

PATENT SPECIFICATION

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(54) TIMEPIECE CALENDAR MECHANISM

(71) We, KABUSHIKI KAISHA SUWA SEIKOSHA, a Japanese Company of 3-4, 4-chome, Ginza, Chuo-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns a timepiece calendar mechanism.

According to the present invention, there is provided a timepiece calendar mechanism comprising at least one calendar member provided with calendar indications, the or each calendar member being associated with a respective driving member having a resilient driving portion engageable with the respective calendar member for driving the latter, and a calendar advancing wheel for advancing the or each driving member, the or each driving member having one portion which is rigidly secured to the calendar advancing wheel, the or each said resilient driving portion being deflected relative to the remainder of the respective driving member if moved by the respective calendar member but not when driving the latter.

Means are preferably provided for rotating the calendar advancing wheel through one complete revolution every twenty four hours.

Preferably there are two calendar members.

The two calendar members may be a date wheel and a day wheel respectively.

Preferably, the resilient driving portion of the driving member which drives the date wheel carries a tooth which is engageable with teeth of the date wheel, this resilient driving portion being provided with a pin which extends into a hole in the calendar advancing wheel, the pin engaging the wall of the hole when this resilient driving portion drives the date wheel and

being deflected away from said wall when this resilient driving portion is moved by the teeth of the date wheel.

Preferably, the driving member which drives the day wheel has a resilient driving portion which is provided with a pin which extends into a hole in the calendar driving wheel, the pin engaging the wall of the hole when this resilient driving portion drives the day wheel and being spaced from the said wall when this resilient driving portion is moved by the day wheel.

The invention also comprises a watch provided with a timepiece calendar mechanism as set forth above.

The invention is illustrated, merely by way of example, in the accompanying drawings in which:—

Figure 1 is a plan view of a timepiece calendar mechanism known in Japan.

Figure 2 is an enlarged sectional view of the timepiece calendar mechanism of Figure 1.

Figure 3 is a plan view of the structure shown in Figure 1, but with the parts thereof in a different relative position.

Figure 4 is a plan view of a timepiece calendar mechanism according to the present invention.

Figure 5 is an enlarged sectional view of the timepiece calendar mechanism of Figure 4, and

Figure 6 is a plan view similar to and showing the same construction as in Figure 4, but with the parts thereof in a different relative position.

In Figures 1 to 3 there is shown in a timepiece calendar mechanism which is known in Japan, and which comprises a plate 10 on which is rotatably mounted an annular date wheel 11 having internal teeth 12. The date wheel 11 is marked at equal angular intervals with a display of numbers from 1 to 31 to present the numbers of the various days during a month. A jumper

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spring 13, which is carried by a pin 14 mounted in the plate 10, has a head 15 which, in the position of the parts shown in Figure 1, engages the adjacent teeth 12a, 12b of the date wheel 11. The jumper spring 13 has a spring portion 16 which engages a fixed abutment 17 on the plate 10, so that the head 15 is resiliently urged into firm contact with the teeth 12a, 12b. Thus (except when the date wheel 11 is being rotated to change the date indication provided thereby) the date wheel 11 is retained in a predetermined angular position in which its date indication is viewable through a window (not shown).

The timepiece calendar mechanism of Figures 1 to 3 also comprises a day wheel 20 having external teeth 21, the day wheel 20 being mounted centrally of the plate 10 and driving a display disc 22 on which the names of the various days of the week are marked at equal angular intervals. Two adjacent teeth 21a, 21b of the day wheel 20 are, in the position of the parts shown in Figure 1, engaged by a head 23 of a jumper spring 24 which is mounted on the plate 10. Thus the day wheel 20 is maintained in a predetermined angular position except when the day wheel 20 is being rotated to alter a day indication on the day display disc 22 which is visible through the said window.

A calendar advancing wheel 25 is rotatably mounted on a pin or projection 26 which is itself mounted in or forms part of the plate 10. The timepiece movement of which the timepiece calendar mechanism forms part is provided with means (not shown) for rotating the calendar advancing wheel 25 through one complete revolution every 24 hours.

