(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 015 926 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.05.2016 Bulletin 2016/18

(51) Int Cl.:
G04C 3/00 (2006.01)

(21) Application number: **14190710.5**

(22) Date of filing: **28.10.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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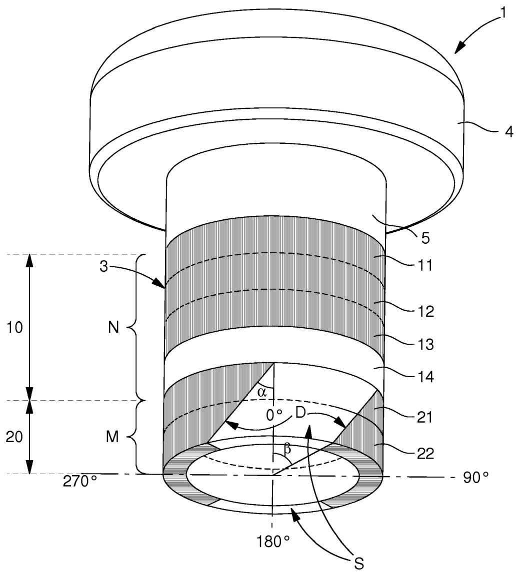
(54) Timepiece crown stem with a coding pattern

(57) The present invention concerns a method of making an encoding pattern (3) on a timepiece setting stem (1) for detecting an axial and/or angular movement and/or position of the setting stem (1). The method comprises providing the surface of a shaft (5) of the setting stem (1) with a first section (A) having first material properties and a second section (B) having second material properties to form the encoding pattern (3), where the first and second material properties are at least partially different from each other. The first section (A) comprises a strip (S) extending diagonally on the surface of the shaft (5).

Fig. 3



EP 3 015 926 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to the field of timepiece setting stems. More specifically, the present invention relates to timepiece setting stems having a special coding pattern used for detecting a movement and/or position of the stem. The invention also relates to a corresponding method of making a coding pattern on a timepiece setting stem and to a sensor arrangement for determining a movement and/or position of a timepiece setting stem.

BACKGROUND OF THE INVENTION

[0002] Incremental or absolute encoding schemes can be used to measure the angular position of a rotating device, such as a volume-control knob or the crown of an electronic watch. In many applications, such rotating control elements are also axially displaceable in order to trigger or activate various functions of a device. Therefore, it may also be necessary to measure the axial position of the same knob or crown. In timepiece applications, the axial position of a setting stem, which is usually terminated by a crown at its distal end, may be used to change the modes of the watch, such as current time display, date setting, and time setting, for example. If the crown is pulled out one discrete axial position to enter the date setting mode, angular rotation of the crown is then used to move from one day to the next. If the crown is pulled out by two discrete axial steps, angular rotation of the crown will then be used to set the time.

[0003] For determining or measuring axial and/or angular movements and/or positions of a rotational device, a sensor arrangement may be used to detect a coding pattern on the rotational device. As timepiece crown shafts are very small elements, it is difficult to make the coding pattern, which may be used for instance to galvanically (i.e. through physical resistive electrical contact) detect the movement or position of the shaft. It is also desirable that such a coding pattern is able to make a high resolution angular and/or translational movement or position detection possible and that wear in the sensor arrangement be minimised while still being able to use galvanic detection.

SUMMARY OF THE INVENTION

[0004] It is an object of the present invention to provide a method of producing a coding pattern for a timepiece setting stem fulfilling the above criteria. It is also an object of the present invention to provide a timepiece setting stem which is easy to manufacture.

[0005] According to a first aspect of the invention, there is provided a method of making a coding pattern on a timepiece setting stem as recited in claim 1.

[0006] The proposed new solution has the advantage that the manufacturing process of the shaft of the setting stem is easier and faster than existing solutions. This is particularly advantageous if machining is used to create the stripe since only one single machining operation is needed per diagonal line making up each stripe, and those lines can extend over a width much larger than the one of usual stacked encoded rings used hitherto.

[0007] According to a second aspect of the invention, there is provided a timepiece setting stem as recited in claim 12.

[0008] According to a third aspect of the invention, there is provided a timepiece sensor arrangement as recited in claim 13.

[0009] Other aspects of the invention are recited in the dependent claims attached hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Other features and advantages of the invention will become apparent from the following description of a non-limiting exemplary embodiment, with reference to the appended drawings, in which:

- Figure 1 shows a perspective view of timepiece setting stem using a prior art encoded shaft for angular movement detection;
- Figure 2a shows schematically an exemplary arrangement to measure axial position and angular movement of a timepiece setting stem according to a preferred embodiment of the present invention;
- Figure 2b shows the signal values measured by the sensors in the arrangement of Figure 2a over a complete revolution of the crown shaft;
- Figure 3 is a perspective view showing an exemplary timepiece setting stem and its shaft according to a preferred embodiment for the present invention.

