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(54) TIMEPIECE MOVEMENT

(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 movement, and, although the invention is not so restricted, it is more particularly concerned with a timepiece movement having first and second hour hands for respectively indicating the time prevailing in two different time zones. Thus these two different time zones may respectively be constituted by the time prevailing in the user's home town or country, and that prevailing in another town, time region, or country to which the user has just travelled. Watches provided with such timepiece movements are known as world time watches.

In such watches, in addition to a normal hour, minute and second hands for indicating the time of the user's home town, the watch is normally provided with a second hour hand which rotates once every 24 hours. Such watches may be used for example by the pilot or navigator of an aircraft, the second hour hand indicating Greenwich Mean Time. However, the use of such a 24 hour time indication requires some practice, and it is not easy to read both 12 hour time and 24 hour time indications in one and the same watch, especially for ordinary people who are not trained to use it.

Such known watches employ completely separate means for adjusting the two hour hands. Accordingly, when a minute hand, which is associated with the first hour hand, has to be corrected so that a corresponding correction is applied to the first hour hand, no such correction is

automatically applied to the second hour hand, and the two hour hands thus become out of step with each other. Moreover, as the second hour hand is not normally provided with its own minute hand, it is not easy to adjust it to the correct position.

According, therefore, to the present invention there is provided a timepiece movement comprising first, second and third wheels; means for effecting rotation of the first wheel and for effecting rotation of the second wheel at one twelfth of the speed of the first wheel; a minute hand driven by the first wheel; an hour hand driven by the third wheel; a clutch for transmitting drive from said second wheel to said third wheel, said clutch comprising a spring which engages both said second and third wheels and urges the latter into a selected one of a plurality of relative angular positions, said spring being disposed between said second and third wheels in such a way that it does not act as a friction brake when the timepiece movement is running; and means for effecting stepwise adjustment of the angular position of the third wheel with respect to the second wheel.

Preferably, the first, second and third wheels are coaxially mounted.

The movement may comprise a rotatable stem which is movable axially into and out of a first position in which the hour hand and minute hand are simultaneously corrected on predetermined rotation of the stem, and a second position in which the hour hand is corrected with respect to the minute hand on predetermined rotation of the stem. The stem may, moreover, be movable axially into and out of a third position in which a mainspring of the movement is wound on predetermined rotation of the stem.

Preferably, when the stem is in the said

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second position, rotation of the stem in one angular sense adjusts the hour hand with respect to the minute hand, and rotation of the stem in the opposite angular sense

5 adjusts a calendar member.

The said hour hand may be a second hour hand, the movement having a first hour hand which is driven by said second wheel.

10 Thus, if the first hour hand needs to be corrected because of an error in the frequency of an oscillator employed in the timepiece movement, or because the watch has stopped through failure to wind a

15 mainspring thereof, the correction of the first hour hand will automatically effect corresponding correction of the second hour hand.

20 Such a watch is convenient for travellers who frequently go to districts where the time differs from their own, because the timepiece movement of the present invention enables the second hour hand to be set with respect to the minute hand and

25 thus with respect to the first hour hand when the user enters a new time zone without disturbing the time indication given by the minute hand. The indications, moreover, may be of a 12 hour, rather

30 than a 24 hour character.

The second hour hand may be corrected with respect to the first hour hand in steps of 30 minutes or of 1 hour.

35 The clutch may comprise a toothed member and a jumper spring, one end of the jumper spring being drivingly connected to the third wheel and the other end of the jumper spring resiliently engaging the teeth of the toothed member,

40 the toothed member forming part of the said second wheel.

Alternatively, one of said second and third wheels may be provided with at least one projection which is adapted to enter

45 into and to be withdrawn from a plurality of angularly spaced apart recesses in a member drivingly connected to the other wheel, the said spring urging the or each projection into a said recess.

50 The movement may for example be provided with a quartz crystal oscillator.

The invention also comprises a time piece provided with a movement as set forth above.

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

Figure 1 is a broken-away cross-sectional view of a first embodiment of a time piece movement according to the present invention,

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Figure 2 is a sectional plan view taken on the line 2-2 of Figure 1,

Figure 3 is a broken-away plan view

65 showing part of the timepiece movement of

Figures 1 and 2, and

Figure 4 is a broken-away cross-sectional view showing a second embodiment of a timepiece movement according to the present invention.

Referring first to Figures 1 to 3, a timepiece movement 10 comprises a seconds hand 11, a minute hand 12 and a first hour hand 13 which cooperate with a dial 14 to provide an indication of

75 the time prevailing in one particular time zone, such as that of the user's home town or country. The movement 10 also comprises a second hour hand 15 which may be used to indicate the

80 time prevailing in another town or time-region to which the user has travelled.

The minute hand 12 is driven, by way of a minute wheel 16 and a first wheel or cannon pinion 17, the minute wheel 16

85 being driven by any desired motor or power source.

