circumferentially disposed flow paths of this compensation chamber 4 end at the external surface 6 or 7 respectively of the walls enclosing the groove 5. A study of Fig. 3 for example will show that because of this arrangement of the flow paths, the writing liquid can pass from the rear on to the annular rib which partly surrounds the pen element 2. This annular rib begins at the external surface 7 and ends shortly before the external surface 6, so that an aperture 9 is formed between the external surface 6 and the end of the annular rib. Through this aperture 9 the ink flows forwardly and on to the next annular rib which is connected to the external surface 6 and which, as indicated in broken lines, ends a short distance in front of the external surface 7, so that the ink in this region can again flow forwardly on to the next annular rib, which is constructed in the same manner as the first-described rib.

The pen element 2 containing the insert 1 is fitted from the rear into the intermediate

element 10, so that the forward end of the intermediate element 10 abuts in sealing-tight manner on the pen element 2, and the internal surface of the intermediate element 10 is in sealing-tight contact with the external surface 8 and the annular ribs forming the ducts of the internal compensation chamber 4. As shown in Fig. 1, the groove 5 ends at its forward end in the space formed between the front end of the intermediate element 10 and the external surface of the pen element 2, and it extends rearwards right through the annular shoulder 3.

Annular ribs are formed on the external surface of the intermediate element 10 and also form a labyrinthin or meandering external compensation chamber 11, the transition from one annular rib to the next occurring in a manner similarly to that described in connection with the annular ribs of the internal compensation chamber 4 and by way of the intervening spaces 12 shown in Figs. 2 and 3. A sleeve element 14 is mounted in sealing-tight manner on the annular ribs of the intermediate element 10, so that between the front end of this sleeve element and the external surface of the intermediate element 10 there is provided an annular space 13 which connects the front end of the external compensation chamber 11 with the ambient air.

The annular shoulder 3 is fitted in sealing-tight manner on the rear end of the sleeve element 14, and there is inserted from the rear into the sleeve element 14 a writing liquid reservoir 15 which is formed with an ink supply compartment 16. From the ink supply compartment 16 the rear end of the insert 1 is impregnated with ink, and ink also flows forwardly through the groove 5, which has a non-capillary cross-section, so that the insert 1 is wetted with ink over the greater proportion of its axial length, in other words the supply of ink to the writing tip 1' is guaranteed.

When a positive pressure occurs, for example owing to expansion of air in the ink supply compartment 16 due to a temperature increase, ink is forced out from the front end of the groove 5 into the front end of the internal compensation chamber 4, and can rise rearwardly therein, so that as a result a pressure equalisation is brought about. When the internal compensation chamber 4 is filled as far as its rear end, ink passes out of it radially outwardly and into the external compensation chamber 11, in which the ink then flows forwardly.

If during use it is necessary to compensate for a negative pressure resulting from ink consumption in the ink supply compartment, or resulting from cooling, air enters the external compensation chamber 11 through the annular space 13, and air migrates through this compensation chamber rearwardly and

then through the internal compensation chamber 4 forwardly, until it reaches the front end of the groove 5, through which it can rise forwardly as a bubble without further hindrance, and at the rear end of the groove 5, in other words at the rear surface of the annular shoulder 3, it enters the ink supply compartment 16.

- 10 It should be pointed out that the writing instrument may of course also be in the form of a tube-point writing instrument, in which case the writing point comprises a conventional writing member which supports a tube writing point and in the interior of which there
- 15 is provided a drop weight which has a cleaning wire and is movable to and fro axially to a limited extent, which a capillary annular space is formed in conventional manner between the external surface of the writing
- 20 member and the internal surface of the wall of the pen element.

CLAIMS

1. A writing instrument, wherein a tubular
- 25 member holding a writing point is formed with an internal bore which at its rear end (remote from the intended point of application of the writing point) is in communication with a reservoir for writing liquid and which at its
- 30 front end (near the intended point of application of the writing point) is in communication with a compensation chamber comprising an internal compensation chamber extending to the rear of the tubular member where it is
- 35 connected to an external compensation chamber, which extends to the front and which, at its front end, is in communication with the ambient atmosphere, and wherein a groove is formed in the internal bore and extends from
- 40 its communication with the compensation chamber rearwardly throughout the remaining length of the internal bore which extends without any reduction in cross-section throughout said length.

- 45 2. A writing instrument as claimed in claim 1, wherein the front end of the groove ends in the internal compensation chamber (4).

3. A writing instrument as claimed in
- 50 claim 1 or 2, wherein the groove has a square or rectangular cross-section.

4. A writing instrument as claimed in any one of claims 1 to 3, wherein the internal compensation chamber extends in a zig-zag or
- 55 meandering fashion from front to rear, and wherein the external surfaces of the walls of the groove limit in each case pairs of circumferentially disposed flow paths of the internal compensation chamber.

- 60 5. A writing instrument as claimed in claim 4, wherein the external compensation chamber extends in a zig-zag or meandering fashion from rear to front externally of and coaxially with the internal compensation
- 65 chamber.

6. A writing instrument as claimed in any one of claims 1 to 5, wherein the writing point is a felt-tip writing point.

7. A writing instrument as claimed in any
- 70 one of claims 1 to 5, wherein the writing point is a tube point writing point.

8. A writing instrument substantially as hereinbefore described with reference to the accompanying drawings.

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