DETAILED DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

[0011] Figure 1 shows an example of a setting stem 1 comprising a terminating crown 4 and a shaft 5 fitted with a encoding pattern 3 consisting only of an angular encoding pattern 20 formed of two consecutive stacked rings, i.e. a first angular detection encoded ring 21 and second angular detection encoded ring 22, each showing two different materials spread alternatively and consecutively over 90 degrees, wherein the first and second encoded rings are shifted of 90 degrees with respect to each other. With such a known angular encoding pattern 20, it would be possible for a sensor (not illustrated) placed in front of either the first angular detection encoded ring 21 or the second angular detection encoded ring 22 to detect an angular movement of the shaft 5: each time a material change is detected, the shaft 5 has been turned of 90 degrees and four such steps can be detected when performing a full revolution of the crown 4 actuating the shaft 5. The sense of rotation of the shaft 5 can additionally be detected with such an angular encoding pattern 20 with the help of an additional sensor placed next to the other, so that two consecutive sensors are placed respectively in front of each of the encoded rings, i.e the first angular detection encoded ring 21 and the second angular detection encoded ring 22, respectively. The sensors can detect the shift between their corresponding detected signals and derive in turn the sense of rotation. However, no absolute angular position can be determined because since the same pattern is repeated twice over the entire circumference of each encoded ring; as a result, the detection of either of the two possible segments that cannot be disambiguated.

[0012] A preferred embodiment of the present invention will now be described in detail, with reference to the attached figures. Identical or corresponding functional and structural elements, which appear in the different drawings are assigned the same reference numerals.

[0013] Figure 2a shows schematically the arrangement that is used to detect a position of a rotational device, such as a setting stem 1 of a watch, which is axially displaceable, i.e. from the left to the right or vice versa and which is rotatable along a central axis of rotation. Figure 2b shows the signals measured by the sensors S1 to S5. The arrangement of Figure 1a is configured to measure both the angular and axial position of the crown shaft 5. This sensor arrangement comprises a first sensor S1, a second sensor S2, a third sensor S3, a fourth sensor S4 and a fifth sensor S5, which may be fixedly arranged to each other, e.g. in or on a housing of a watch or some other type of device. The sensor arrangement further comprises an encoding pattern3, also referred to as a encoded portion or member, on the surface of the shaft 5. The encoding pattern 3 has a cylindrical or tubular shape in this example. Preferably the sensors S1 to S5 are aligned parallel to the crown shaft. In the case of a watch, the encoding pattern 3 is a part of a shaft 5 of the setting stem 1 ended by a crown 4 operated outside of the watch housing in order to control some functions or to set time and date of said watch. In a wristwatch, the diameter of the shaft is typically in the range of 0.5 to 2 mm.

[0014] Figure 3 shows a three-dimensional view of the encoding pattern 3 on the shaft 5 ended by a crown 4 that is represented in two-dimensions in Figure 2a. On the three-dimensional view of a cylinder, part of the surface of the cylinder is not visible because it is on the back side. Therefore, in order to clearly represent the entire surface of the cylinder on a two-dimensional view, it makes sense to imagine that one can unroll the surface of the cylinder as if one were unrolling a sheet of paper wrapped around the entire circumference of the cylinder. By comparing Figure 2a and Figure 3, both showing the wrapping angle β of the encoding pattern 3 around the shaft, it can be appreciated that Figure 2a is not a cross-section or a front view of the cylinder, but actually an unwrapped or unrolled representation of the surface of the cylinder that cannot be entirely seen on a three-dimensional Figure 3. The axis of the cylinder is represented in Figure 2a by the horizontal dashed line, which is the axis around which the cylindrical surface has been unwrapped or unrolled for the two-dimensional representation. The wrapping angle β is thus comprised within 0 and 360 degrees, which corresponds to a full revolution of the encoding pattern 3 around the shaft 5.

[0015] In the configuration as illustrated in Figure 2a, the encoding pattern 3 comprises two distinct portions, the first one being meant for axial detection, and the second one for angular detection. The first portion is therefore referred to as axial encoding pattern 10, while the second portion as angular encoding pattern 20. The axial encoding pattern 10 comprises a first axial detection encoded ring 11, illustrated as the rightmost vertical stripe. It further comprises a second axial detection encoded ring 12 next to the first axial encoded ring 11, a third axial encoded ring 13 and a fourth axial encoded ring 14 adjacent to each other as indicated by the central vertical stripes in Figure 1. The second portion, i.e. the angular encoding pattern 20, comprises a first angular detection encoded ring 21 axially adjacent to the fourth axial detection encoded ring 14, and a second angular detection encoded ring 22 axially adjacent to the first angular detection encoded ring 21. In this example, the number of axial detection encoded rings of the axial encoding pattern 10 is four, and the number of angular detection encoded rings of the angular encoding pattern 20 is two.

