Claims

1. A method for manufacturing an optical fiber sensor device ~~(1)~~, comprising an enclosure ~~(10)~~ delimiting a cavity ~~(3)~~ and an optical fiber sensor ~~(2)~~, said optical fiber sensor comprising an optical fiber ~~(12)~~ and a holding device of the sensor ~~(11)~~ secured to the optical fiber, said holding device being passed through by the optical fiber between two fixing points provided on said holding device, ~~characterized in that it comprises~~ comprising the steps of:

- positioning the optical fiber sensor ~~(2)~~ in the enclosure ~~(10)~~ so as to have the fiber ~~(12)~~ pass through two passage openings ~~(130, 140)~~ provided on the enclosure ~~(10)~~, the optical fiber extending generally along a longitudinal axis in said cavity ~~(3)~~, which delimits two portions of optical fibers in the enclosure, on either side of the holding device ~~(11)~~, each portion of fiber extending between one of said fixing points of the holding device and one of said passage openings of the enclosure, substantially along a straight line;
- holding the optical fiber sensor in position;
- producing a differential elongation of the enclosure ~~(10)~~ in relation to the optical fiber sensor ~~(2)~~ in the longitudinal direction, and toward the outside of the enclosure ~~(10)~~, while the optical fiber sensor remains held in position;
- fixing the optical fiber to the enclosure ~~(10)~~ at said passage openings; and
- bringing the enclosure ~~(10)~~ into a position of balance.

2. The manufacturing method as claimed in claim 1, ~~characterized in that~~wherein said step of differential elongation of the fiber is performed by mechanically stretching the enclosure ~~(10)~~ in said longitudinal direction, on each side of the enclosure ~~(10)~~, toward the outside of the enclosure, and in that the enclosure is brought into said position of balance by relaxing the enclosure.

3. The manufacturing method as claimed in claim 2, ~~characterized in that~~wherein the differential elongation Δ_L of the enclosure ~~(10)~~ in relation to the optical fiber sensor ~~(2)~~ satisfies a constraint relating to the ambient temperature T_S at the time of the fixing of the fiber to the enclosure ~~(10)~~, to the maximum operating temperature T_{max} of the fiber sensor ~~(2)~~, to the thermal expansion coefficient λ_C of the fiber sensor ~~(2)~~ and to the thermal expansion coefficient λ_P of the enclosure ~~(10)~~.

4. The manufacturing method as claimed in claim 3, ~~characterized in that~~wherein said constraint is defined by the inequality:

$$\Delta_L \geq \frac{L_P}{2}.\lambda_P(T_{max} - T_S) - \frac{L_C}{2}.\lambda_C(T_{max} - T_S),$$

in which λ_C denotes the thermal expansion coefficient of the fiber sensor ~~(2)~~, λ_P the thermal expansion coefficient of the enclosure, L_C denotes the length of the fiber sensor ~~(2)~~, L_P denotes the length of the enclosure ~~(10)~~, T_S the ambient temperature at the time of the fixing of the fiber to the enclosure ~~(10)~~, and T_{max} the maximum operating temperature of the sensor.

5. The manufacturing method as claimed in claim 1, ~~characterized in that~~wherein said step of differential elongation is performed by differential thermal expansion of the enclosure ~~(10)~~ relative to the optical fiber sensor ~~(2)~~ by increasing the temperature up to an expansion temperature greater than the maximum operating temperature defined for the optical fiber sensor device ~~(1)~~, and ~~in that~~wherein the enclosure is brought into said position of balance by bringing the temperature to a temperature less than the expansion temperature.

6. The manufacturing method as claimed in claim 5, ~~characterized in that~~wherein the enclosure ~~(10)~~ is chosen so as to have a thermal expansion coefficient according to the equation:

$$L_P\lambda_P > L_C\lambda_C,$$

in which λ_C denotes the thermal expansion coefficient of the holding device of the sensor ~~(2)~~, λ_P the thermal expansion coefficient of the enclosure, L_C denotes the length of the holding device ~~(11)~~, and L_P denotes the length of the enclosure ~~(10)~~.

7. The manufacturing method as claimed in claim 6, ~~characterized in that~~wherein the differential elongation of the enclosure ~~(10)~~ is equal to:

$$\Delta'_L = \frac{L_P}{2}.\lambda_P(T - T_1) - \frac{L_C}{2}.\lambda_C(T - T_1)$$

in which λ_C denotes the thermal expansion coefficient of the sensor ~~(11)~~, λ_P the thermal expansion coefficient of the enclosure, L_C denotes the length of the holding device ~~(11)~~, L_P denotes the length of the enclosure ~~(10)~~, T the operating temperature, and T_1 the expansion temperature.

8. The manufacturing method as claimed in ~~one of the preceding claims~~claim 1, ~~characterized in that~~wherein the step of fixing of the fiber to the enclosure at the passage openings comprises a gluing of the fiber at the blocking points.

9. The manufacturing method as claimed in ~~one of the preceding claims~~claim 1, ~~characterized in that it further comprises~~ comprising the fixing of the fiber sensor ~~(2)~~ to the enclosure ~~(10)~~ in at least one connection zone ~~(171)~~.

10. The manufacturing method as claimed in claim 9, ~~characterized in that~~wherein the fixing of the sensor ~~(2)~~ to the enclosure ~~(10)~~ in at least one connection zone ~~(171)~~ is performed by gluing.

11. The manufacturing method as claimed in ~~one of the preceding claims~~claim 1, ~~characterized in that~~wherein the step of positioning of the optical fiber

sensor comprises the longitudinal positioning of the optical fiber sensor substantially in the middle of the enclosure.

12. The manufacturing method as claimed in ~~one of the preceding claims~~claim 1, ~~characterized in that~~ wherein the sensor is a hydrophone.

~~13. An optical fiber sensor device (1), comprising an enclosure (10) delimiting a cavity (3), an optical fiber sensor (2), said optical fiber sensor comprising an optical fiber (12) and a holding device (11) secured to the optical fiber, said holding device being passed through by the optical fiber between two fixing points provided on said holding device, characterized in that the optical fiber (12) passes through the enclosure at two passage openings (130, 140) provided on the enclosure (10) and extends generally along a longitudinal axis in said cavity (3), which delimits two portions of optical fibers of given lengths in the enclosure, on either side of the holding device (11), the enclosure (10) being secured to the optical fiber (12) at the two passage openings (130, 140) of the enclosure, and in that each portion of fiber extends between one of said fixing points of the holding device (11) and the passage opening (130, 140) of the enclosure (10) situated on the same side of the optical fiber sensor (2) and is substantially in a straight line, each portion of fiber comprising a slackening such that the length of each portion of fiber extending between a fixing point of the holding device and a passage opening of the enclosure is greater than the geometrical distance between said fixing point of the holding device (11) and said passage opening.~~

~~14. The sensor device as claimed in claim 13, characterized in that the wavelength of the light which passes through the optical fiber of the sensor device is a linear function of a stretching parameter corresponding to a stretching applied to the sensor device, said linear function exhibiting a break of slope~~

~~for a critical value of the stretching parameter such that the directing coefficient of the linear function after said critical value is greater than the directing coefficient of the linear function before said critical value.~~