CLAIMS

1.- A method for controlling the operation of a positioning system (10) of a train, the system (10) including:

- a toothed tone wheel (12),
- a first sensor (18) for detecting the presence of a tooth,
- a second sensor (20) for detecting the presence of a tooth,
- a third sensor (22) for detecting the presence of a tooth, the three sensors (18, 20, 22) being spatially arranged so that at least six possible and different positions of the wheel (12) may be represented by at least six possible logic states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6) of the three sensors (18, 20, 22), the six states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6) being different,

the method including a step for:

- detecting states corresponding to the signals delivered by the three sensors (18, 20, 22),
- comparing the detected states with the six possible logic states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6),
- determining the operation state of the system (10) according to the comparison.

2.- The method according to claim 1, wherein an operating abnormality of the system (10) in the determination step is sent back when the detected state is not one of the six logic states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6).

3.- The method according to claim 1 or claim 2, wherein the switching from a logic state (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6) to another is governed by switching relationships and the method further includes a step for checking the compliance of the succession of the detected states with the switching relationships.

4.- The method according to claim 3, wherein an operating abnormality of the system (10) in the determination step is sent back when the succession of the detected states is not compliant with the switching relationships.

5.- The method according to any one of claims 3 or 4, wherein the six consecutive logic states are marked with successive integers, the switching relationships being $D2 = (D1 - 1 \pm 1)\ [6] + 1$ with D1 and D2 being the numbers of the detected states and [ ] is the mathematical modulo operation.

6.- The method according to any one of claims 1 to 5, wherein each sensor has a duty cycle, the first sensor (18) and the second sensor (20) are shifted by a first shift (D1) relatively to a tooth in a direction of rotation, the second sensor (20) and the third sensor (22)

are shifted by a second shift (D2) relatively to a tooth in the same direction of rotation, each shift has the value 120° ± x, x being comprised between 0 and 60°.

7.- The method according to claim 6, wherein the duty cycle of each sensor (18, 20, 22) is comprised between (180 – x)/360 and (180 + x)/360.

8.- The method according to any one of claims 1 to 7, wherein the step for detecting a state is triggered in the presence of a rising or falling edge on one of the three signals delivered by the sensors (18, 20, 22).

9.- The method according to any one of claims 1 to 8, wherein the possible states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6), are represented by a triplet of values corresponding to the logic states of the sensors (18, 20, 22).

10.- The method according to claim 9, wherein the logic states of the sensors (18, 20, 22) comprise a high state and a low state.

11.- The method according to claim 9, wherein each triplet of values includes a rising or falling edge for a value, a high state or a low state for the other values.

12.- The method according to any one of claims 1 to 11, wherein the system (10) further includes at least one detector (29) for the operating state of the sensors (18, 20, 22) and wherein an operating abnormality of the system (10) in the determination step is sent back when the detector (29) detects a malfunction of one of the sensors (18, 20, 22).

13.- The method according to any one of claims 1 to 12, wherein the system (10) further includes at least one means for measuring the acceleration of the train and wherein an operating abnormality of the system (10) in the determination step is sent back when the acceleration measured by the measurement means is greater than a threshold value.

14.- A positioning system (10) of a train including:

- a toothed tone wheel (12),
- a first sensor (18) for detecting the presence of a tooth,
- a second sensor (20) for detecting the presence of a tooth,
- a third sensor (22) for detecting the presence of a tooth, the three sensors (18, 20, 22) being spatially arranged so that at least six possible and different positions of the wheel (12) may be represented by at least six possible logic states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6) of the three sensors (18, 20, 22), the six states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6) being different,
- a device (30) for controlling the position adapted for applying the method according to any one of claims 1 to 13.

15.- A railway vehicle including the positioning system (10) of claim 14.

CLAIMS

1.- A method for controlling the operation of a system (10), the system (10) including:

- a toothed tone wheel (12),
- a first sensor (18) for detecting the presence of a tooth,
- a second sensor (20) for detecting the presence of a tooth,
- a third sensor (22) for detecting the presence of a tooth, the three sensors (18, 20, 22) being spatially arranged so that at least six possible and different positions of the wheel (12) may be represented by at least six possible logic states (E_1, E_2, E_3, E_4, E_5, E_6 ; F_1, F_2, F_3, F_4, F_5, F_6) of the three sensors (18, 20, 22), the six states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6) being different,

the method including a step for:

- detecting states corresponding to the signals delivered by the three sensors (18, 20, 22),
- comparing the detected states with the six possible logic states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6),
- determining the operation state of the system (10) according to the comparison.

2.- The method according to claim 1, wherein an operating abnormality of the system (10) in the determination step is sent back when the detected state is not one of the six logic states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6).

3.- The method according to claim 1 or claim 2, wherein the switching from a logic state (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6) to another is governed by switching relationships and the method further includes a step for checking the compliance of the succession of the detected states with the switching relationships.

4.- The method according to claim 3, wherein an operating abnormality of the system (10) in the determination step is sent back when the succession of the detected states is not compliant with the switching relationships.

5.- The method according to any one of claims 3 or 4, wherein the six consecutive logic states are marked with successive integers, the switching relationships being $D2 = (D1 - 1 \pm 1)\ [6] + 1$ with D1 and D2 being the numbers of the detected states and [ ] is the mathematical modulo operation.

6.- The method according to any one of claims 1 to 5, wherein each sensor has a duty cycle, the first sensor (18) and the second sensor (20) are shifted by a first shift (D1) relatively to a tooth in a direction of rotation, the second sensor (20) and the third sensor (22) are shifted by a second shift (D2) relatively to a tooth in the same direction of rotation, each shift has the value $120° \pm x$, x being comprised between 0 and 60°.

7.- The method according to claim 6, wherein the duty cycle of each sensor (18, 20, 22) is comprised between (180 – x)/360 and (180 + x)/360.

8.- The method according to any one of claims 1 to 7, wherein the step for detecting a state is triggered in the presence of a rising or falling edge on one of the three signals delivered by the sensors (18, 20, 22).

9.- The method according to any one of claims 1 to 8, wherein the possible states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6), are represented by a triplet of values corresponding to the logic states of the sensors (18, 20, 22).

10.- The method according to claim 9, wherein the logic states of the sensors (18, 20, 22) comprise a high state and a low state.

11.- The method according to claim 9, wherein each triplet of values includes a rising or falling edge for a value, a high state or a low state for the other values.

12.- The method according to any one of claims 1 to 11, wherein the system (10) further includes at least one detector (29) for the operating state of the sensors (18, 20, 22) and wherein an operating abnormality of the system (10) in the determination step is sent back when the detector (29) detects a malfunction of one of the sensors (18, 20, 22).

13.- The method according to one of claims 1 to 12, wherein the system (10) is a positioning system of a train and further includes at least one means for measuring the acceleration of the train and wherein an operating abnormality of the system (10) in the determination step is sent back when the acceleration measured by the measurement means is greater than a threshold value.

14.- A system (10) including:

- a toothed tone wheel (12),
- a first sensor (18) for detecting the presence of a tooth,
- a second sensor (20) for detecting the presence of a tooth,
- a third sensor (22) for detecting the presence of a tooth, the three sensors (18, 20, 22) being spatially arranged so that at least six possible and different positions of the wheel (12) may be represented by at least six possible logic states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6) of the three sensors (18, 20, 22), the six states (E_1, E_2, E_3, E_4, E_5, E_6; F_1, F_2, F_3, F_4, F_5, F_6) being different,
- a device (30) for controlling the position adapted for applying the method according to any one of claims 1 to 13.

15.- A vehicle including the system (10) of claim 14.