[0016] First, second and third axial detection encoded rings 11, 12 and 13 are with value B along their entire circumference, whereas the fourth axial detection encoded ring 14 is with value A along its entire circumference. Given that the first, second, third and fourth axial detection encoded rings 11, 12, 13 and 14 only have the value A along their entire circumference or the value B along their entire circumference, these axial detection encoded rings, and as a result the whole axial encoding pattern 10, are rotation invariant. With these four axial detection encoded rings, the measurement unit 5 connected to the five sensors can determine four axial positions of the encoding pattern 3, from the first axial position in which the first sensor S1 overlaps the first axial detection encoded ring 11, to the fourth axial position in which the first sensor S1 overlaps the fourth axial detection encoded ring 14 after the shaft 1 has moved from left to right in the illustration of Figure 2a. The first and second angular detection encoded rings 21, 22 are axially arranged adjacent to the fourth axial detection encoded ring 14. The two angular detection encoded rings 21, 22 comprise a different coding pattern composed of A and B values along their circumference. In this example, the illustrated pattern is a binary pattern consisting of values A and B, which may represent for instance first and second conductive values that can be detected by suitable measurement sensors. Preferably, in order to simplify the detection process by sensors, the encoded rings may represent a binary pattern comprising a representation of logical 1 s and 0s. One logical state, such as the logical bit 1, may be represented by a first material, whereas another logical state, such as the logical state 0, may be represented by a second material, where the first and second materials are different from each other. In the preferred embodiment illustrated by Figure 2a, 2b and 3, A represents a logical state of 0, i.e. the corresponding material is non-conductive, whereas B represents a logical value of 1, i.e. the material is conductive.

[0017] As illustrated in Figure 2a, the crown shaft 5 is in a depressed position P1. In this depressed position P1, the first sensor S1 overlaps the first axial detection encoded ring 11, whereas the second, third, fourth and fifth sensors S2, S3, S4 and S5 overlap the second, third and fourth axial detection encoded rings 12, 13, 14 and the first angular detection encoded ring 21, respectively. In Figure 2b the signals from the sensors S1 to S5 are shown over a complete revolution of the encoded portion 3. In this position as shown in Figure 2a, the first, second and third sensors S1, S2, S3 always detect value B, whereas the fourth sensor S4 always detects value A over a complete revolution of the axial encoding pattern 10 portion of the encoding pattern 3. The fifth sensor S5 is operable to generate a signal shown in the left part of Figure 2b in response to a complete revolution of the encoding pattern 3 in the position shown in Figure 2a. The signal changes 4 times per revolution given that the specific code is repeated 2 times around the encoded portion with a succession of values A, B, A, then B from the upper part (β=0) to the lower part (β=360). In this position P1, the combined angular and axial position sensor arrangement detects one precise discrete axial position, between the four possible axial positioning options, i.e. the incremental changes in the angular position, but neither the sense of rotation nor the absolute angular position can be determined in this position of the shaft 5.

[0018] If the encoding pattern 3 is displaced axially one step to the right, then the shaft 5 would find itself in an intermediate axial position in which the sensor S5 is then aligned with the second angular detection encoded ring 22. Since the coding patterns of first and second angular detection encoded rings 21, 22 are angularly offset, a measurement unit 7 is operable to determine the sense of rotation of the angular encoding pattern 20 relative to the row of sensors S1 to S5 thanks to the measurement of a phase shift between the two detected signals measured by the fourth and fifth sensors S4 and respectively S5, and which are identical, since the demarcation lines D between the portions of value A and the portions of value B of the encoding pattern 3 are parallel. While measuring angular incremental movements with the help of the angular encoding pattern 20 in this position, the axial encoding pattern 10 still allows for a precise axial position detection.

