CLAIMS

1. Timepiece movement comprising a balance-and-hairspring oscillator (16) and an escapement (15) cooperating with the oscillator (16), the outer turn of the hairspring comprising a stiffened portion (9'; 9"; 9"'), characterised in that the stiffened portion (9'; 9"; 9"') is arranged so that the hairspring produces a rate difference caused by the lack of concentricity of the development of the hairspring of at least 2 s/d at an amplitude of 150° with respect to an amplitude of 300° to at least partially compensate for the variation in the rate of the movement in dependence upon the oscillation amplitude of the balance caused by the escapement, and in that the hairspring further comprises at least one of the following features:
   a) a distance (R') between the inner end of the hairspring and the centre of rotation of the hairspring lower than 400 µm,
   b) a Grossmann curve (10) defined by the inner turn of the hairspring,
   c) a stiffened portion (11) defined by the inner turn of the hairspring.

~~2. Timepiece movement as claimed in claim 1, characterised in that the stiffened portion (9'; 9"; 9"') of the outer turn is arranged so that the hairspring produces a rate difference caused by the lack of concentricity of the development of the hairspring of at least 2 s/d at an amplitude of 150° with respect to an amplitude of 300°, at least partially compensating for said rate variation caused by the escapement.~~

~~3~~2. Timepiece movement as claimed in claim ~~2~~1, characterised in that the stiffened portion (9'; 9"; 9"') of the outer turn is arranged so that the hairspring produces a rate difference caused by the lack of concentricity of the development of the hairspring of at least 4 s/d at an amplitude of 150° with respect to an amplitude of 300°, at least partially compensating for said rate variation caused by the escapement.

4~~3~~. Timepiece movement as claimed in claim ~~3~~2, characterised in that the stiffened

portion (9'; 9"; 9"') of the outer turn is arranged so that the hairspring produces a rate difference caused by the lack of concentricity of the development of the hairspring of at least 6 s/d at an amplitude of 150° with respect to an amplitude of 300°, at least partially compensating for said rate variation caused by the escapement.

~~54~~. Timepiece movement as claimed in claim 43, characterised in that the stiffened portion (9'; 9"; 9"') of the outer turn is arranged so that the hairspring produces a rate difference caused by the lack of concentricity of the development of the hairspring of at least 8 s/d at an amplitude of 150° with respect to an amplitude of 300°, at least partially compensating for said rate variation caused by the escapement.

~~65~~. Timepiece movement according to any one of claims 1 to ~~54~~, characterised in that said rate difference is a rate gain.

~~76~~. Timepiece movement as claimed in any one of claims 1 to ~~65~~, characterised in that the stiffened portion (6') of the outer turn is closer to the outer end (4) of the hairspring than a theoretical stiffened portion (6) which would have the same thickness (e) and the same extent (θ) as said stiffened portion (6') and which would make the development of the hairspring ~~substantially perfectly~~ concentric.

~~87~~. Timepiece movement as claimed in any one of claims 1 to ~~75~~, characterised in that the stiffened portion (6") of the outer turn is thinner than a theoretical stiffened portion (6) which would have the same position (α) and the same extent (θ) as said stiffened portion (6') and which would make the development of the hairspring ~~substantially perfectly~~ concentric.

~~98~~. Timepiece movement as claimed in any one of claims 1 to ~~85~~, characterised in that the stiffened portion (6"') of the outer turn is less extended than a theoretical stiffened portion (6) which would have the same position (α) and the same thickness (e) as said stiffened portion (6') and which would make the development

of the hairspring ~~substantially perfectly~~ concentric.

~~10. Timepiece movement as claimed in claim 7, characterised in that the thickness (e) and extent (θ) of the stiffened portion (6') of the outer turn are substantially identical to those of said theoretical stiffened portion (6).~~

~~11. Timepiece movement as claimed in claim 8, characterised in that the position (α) and extent (θ) of the stiffened portion (6") of the outer turn are substantially identical to those of said theoretical stiffened portion (6).~~

~~12. Timepiece movement as claimed in claim 9, characterised in that the position (α) and thickness (e) of the stiffened portion (6"') of the outer turn are substantially identical to those of said theoretical stiffened portion (6).~~

~~13~~9. Timepiece movement according to any one of claims 1 to ~~12~~8, characterised in that the hairspring comprises the feature a).