A part-annular calendar driving member 30 is provided adjacent one end thereof with an external tooth 31 which is engageable with the internal teeth 12 of the date wheel 11. The calendar driving member 30 is provided with pins 32, 33 which respectively engage in holes 34, 35 in the calendar advancing wheel 25. Thus, when the calendar advancing wheel 25 is rotated clockwise as shown, the radially extending end walls 36, 37 of the holes 34, 35 respectively, will respectively engage the pins 32, 33 so as to impart a direct clockwise drive to the calendar driving member 30. Thus during one complete revolution of the calendar advancing wheel 30 the tooth 31 will drivingly engage a tooth 12c of the date wheel 11 so as to move the latter through one angular step, whereby to change the date indication in the said window.

The calendar driving member 30 is also provided with a pin 40 which engages in a notch 41 in a calendar driving member 42.

The arrangement is thus such that when the calendar advancing wheel 25 is rotated clockwise, the calendar driving member 42 is indirectly rotated thereby, i.e. is rotated by way of the calendar driving member 30. The calendar driving member 42 is rotatably mounted on a pin 43 which is itself eccentrically mounted on the pin 26. The calendar driving member 42 is externally provided with a tooth 44 which is engageable with the teeth 21 of the day wheel 20. The arrangement is such that when the calendar advancing wheel 25, and thus the calendar driving member 42, are rotated through one complete revolution, the day wheel 20 is moved angularly through the distance from one day indication thereon to the next.

The eccentricity of the pins 26, 43, and the relative dimensions of the parts is such that the tooth 31 is engageable with the teeth 12 but not with the teeth 21, while the tooth 44 is engageable with the teeth 21 but not with the teeth 12.

A calendar correcting mechanism (not shown) is provided to enable the day and date indications to be corrected when necessary. This mechanism is such that, during a correction operation, the date wheel 11 and the day wheel 20 are rotated in the same angular directions as those in which they are driven during normal operation. Thus, as shown in the drawings, the date wheel 11 is rotated clockwise, while the day wheel 20 is rotated counter-clockwise.

When the parts are as shown in Figure 1, in which the tooth 31 is about to engage the tooth 12c of the date wheel 11, if the said calendar correcting mechanism were to be operated at this moment, the succeeding tooth 12d would be brought into engagement with the tooth 31. In order to permit the tooth 12d to pass the tooth 31, the latter is provided on a deflectable part of the calendar driving member 30. Thus parts of the mechanism are not damaged during rate correction. This, however, means that when the date wheel 11 is normally driven by the tooth 31, the turning moment applied to the date wheel 11 is not constant because the resilient part of the calendar driving member 30 bends during date indication advancement and the degree to which it bends is not fixed.

When the date wheel 11 is driven by the tooth 31, the tooth 12a of the date wheel 11 first of all slides along the adjacent surface of the head 15 of the jumper spring 13. The tooth 12a then finally passes over the radially outer surface of the head 15, at which time the date wheel 11 will be driven by the jumper spring 13. During the period, during which the date indication is changed, there is a period of instability

because the tooth 31 is bent at this time.

Furthermore, in the construction illustrated in Figures 1 to 3 the whole of the calendar driving member 42, and its tooth 44, are rigid. Consequently, if the said calendar correcting mechanism is operated in an attempt to alter the day and date indications at a time when the parts are as shown in Figure 3, damage can be caused. As will be seen, when the parts are as in the Figure 3 position, the tooth 44 engages a tooth 21 of the day wheel 20 so as to prevent rotation of the latter by the calendar correcting mechanism. The same problem arises when the day indication only is to be corrected.

Moreover, the exact time at which the day indication is advanced, and the turning moment applied to the day wheel 20 are not constant because the tooth 44 instead of being directly driven by the calendar is driven therefrom by way of the calendar driving member 30, so that time is taken to take up play between the parts. Consequently, in the construction shown in Figures 1 to 3, the date turning moments applied to the date wheel 11 and day wheel 20, and the time at which day advancement occurs, are not fixed, and it is necessary to provide a lengthy period during which the date and day indications are changed.

Furthermore, in a conventional timepiece calendar mechanism (not shown) the calendar driving member has been constructed of two separate parts, namely a resilient part which is provided with a tooth corresponding to the tooth 31, and a rigid part. This two part structure has been adopted in order to stabilise the time during which the date wheel is turned, because if the calendar driving member is constructed as one integral part, as shown in Figures 1 to 3, the portion thereof which bends when the date wheel 11 is rotated by the calendar correcting mechanism during date advancement operates as a spring during normal date advancement, and the period of time for which the date wheel 11 is turned is not therefore fixed. However, it is difficult to produce such a conventional two-part structure.