[0019] According to a preferred embodiment for the present invention, galvanic detection is used, and the sensors comprise conducting elements making mechanical and hence resistive electrical contact with the axial and/or angular detection encoded rings of the encoded portion of the shaft, i.e. the encoding pattern 3. The encoded rings comprise conducting sections for defining value B and insulating sections for defining value A or vice versa. Depending on whether an insulating or conducting section of an encoded ring is in contact with a particular sensor, said sensor is operable to generate a corresponding signal representing the particular encoded section of the respective encoded ring. For the case of an electrical contact, an additional axial ring may be provided adjacent to the first axial detection encoded ring to make electrical contact by means of a brush for example to define value B of the conducting sections to have a certain electrical voltage. The sensors may comprise a roller or wheel to come in contact with the encoded portion thus making mechanical and electrical contact with the surface of the crown shaft. This is particularly advantageous if the sensor performs the position detection galvanically. The use of the roller or wheel has the advantage that the wear in the measurement arrangement can be minimised. The roller or wheel may be oriented so that its rotational axis is essentially perpendicular or parallel to the axial rotational axis of the shaft. A roller rotational axis arranged parallel to the rotational axis of the shaft allows minimizing the wear during rotational movements of the encoding pattern 3, whereas a roller rotational axis arranged perpendicular to the rotational axis of the shaft allows minimizing the wear during axial movements of the encoding pattern 3. Alternatively, or additionally, it is also possible to lubricate the galvanic contacts wherever necessary; however, in this case it needs to be ensured that good electrical contact quality is still maintained. This can be achieved e.g. through the use of conductive lubricants. It is noted though that in order to obviate this wear problem, the sensors and the corresponding encoded rings could alternatively interact in, magnetic manner, capacitive manner or optical manner instead of galvanic manner.

[0020] In practice, the values A and B may be obtained by materials having different properties from each other. For instance, the sections of value A may be obtained by a specific, non-conducting material or painting cover, whereas the value B may be obtained by a metal surface of the shaft 1. Alternatively, the sections corresponding to either one of the values A or B may be machined to create a groove in the surface of the encoded portion of the shaft 1 to make the encoding pattern 3. This groove may then be filled with a non-conducting material, such as plastic, for example. It is also possible to use etching. This is done by using strong acid or mordant to cut into the unprotected parts of the metal surface of the shaft 5 to create the desired pattern.

[0021] In the present invention, the shaft 5 comprises a diagonal marking pattern as opposed to a non-diagonal pattern shown in Figure 1. The diagonal marking as shown in Figures 2a and 3 allows for a smooth and continuous transition from one coded ring to another to form a line or strip S extending over two coded rings in this example. The advantage of the diagonal marking pattern is that this kind of pattern can be created more easily than the non-diagonal marking pattern shown in Figure 1 and can spread over larger axial dimensions, which avoids to pile up a series of encoded rings as in the prior art solutions, such as the one of Fig. 1, while also avoid the need of a precise mutual angular positioning of consecutive encoded rings e.g. in order to detect the sense of rotation. For instance, when the diagonal marking pattern is obtained by machining, then one continuous diagonal groove extending over the width of at least two different axial detection encoded rings may be obtained by only one machining operation.

[0022] The strips S can be defined as the surface between demarcation lines D, and are preferably arranged rectilinear and parallel to each other not only in order to simplify the machining process, but also ease the detection process since such a layout of the strips S ensures that the same signals with a constant phase shift are detected by subsequent sensors for adjacent coded rings, such as, in the illustrated preferred embodiment of Figs. 2A and 3, the first angular encoded ring and the second angular encoded ring.

[0023] For the diagonal markings, the diagonal angle α between the axial rotational axis of the shaft 5 and an imaginary line parallel to the marking is preferably strictly comprised within 0 and 90 degrees and depends on the desired pattern. An angle of 0 would not allow detecting the sense of rotation anymore and should therefore rather be avoided, while an angle of 90 degrees would correspond to the extreme case of creating an encoded ring orthogonal to the axial rotational axis of the shaft, such as the fourth axial detection ring 14. The machining of such encoded rings allows for axial position and possibly axial movement detection, but unfortunately no more angular movement detection.

[0024] In the case illustrated in Figures 2a and 3, the pattern on second angular encoded ring 22 is shifted by a development angle β of 45 degrees - NB: on Figure 2a four squares spread vertically over 180 degrees and eight over 360 degrees - with respect to the pattern on the first angular encoded ring 21, the angle α is about 27 degrees. If the shift between the patterns on consecutive encoded rings is 90 degrees, then the angle α would need to be about 45 degrees. Other angles are possible depending on the desired pattern; however in order to simplify the angular detection and ensure that sense of rotation detection can always be easily provided, even with adverse manufacturing tolerances, according to a preferred embodiment the angle α will be chosen to remain within the range of 15 and 75 degrees.