The first hour hand 13 is secured to a second wheel 20 which is mounted rotatably and coaxially about the first wheel or cannon pinion 17, while the second hour hand 15 is secured to a third wheel 21 which is mounted concentrically about and is rotatable with respect to the second wheel 20. The second wheel 20 has gear teeth 22

95 which mesh with internal gear teeth of an annular first hour wheel gear 23, the gear 23 having external teeth 24 which mesh with teeth 25 on the minute wheel 16. Thus the first hour hand 13 is also driven from the minute wheel 16, as is the seconds hand 11 by means not shown. The third wheel 21 has external teeth 26 which mesh with a correction transmitting wheel 27. As will be appreciated, the second

100 wheel 20 is driven at one twelfth of the speed of the first wheel 17.

A jumper spring 30 (whose shape does not of course need to be as shown in Figure 2) has an end portion 31 which is

110 secured to the third wheel 21, the jumper spring 30 having an opposite end portion or head 32 which is pressed, by virtue of the resilience of the jumper spring 30, against the teeth 22 of the second wheel

115 20. The jumper spring 30 and the teeth 22 of the second wheel 20 thus collectively constitute a slipping clutch which normally ensures that the drive transmitted to the second wheel 20 from the minute wheel

120 16 is also transmitted to the third wheel 21 and thus to the second hour hand 15. The jumper spring 30 is thus disposed between the second wheel 20 and the third wheel 21 in such a way that it

125 does not act as a friction brake when the timepiece movement 10 is running.

As will be seen from Figure 2, twelve teeth 22 are provided on the second wheel 20 so that when, as described below, the

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head 32 is moved from the position shown in Figure 2 to a position in which it engages the next adjacent teeth of the second wheel 20, the time indication provided by the second hour hand 15 is adjusted with respect to the first hour hand 13 by one hour. Similarly, if twenty-four instead of twelve teeth 22 were provided then such adjustment of the head 32 would effect an adjustment of thirty minutes instead of one hour.

Normally, therefore the drive to the hands 11 to 13 is transmitted to the hand 15 through the slipping clutch 22, 32. However, if it is desired to adjust the second hour hand 15 with respect to the first hour hand 13, this is done by rotating the correction transmitting wheel 27 by means of a stem 34 (see Figure 3). This effects rotation of the third wheel 21, but it does not effect rotation of the second wheel 20 since the latter is in effect fixed by virtue of being driven by the minute wheel 16. Consequently the rotation of the correction transmitting wheel 27 causes the head 32 of the jumper spring 30 to pass stepwise over the teeth 22 throughout movement of the correction transmitting wheel 27. The second hour hand 15 is thus adjusted by an appropriate number of either hour or thirty-minute steps.

The stem 34 is axially movable between three positions in the first or radially outermost, of which rotation of the stem alters the time indication provided by the hands 11 to 13 and, through the slipping clutch 22, 32, also alters the time indicated by the second hour hand 15. In the second, or intermediate, of the three positions, rotation of the stem 34 clockwise effects correction of a calendar member 35 (e.g. for indicating the date), while rotation of the stem 34 counterclockwise effects rotation of the correction transmitting wheel 27 and thus adjustment of the time indicated by the second hour hand 15 with respect to that indicated by the first hour hand 13. In the third or radially innermost position of the stem 34, which is that illustrated in Figure 3, rotation of the stem 34 in a predetermined angular sense effects winding of a main spring (not shown) of the movement. The watch may also have in addition to a date indication a day indication (not shown).

If the stem 34 is placed in the said second position, and is rotated counterclockwise, a lever 36 is moved by means not shown to a position in which a correcting wheel 40 which is mounted on the lever 36 engages internal teeth of the calendar member 35 so as to effect stepwise rotation of the latter. If, on the other hand the stem 34 is rotated clockwise, the lever 36 is moved to a position in which the cor-

recting wheel 40 is moved by the said means not shown into engagement with the correction transmitting wheel 27. Thus the second hour hand 15 is corrected only in a losing direction. However, one can if desired provide other structure (not shown) such that operation of the lever 36 may either effect correction only in an advancing direction or both in an advancing and in a losing direction.

The use of a single stem 34 which is adjustable from the exterior of the watch, improves the appearance of the watch, reduces the number of its component parts, and makes it easier to effect water-tightness. The fact that the watch is provided with one single stem or crown does not make it look as though it is a special watch.

The slipping clutch 22, 32 ensures that the hands 13, 15 will at all times, except when the hand 15 is being adjusted, move together. Furthermore, the adjustment of the second hour hand 15 does not disturb the indication provided by the first hour hand 13.

The embodiment of the timepiece movement shown in Figure 4 is generally similar to that of Figures 1 to 3 and for this reason will not be described in detail, like reference numerals indicating like parts.