During the time that the date wheel 11 and the day wheel 20 are being moved from one predetermined angular position to the next, i.e. during the time when normal day and date change is occurring, the date number and the day letters do not appear centrally of the window and are not easy to read. Consequently, it is desirable that the time taken for day and date advancement is kept as short as possible. In practice, however, with the construction of Figures 1 to 3, it is not possible to keep this time short.

It is necessary to provide jumpers 13, 24, so as to maintain the date wheel 11 and the day wheel 20 in a fixed position except when these wheels are being rotated. Consequently, the driving mechanism of the watch needs to have considerable torque to overcome the forces applied by the jumpers 13, 24. This means that if the date wheel 11 and the day wheel 20 are to be rotated through one step at exactly the same time, the driving mechanism will have to overcome the effects of both jumpers at the same time. Thus, if the torque of the driving mechanism is small, as it is in the case of a ladies' watch or in the case of an electric watch, there is a possibility of the watch stopping at this time. In order to avoid this possibility, a time gap has to be imposed between the time during which date indication advancement and the time during which day indication advancement occurs. Consequently, there is an extended period in which the day and date indications visible through the said window are difficult to read or are inaccurate.

Turning now to the embodiment of the present invention which is shown in Figures 4 to 6, many of the parts of the latter embodiment are the same as or similar to those of the known embodiment of Figures 1 to 3, and these particular parts (which are given the same reference numerals as in Figures 1 to 3) will not therefore be described in detail.

In the construction of Figures 4 to 6, however, the calendar driving members 30, 42 are respectively replaced by calendar driving members 50, 51.

The calendar driving member 50 is a one-piece substantially part-annular member which is provided with pins 52, 53, 54, and also with a tooth 55 which corresponds to the tooth 31 of the embodiment of Figures 1 to 3. The pins 52, 53 fit into correspondingly sized holes 56 in the calendar advancing wheel 25 so that rotation of the latter is simultaneously transmitted to the calendar driving member 50. The pins 52, 53 are carried by an end portion 57 of the calendar driving member 50 which is rigidly secured to the calendar advancing wheel 25. The pin 54, however, which is disposed adjacent to the tooth 55, extends into a large hole 58 in the calendar advancing wheel 25. The opposite end portion 59 of the calendar driving member 50 which extends between the pins 53, 54 and which carries the tooth 55 constitutes a deflectable resilient driving portion, since the pin 54 is capable of moving throughout the radial extent of the hole 58 and thus through a radial distance equal to about twice that of the diameter of the pin itself.

When the tooth 55 moves the date wheel

11, the pin 54 engages the wall of the hole 58 so that the resilient driving portion 59 is maintained rigid at this time, with the result that the turning moment applied to the date wheel 11 will be constant. On the other hand, when the date is corrected by the calendar correcting mechanism during the time that date advancement is occurring, the teeth 12 of the date wheel 11 will contact the tooth 55 so as to deflect the latter radially inwardly and thus to cause the resilient driving portion 59 to flex. The extent to which the resilient driving portion 59 can be deflected is determined by the size of the hole 58, the arrangement being such that the pin 54 does not touch the wall of the hole during such deflection. Thus the date can be corrected during automatic date indication advancement without damage to the parts.

The calendar driving member 51 has a main portion 60, which is provided with a pin 61, and a resilient driving portion 62 which is provided with a pin 63. The pins 61, 63 respectively extend into large holes 64, 65 respectively of the calendar advancing wheel 25. The resilient driving portion 62 is provided at its outer end with a tooth 66 which is adapted to cooperate with the teeth 21 of the day wheel 20 and which corresponds to the tooth 44 of the construction of Figures 1 to 3.