[0025] In practice, when the system contains two strips S spreading each over a development angle β of 90 degrees around the shaft, as on Figures 2a and 3, the width, length and inclination of the strips S can preferably be configured to also provide a phase shift of 90 degrees between signals detected by consecutive sensors, in order to detect state changes of the system at constant time intervals. The number of strips S can be increased in order to improve the angular encoding pattern resolution, e.g. 4 stripes S instead of 2, so that each stripe spreads over a width corresponding to a development angle β of 45 degrees only. When changing the number of stripes S, the phase shift may preferably be adjusted accordingly so that the pace of system state detection change is still kept invariant (i.e. when using 4 stripes spread over 45 degrees, applying phase shift of also 45 degrees = 360/(2*4) also, and e.g. when using 3 stripes spread each over 60 degrees, phase shift of 60 degrees). When applying such a preferred layout for the stripes S, it can be appreciated that the phase shift is chosen to remain exactly equal to the value of width of each stripe S (expressed in terms of development angle β).

[0026] As far as the axial detection encoded rings are concerned, the consecutive rings of the same type may also be obtained by using only one machining operation as explained above. More specifically, if machining is used to create grooves on the surface of the shaft 5, then the consecutive rings of the same type may be obtained by one single machining operation. For example, to obtain the grooves needed to create the pattern shown on the shaft of Figure 2a by machining, only three machining operations are needed, namely two diagonal machinings and one machining orthogonal to the axial shaft rotational axis. Therefore, only dotted lines are used on Figure 3 to show the separation between the several axial detection rings (i.e. first axial detection ring 11, second axial detection ring 12, and third axial detection ring 13) and angular encoded rings (i.e. first angular detection ring 21 and second angular detection ring 22) which are only virtually separated from each other, but actually made from the same block of materials associated with the A & B values. Thus, according to the teachings of the present invention, there is no more need to encode rings one by one, each requiring its own manufacturing step, which would not be very efficient, and, as far as an angular encoding pattern 20 is concerned, to stack then carefully and precisely each adjacent ring angularly with respect to each other, which is very time consuming.

[0027] It will be noted that an axial position and/or angular and or axial movement sensor arrangement manufactured thanks to the method of the present invention more generally typically includes L sensors, where L is a whole number greater than or equal to 2, and an encoded member, which can be rotated around an axis and displaced axially relative to the sensors. The encoded member can be arranged on an angularly and axially displaceable element of an instrument. Said encoded member, which can be a rod ended by a crown of an instrument, such as a wristwatch, typically includes N axial detection encoded rings, which are axially adjacent, and where N is a whole number typically greater than or equal to 2, and is equal to total number of possible discrete axial positions, and M angular detection encoded rings, which are axially adjacent, and where M is a whole number, and typically greater than or equal to 1, whereby if M is strictly equal to 1, it is not possible to detect the sense of rotation anymore. The first N-1 axial detection encoded rings are typically defined with value B along their entire circumference and the Nth axial detection encoded ring is typically defined with value A, different from value B, along its entire circumference. The M angular detection encoded rings are axially adjacent to the Nth axial detection encoded ring, and each typically comprises a coding pattern consisting of values A and B along its circumference, permitting the determination of angular movement and possibly its sense by the sensors overlapping one or several angular detection encoded rings.

[0028] In the above configuration, in order to determine the axial position of the encoded portion, it is necessary to have a number L of sensors at least equal to the number N of axial detection encoded rings minus one, i.e. at least L = N-1 when the number N is at least 2. Generally the number L of sensors can be equal to or greater than the number N of axial detection encoded rings in order to use some sensors in a specific location to determine the angular position of the encoded portion. The first sensor of the series of sensors may be displaceable from the first axial detection encoded ring to the Nth axial detection encoded ring for determining the axial position of said encoded portion. Said axial position can be determined by the measurement unit 7 connected to said sensors by counting, starting with the first sensor, the number of B values detected by the sensors before the first A value.

[0029] In the above configuration, generally it can be provided that L and N are at least equal to 2 and M is at least equal to 1, or L and N can be equal to 3 or 4, and M can be equal to 2 or 3, or L is equal to 5, N is equal to 4 and M is equal to 2 as in the configuration of Figure 2a, but other values can be envisaged. However, other solutions can be provided for the angular and axial position sensor arrangement.

[0030] While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive, the invention being not limited to the disclosed embodiment. Other embodiments and variants are understood, and can be achieved by those skilled in the art when carrying out the claimed invention, based on a study of the drawings, the disclosure and the appended claims. For instance, instead of the encoding pattern 3 being directly on the metal surface of the crown shaft, the crown shaft 5 may comprise a metallic core portion and a sleeve around it, so that the sleeve would comprise the encoding pattern 3. The sleeve may be of various materials, such as plastic or metal.

[0031] In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that different features are recited in mutually different dependent claims does not indicate that a combination of these features cannot be advantageously used. Any reference signs in the claims should not be construed as limiting the scope of the invention.

