CLAIMS

1. A pressure regulating device (30) for a writing tool, the pressure regulating device (30) slidably mounted in a pen tube (10) of the writing tool for dividing an interior space of the pen tube (10) into an internal chamber (12) and an external communication chamber (11), an air pressure of the internal chamber (12) being not smaller than that of the external communication chamber (11), the pressure regulating device (30) comprising:

a tubular member (31, 31C) provided with an outer periphery abutting on an inner sidewall of the pen tube (10); and

a deformable member (32, 32A, 32B, 32C) disposed in the tubular member (31, 31C);

wherein when a pressure difference between the internal chamber (12) and the external communication chamber (11) is larger than a first predetermined value, the deformable member (32, 32A, 32B, 32C) deforms toward the external communication chamber (11); and

when the pressure difference between the internal chamber (12) and the external communication chamber (11) is larger than a second predetermined value, the pressure regulating device (30) slides toward the external communication chamber (11) relative to the pen tube (10);

wherein the second predetermined value is larger than the first predetermined value.

2. The pressure regulating device (30) for the writing tool as claimed in claim 1, wherein

when the pressure difference between the internal chamber (12) and the external communication chamber (11) is smaller than the first predetermined value, the deformable member (32, 32A) protrudes toward the internal chamber (12); and

when the pressure difference between the internal chamber (12) and the external communication chamber (11) is larger than the first predetermined value, the deformable member (32, 32A) protrudes toward the external communication chamber (11).

3. The pressure regulating device (30) for the writing tool as claimed in claim 2, wherein the deformable member (32) is hemispherical in shape.

4. The pressure regulating device (30) for the writing tool as claimed in claim 2, wherein the deformable member (32A) has a first piece (321A) and a second piece (322A), an end of the first piece (321A) is connected to an end of the second piece (322A), another end of the first piece (321A) is connected to an inner sidewall of the tubular member (31), another end of the second piece (322A) is formed as a closed end, and an inner diameter of the first piece (321A) is larger than that of the second piece (322A);

wherein when the deformable member (32A) protrudes toward the internal chamber (12), both the first piece (321A) and the second piece (322A) protrude toward the internal chamber (12); and

when the deformable member (32A) protrudes toward the external communication chamber (11), both the first piece (321A) and the second piece (322A) protrude toward the external communication chamber (11).

5. The pressure regulating device (30) for the writing tool as claimed in claim 1, wherein the deformable member (32B, 32C) protrudes toward the external communication chamber (11) and encloses an inner space;

wherein when the pressure difference between the internal chamber (12) and the external communication chamber (11) is larger than the first predetermined value, the deformable member (32B, 32C) deforms to expand toward the external communication chamber (11), such that the inner space in this state is volumetrically larger than the inner space when the pressure difference between the internal chamber (12) and the external communication chamber (11) is smaller than the first predetermined value.

6. The pressure regulating device (30) for the writing tool as claimed in claim 5, wherein the deformable member (32B) is a resilient bag that is expandable subject to air pressure;

wherein when the pressure difference between the internal chamber (12) and the external communication chamber (11) is smaller than the first predetermined value, the deformable member (32B) shrinks; and

when the pressure difference between the internal chamber (12) and the external communication chamber (11) is larger than the first predetermined value, the deformable member (32B) expands toward the external

communication chamber (11).

7. The pressure regulating device (30) for the writing tool as claimed in claim 5, wherein the deformable member (32C) is formed as a tubular bellows, an end of the deformable member (32C) is connected to an inner sidewall of the tubular member (31C), and another end of the deformable member (32C) is formed as a closed end; wherein when the pressure difference between the internal chamber (12) and the external communication chamber (11) is larger than the first predetermined value, the deformable member (32C) expands and elongates, such that the deformable member (32C) in this state is longer than the deformable member (32C) when the pressure difference between the internal chamber (12) and the external communication chamber (11) is smaller than the first predetermined value.

8. The pressure regulating device (30) for the writing tool as claimed in any one of claims 1 to 7, wherein

an external temperature variation that corresponds to the first predetermined value ranges from 2℃ to 4℃; and

an external temperature variation that corresponds to the second predetermined value ranges from 5℃ to 7℃.

9. The pressure regulating device (30) for the writing tool as claimed in any one of claims 1 to 7, wherein X is defined as a diameter of a widest part of

the deformable member (32), Y is defined as a thickness of the deformable member (32), and a relation between the diameter of the widest part of the deformable member (32) and the thickness of the deformable member (32) is expressed by a formula as follows:

$$Y=0.09X-0.1.$$

10. The pressure regulating device (30) for the writing tool as claimed in claim 9, wherein the thickness of the deformable member (32) ranges from 0.35 mm to 0.8 mm, and the diameter of the widest part of the deformable member (32) ranges from 5 mm to 10 mm.

11. The pressure regulating device (30) for the writing tool as claimed in any one of claims 1 to 7, wherein the outer periphery of the tubular member (31) has an outer sidewall and two annular flanges (311), the annular flanges (311) being spaced from each other, being formed around and protruding from the outer sidewall of the outer periphery of the tubular member (31), and abutting on the inner sidewall of the pen tube (10).

12. A writing tool comprising:

a pen tube (10);

the pressure regulating device (30) as claimed in claim 1; and

a nib assembly (20) mounted to an open end of the pen tube (10) and beside an internal chamber (12) of the pen tube (10);

wherein the deformable member (32, 32A, 32B, 32C) of the pressure

regulating device (30) is pressurized in advance, thereby enabling the deformable member (32, 32A, 32B, 32C) for resistance against its deformation toward an external communication chamber (11) of the pen tube (10).