When the pins 61, 63 are respectively in engagement with radially extending walls 70, 71 of the holes 64, 65, and the calendar advancing wheel 25 is rotated clockwise, the calendar driving member 51 will be directly driven by the calendar advancing wheel 25 (as opposed to the indirect drive provided in the construction of Figures 1 to 3) and, during one revolution of the calendar advancing wheel 25, will move the day wheel 20 from one predetermined angular position thereof to the next angular position so as to alter the day indication. Thus the moment exerted on the day wheel 20 by the tooth 66 is constant since, during the time that it is rotating the day wheel 20, the resilient driving portion 62 is maintained rigid by virtue of the contact between the wall 71 and the pin 63. This effect can easily be achieved merely by appropriately locating the positions of the pins 61, 63 and the walls of the holes 64, 65. When the tooth 66 is not effecting rotation of the day wheel 20, the pin 61 is driven by the wall 70 of the hole 64.

Figure 6 illustrates the position of the parts when the tooth 66 is contacting a tooth 21 of the day wheel 20. When the day indication is to be corrected at this particular time, this operation can be effected without damaging any parts. This is to say, if the day wheel 20 is rotated coun-

terclockwise as shown, it will merely cause deflection of the resilient driving portion 62 of the calendar driving member 51, this being in contrast to what occurs in the construction shown in Figures 1 to 3 in which the tooth 44 cannot be deflected away from the path of the teeth 21.

When the day indication is to be corrected at a time when the tooth 66 has advanced further than the position shown in Figure 6 and is engaged completely with the teeth 21 of the day wheel 20, the resilient driving portion 62 will be deflected by the engagement between the teeth 21 and the tooth 66 until the pin 61 touches the adjacent wall of the hole 64 of the calendar advancing wheel 25, and the spring portion 62 bends in response to movement of the day wheel 20. In this case, if the pin 63 touches the wall of the hole 65, the tooth 66 will be damaged or else it will not be possible to correct the day indication. Consequently the sizes and relative positions of the holes 64, 65 and the pins 61, 63 must be arranged so as to prevent such an accident.

In the case of the construction of Figures 4 to 6, a smaller time gap may be arranged between the beginning of the day indication advancement and the actual turning of the day wheel 20 than is the case in the construction of Figures 1 to 3, because both the calendar driving members 50, 51 are directly driven by the calendar advancing wheel 25, and because the calendar driving member 50 and the resilient driving portion 62 act as rigid bodies when the date indication and day indication are changed.

In the construction of Figures 4 to 6, the date indication can be corrected during automatic date advancement and the day indication can be corrected during automatic day advancement without damaging parts. Moreover, the time taken to change the date and day indications in the window of the dial may be shortened because the turning moment exerted on the date wheel 11 is constant the time at which day indication advancement occurs is constant, and the moment exerted on the day wheel 20 is constant.

WHAT WE CLAIM IS:—

1. A timepiece calendar mechanism comprising at least one calendar member provided with calendar indications, the or each calendar member being associated with a respective driving member having a resilient driving portion engageable with the respective calendar member for driving the latter, and a calendar advancing wheel for advancing the or each driving member, the or each driving member having one portion which is rigidly secured to the calendar advancing wheel, the or each said

11, the pin 54 engages the wall of the hole 58 so that the resilient driving portion 59 is maintained rigid at this time, with the result that the turning moment applied to the date wheel 11 will be constant. On the other hand, when the date is corrected by the calendar correcting mechanism during the time that date advancement is occurring, the teeth 12 of the date wheel 11 will contact the tooth 55 so as to deflect the latter radially inwardly and thus to cause the resilient driving portion 59 to flex. The extent to which the resilient driving portion 59 can be deflected is determined by the size of the hole 58, the arrangement being such that the pin 54 does not touch the wall of the hole during such deflection. Thus the date can be corrected during automatic date indication advancement without damage to the parts.

The calendar driving member 51 has a main portion 60, which is provided with a pin 61, and a resilient driving portion 62 which is provided with a pin 63. The pins 61, 63 respectively extend into large holes 64, 65 respectively of the calendar advancing wheel 25. The resilient driving portion 62 is provided at its outer end with a tooth 66 which is adapted to cooperate with the teeth 21 of the day wheel 20 and which corresponds to the tooth 44 of the construction of Figures 1 to 3.