Claims

1. A method of making an encoding pattern (3) on a timepiece setting stem (1) for detecting an axial and/or rotational movement, and/or an axial position of said setting stem (1), the method comprising: providing the surface of a shaft (5) of said setting stem (1) with a first section (A) having first material properties and with a second section (B) having second material properties to form the encoding pattern (3), wherein said first and second material properties being at least partially different from each other, **characterised in that** said first section (A) comprises a strip (S) extending diagonally over the surface of said shaft (5).

2. A method according to claim 1, wherein one of the first and second sections (A, B) is of a non-conductive material, while the other section (A, B) is of a conductive material.

3. A method according to claim 2, wherein the non-conductive material is a plastic, and the conducting material is a metal.

4. A method according to any one of the preceding claims, wherein said first section (A) is provided by

    - selectively removing shaft material from the surface of the shaft (5) to create one or more recesses on the surface of the shaft (5); and
    - applying a first material having the first material properties onto the one or more recesses to create said strip (S).

5. A method according claim 4, wherein the shaft material is removed by machining and/or etching.

6. A method according any one of the preceding claims, wherein said strip (S) is made of a non-conductive painting cover.

7. A method according to any one of the preceding claims, wherein the number of the stripes (S) extending diagonally is at least two.

8. A method according to any one of the preceding claims, wherein the strip (S) forms an angle (α) with respect to an axial rotational axis of shaft (5) lies between 0 and 90 degrees.

9. A method according claim 8, wherein said angle (α)

lies within 15 and 75 degrees.

10. A method according to any one of the preceding claims, wherein the encoding pattern (3) is a binary pattern.

11. A method according to any one of the preceding claims, wherein the first section (A) further comprises an encoded ring (14) extending orthogonally with respect to an axial rotational axis of the shaft (5).

12. A timepiece setting stem (1) fitted with a shaft (5) comprising a encoding pattern (3) for detecting an axial and/or angular movement and/or axial position of said setting stem (1), wherein said crown shaft (5) has a surface comprising a first section (A) having first material properties and a second section (B) having second material properties to form the encoding pattern (3), the first and second material properties being at least partially different from each other, **characterised in that** said first section (A) comprises a strip (S) extending diagonally over said surface of said shaft (5).

13. A timepiece sensor arrangement for detecting an axial and/or angular movement and/or axial position of a timepiece setting stem (1), wherein said sensor arrangement comprises a timepiece setting stem (1) according to claim 12 and a measurement sensor (S1 to S5) comprising a roller configured to come mechanically in contact with said shaft (5) of said setting stem (1).

14. A timepiece sensor arrangement according to claim 13, wherein the rotational axis of said roller is parallel or orthogonal to the rotational axis of said shaft (5) of said setting stem (1).

15. A timepiece sensor arrangement according to claim 13 or 14, wherein said measurement sensor (S1 to S5) is configured to electrically detect the axial and/or angular movement and/or axial position of said timepiece setting stem (1).

Fig. 1
(PRIOR ART)