~~14~~10. Timepiece movement according to claim ~~13~~9, characterised in that said distance (R') is of about 300 μm.

~~15~~11. Timepiece movement according to claim ~~13~~ 9 or ~~14~~10, characterised in that the hairspring further comprises the feature b).

~~16~~12. Timepiece movement according to any one of claims ~~13~~ 9 to ~~15~~11, characterised in that the hairspring further comprises the feature c).

CLAIMS

1. Timepiece movement comprising a balance-and-hairspring oscillator (16) and an escapement (15) cooperating with the oscillator (16), the outer turn of the hairspring comprising a stiffened portion (9'; 9"; 9"'), characterised in that the stiffened portion (9'; 9"; 9"') is arranged so that the hairspring produces a rate difference caused by the lack of concentricity of the development of the hairspring of at least 2 s/d at an amplitude of 150° with respect to an amplitude of 300° to at least partially compensate for the variation in the rate of the movement in dependence upon the oscillation amplitude of the balance caused by the escapement, and in that the hairspring further comprises at least one of the following features:
   a) a distance (R') between the inner end of the hairspring and the centre of rotation of the hairspring lower than 400 µm,
   b) a Grossmann curve (10) defined by the inner turn of the hairspring,
   c) a stiffened portion (11) defined by the inner turn of the hairspring.

2. Timepiece movement as claimed in claim 1, characterised in that the stiffened portion (9'; 9"; 9"') of the outer turn is arranged so that the hairspring produces a rate difference caused by the lack of concentricity of the development of the hairspring of at least 4 s/d at an amplitude of 150° with respect to an amplitude of 300°, at least partially compensating for said rate variation caused by the escapement.

3. Timepiece movement as claimed in claim 2, characterised in that the stiffened portion (9'; 9"; 9"') of the outer turn is arranged so that the hairspring produces a rate difference caused by the lack of concentricity of the development of the hairspring of at least 6 s/d at an amplitude of 150° with respect to an amplitude of 300°, at least partially compensating for said rate variation caused by the escapement.

4. Timepiece movement as claimed in claim 3, characterised in that the stiffened

portion (9'; 9"; 9"') of the outer turn is arranged so that the hairspring produces a rate difference caused by the lack of concentricity of the development of the hairspring of at least 8 s/d at an amplitude of 150° with respect to an amplitude of 300°, at least partially compensating for said rate variation caused by the escapement.

5. Timepiece movement according to any one of claims 1 to 4, characterised in that said rate difference is a rate gain.

6. Timepiece movement as claimed in any one of claims 1 to 5, characterised in that the stiffened portion (6') of the outer turn is closer to the outer end (4) of the hairspring than a theoretical stiffened portion (6) which would have the same thickness (e) and the same extent (θ) as said stiffened portion (6') and which would make the development of the hairspring concentric.

7. Timepiece movement as claimed in any one of claims 1 to 5, characterised in that the stiffened portion (6") of the outer turn is thinner than a theoretical stiffened portion (6) which would have the same position (α) and the same extent (θ) as said stiffened portion (6') and which would make the development of the hairspring concentric.

8. Timepiece movement as claimed in any one of claims 1 to 5, characterised in that the stiffened portion (6"') of the outer turn is less extended than a theoretical stiffened portion (6) which would have the same position (α) and the same thickness (e) as said stiffened portion (6') and which would make the development of the hairspring concentric.

9. Timepiece movement according to any one of claims 1 to 8, characterised in that the hairspring comprises the feature a).

10. Timepiece movement according to claim 9, characterised in that said distance (R')

is of about 300 µm.

11. Timepiece movement according to claim 9 or 10, characterised in that the hairspring further comprises the feature b).

12. Timepiece movement according to any one of claims 9 to 11, characterised in that the hairspring further comprises the feature c).