When the pins 61, 63 are respectively in engagement with radially extending walls 70, 71 of the holes 64, 65, and the calendar advancing wheel 25 is rotated clockwise, the calendar driving member 51 will be directly driven by the calendar advancing wheel 25 (as opposed to the indirect drive provided in the construction of Figures 1 to 3) and, during one revolution of the calendar advancing wheel 25, will move the day wheel 20 from one predetermined angular position thereof to the next angular position so as to alter the day indication. Thus the moment exerted on the day wheel 20 by the tooth 66 is constant since, during the time that it is rotating the day wheel 20, the resilient driving portion 62 is maintained rigid by virtue of the contact between the wall 71 and the pin 63. This effect can easily be achieved merely by appropriately locating the positions of the pins 61, 63 and the walls of the holes 64, 65. When the tooth 66 is not effecting rotation of the day wheel 20, the pin 61 is driven by the wall 70 of the hole 64.

Figure 6 illustrates the position of the parts when the tooth 66 is contacting a tooth 21 of the day wheel 20. When the day indication is to be corrected at this particular time, this operation can be effected without damaging any parts. This is to say, if the day wheel 20 is rotated coun-

terclockwise as shown, it will merely cause deflection of the resilient driving portion 62 of the calendar driving member 51, this being in contrast to what occurs in the construction shown in Figures 1 to 3 in which the tooth 44 cannot be deflected away from the path of the teeth 21.

When the day indication is to be corrected at a time when the tooth 66 has advanced further than the position shown in Figure 6 and is engaged completely with the teeth 21 of the day wheel 20, the resilient driving portion 62 will be deflected by the engagement between the teeth 21 and the tooth 66 until the pin 61 touches the adjacent wall of the hole 64 of the calendar advancing wheel 25, and the spring portion 62 bends in response to movement of the day wheel 20. In this case, if the pin 63 touches the wall of the hole 65, the tooth 66 will be damaged or else it will not be possible to correct the day indication. Consequently the sizes and relative positions of the holes 64, 65 and the pins 61, 63 must be arranged so as to prevent such an accident.

In the case of the construction of Figures 4 to 6, a smaller time gap may be arranged between the beginning of the day indication advancement and the actual turning of the day wheel 20 than is the case in the construction of Figures 1 to 3, because both the calendar driving members 50, 51 are directly driven by the calendar advancing wheel 25, and because the calendar driving member 50 and the resilient driving portion 62 act as rigid bodies when the date indication and day indication are changed.

In the construction of Figures 4 to 6, the date indication can be corrected during automatic date advancement and the day indication can be corrected during automatic day advancement without damaging parts. Moreover, the time taken to change the date and day indications in the window of the dial may be shortened because the turning moment exerted on the date wheel 11 is constant the time at which day indication advancement occurs is constant, and the moment exerted on the day wheel 20 is constant.

WHAT WE CLAIM IS:—

1. A timepiece calendar mechanism comprising at least one calendar member provided with calendar indications, the or each calendar member being associated with a respective driving member having a resilient driving portion engageable with the respective calendar member for driving the latter, and a calendar advancing wheel for advancing the or each driving member, the or each driving member having one portion which is rigidly secured to the calendar advancing wheel, the or each said



resilient driving portion being deflected relative to the remainder of the respective driving member if moved by the respective calendar member but not when driving the latter.

2. A timepiece calendar mechanism as claimed in claim 1 in which means are provided for rotating the calendar advancing wheel through one complete revolution every twenty four hours.

3. A timepiece calendar mechanism as claimed in claim 1 or 2 in which there are two calendar members.

4. A timepiece calendar mechanism as claimed in claim 3 in which the two calendar members are respectively a date wheel and a day wheel.

5. A timepiece calendar mechanism as claimed in claim 4 in which the resilient driving portion of the driving member which drives the date wheel carries a tooth which is engageable with teeth of the date wheel, this resilient driving portion being provided with a pin which extends into a hole in the calendar advancing wheel, the pin engaging the wall of the hole when this resilient driving portion drives the date

wheel and being deflected away from said wall when this resilient driving portion is moved by the teeth of the date wheel.

6. A timepiece calendar mechanism as claimed in claim 4 or 5 in which the driving member which drives the day wheel has a resilient driving portion which is provided with a pin which extends into a hole in the calendar driving wheel, the pin engaging the wall of the hole when this resilient driving portion drives the day wheel and being spaced from the said wall when this resilient driving portion is moved by the day wheel.

7. A timepiece calendar mechanism substantially as hereinbefore described with reference to and as shown in Figures 4 to 6 of the accompanying drawings.

8. A watch provided with a timepiece calendar mechanism as claimed in any preceding claim.

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