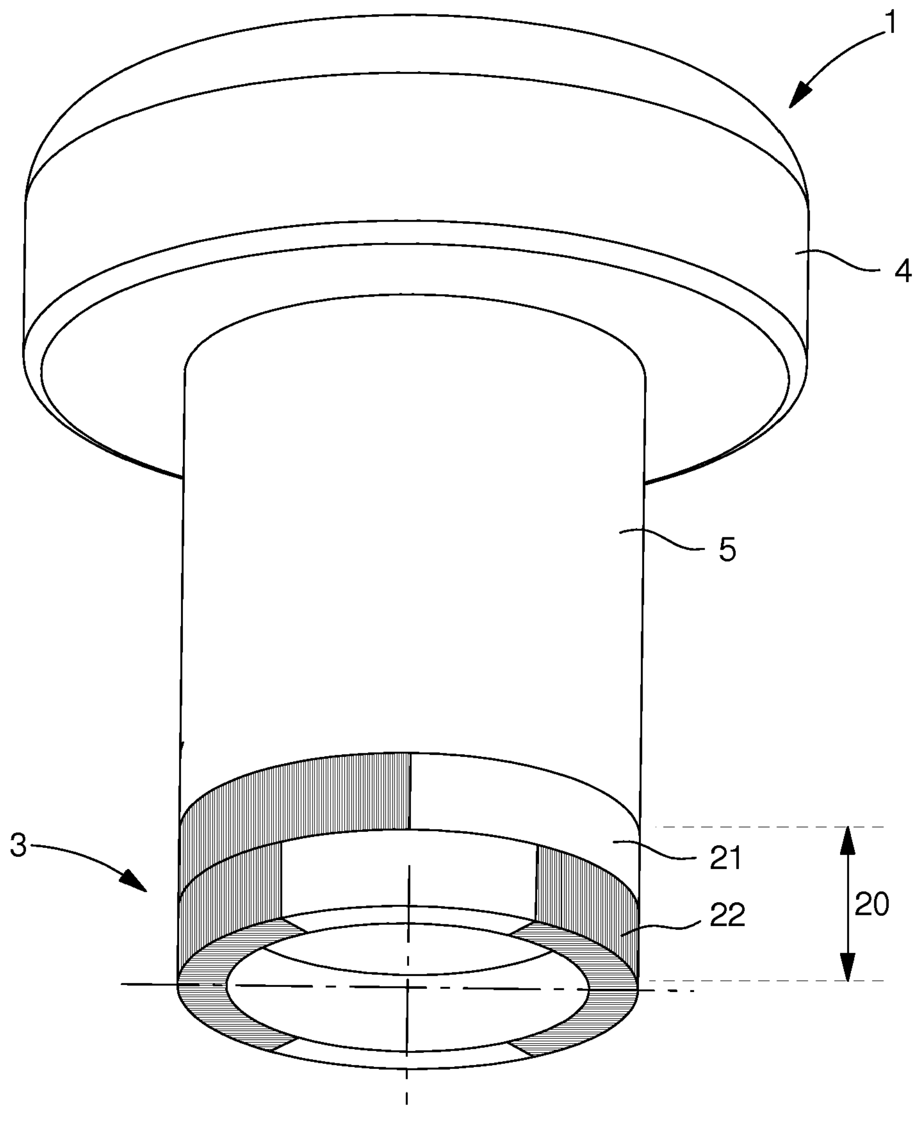
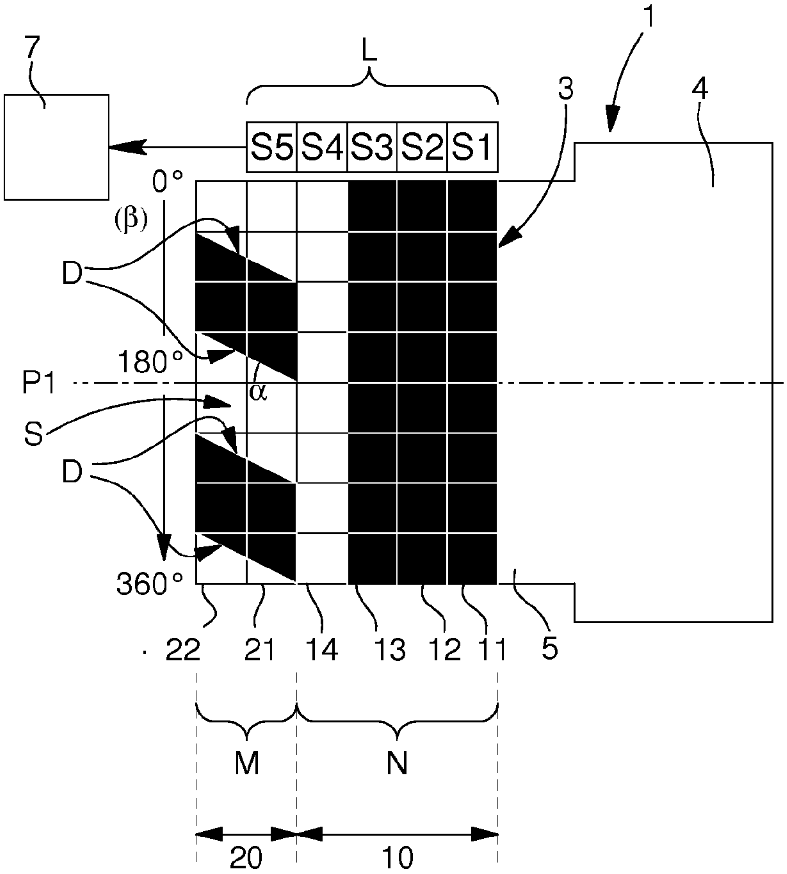


Fig. 2a


7
L
S5 S4 S3 S2 S1
1
3
4
0°
(β)
D
180°
α
P1
S
D
360°
22
21
14
13
12
11
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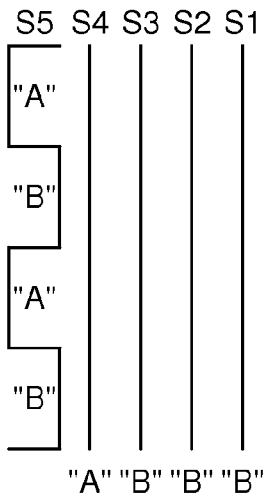
M
N
20
10

Fig. 2b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"B"
"A"
"B"
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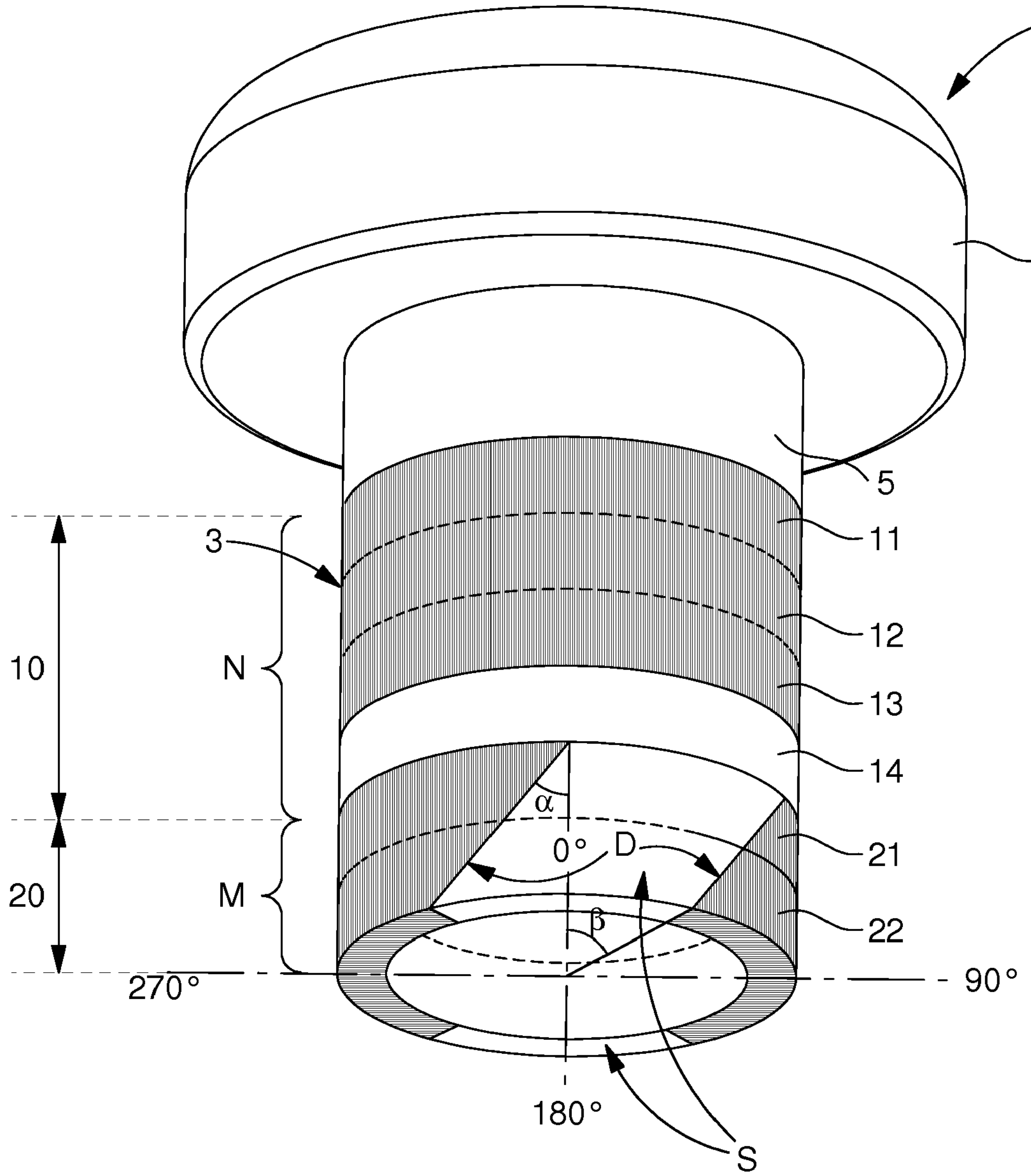
Fig. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 14 19 0710

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	GB 2 037 027 A (DIEHL GMBH & CO) 2 July 1980 (1980-07-02) * abstract * * page 3, lines 5-127 * * figures 1-3,6 * -----	1-6,8-15 7	INV. G04C3/00
Y	US 6 422 740 B1 (LEUENBERGER CLAUDE-ERIC [CH]) 23 July 2002 (2002-07-23) * column 1, lines 5-12 * * column 2, line 65 - column 3, line 40 * * column 5, lines 47-58 * * figures 1-7 * -----	7	
			TECHNICAL FIELDS SEARCHED (IPC)
			G04C G06F

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	13 August 2015	Couteau, Olivier

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
L : document cited for other reasons
& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 19 0710

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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13-08-2015

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