However, in the case of the construction shown in Figure 4, a jumper spring 30 is not provided nor is the tubular member 20 provided with the teeth 22. Instead, the tubular member 21 is provided with a flange 42 having holes in which are located and from the bottom of which project a plurality of equi-angularly spaced apart pins 43. The flange 42 is mounted immediately adjacent to and above the first hour wheel gear 23, the latter being provided with either twelve or twenty-four recesses or apertures 44 in which the pins 43 may be located and from which they may be withdrawn on relative rotation between the tubular members 20, 21. A stepwise adjustment system of this kind is described and claimed in our Patent No. 1,330,261.

It is preferred to provide three pins 43 but more or fewer pins may be provided since the number of pins is obviously a matter of choice. It is also possible to arrange that the pins 43, instead of being separate members located in holes in the flange 42, are integral with the flange 42. It is further possible to arrange that the first hour wheel gear 23 is provided with the pins, while the flange 42 is provided with the apertures for receiving the pins. A spring 45 acts between the upper surface of the tubular member 21 and a flange 46 of the tubular member 20 so as to urge

the tubular member 21 downwardly towards the wheel 23, whereby to urge the pins 43 into the apertures 44.

Thus in normal operation when the hands 11 to 13 are driven, a drive is also imparted to the second hour hand 15 by way of the pins 43 and tubular member 21. However, when it is desired to adjust the second hour hand 15 with respect to the first hour hand 13, the correction transmitting wheel 27 is rotated as described above, and this forces the pins 43 to ride up out of the holes 44 until they enter the further holes 44. If the correction transmitting wheel 27 is moved through 70% of one pitch, the arrangement is such that the pins 43 will be urged into the next adjacent apertures 44. In this structure it is easy to arrange that correction can be performed both in an advancing and in a losing direction. Moreover, as a spring is inserted between the two hour wheels, no brake is applied to the normal movement.

The invention is especially useful in the case of a very high precision electronic watch using a quartz crystal oscillator or a tuning fork oscillator. In such a watch the first and second hour hands 13, 15 very rarely need to be corrected at the same time. As, however, the second hour hand 15 will at times need to be corrected with respect to the first hour hand 13, the stem 34 may be provided with three positions such that when pulled out to its second or intermediate position, the first hour hand 13 is corrected and when pulled out to its first or outermost position, the second hour hand 15 is corrected. The click from the innermost position to the intermediate position may be made weak, while the click from the intermediate position to the outermost position may be made strong.

If desired, when the stem 34 is set at the position for adjusting the hands 11 to 13, the seconds hand 11 may be stopped by the operation of a mechanism not shown.

WHAT WE CLAIM IS:—

1. A timepiece movement comprising first, second and third wheels; means for effecting rotation of the first wheel and for effecting rotation of the second wheel at one twelfth of the speed of the first wheel; a minute hand driven by the first wheel; an hour hand driven by the third wheel; a clutch for transmitting drive from said second wheel to said third wheel, said clutch comprising a spring which engages both said second and third wheels and urges the latter into a selected one of a plurality of relative angular positions, said spring being disposed between said second and third wheels in such a way that it does not act as a friction brake when the timepiece movement is running; and means for effecting stepwise adjustment of the angular

position of the third wheel with respect to the second wheel.

2. A movement as claimed in claim 1 in which the first, second and third wheels are coaxially mounted.

3. A movement as claimed in claim 1 or 2 comprising a rotatable stem which is movable axially into and out of a first position in which the hour hand and minute hand are simultaneously corrected on predetermined rotation of the stem, and a second position in which the hour hand is corrected with respect to the minute hand on predetermined rotation of the stem.

4. A movement as claimed in claim 3 in which the stem is movable axially into and out of a third position in which a mainspring of the movement is wound on predetermined rotation of the stem.

5. A movement as claimed in claim 3 or 4 in which, when the stem is in the said second position, rotation of the stem in one angular sense adjusts the hour hand with respect to the minute hand, and rotation of the stem in the opposite angular sense adjusts a calendar member.

6. A movement as claimed in any preceding claim in which the said hour hand is a second hour hand, the movement having a first hour hand which is driven by said second wheel.

7. A movement as claimed in any preceding claim in which the clutch comprises a toothed member and a jumper spring, one end of the jumper spring being drivingly connected to the third wheel and the other end of the jumper spring resiliently engaging the teeth of the toothed member, the toothed member forming part of the said second wheel.

8. A movement as claimed in any of claims 1 to 6 in which one of said second and third wheels is provided with at least one projection which is adapted to enter into and to be withdrawn from a plurality of angularly spaced apart recesses in a member drivingly connected to the other wheel, the said spring urging the or each projection into a said recess.

9. A movement as claimed in any preceding claim in which the movement is provided with a quartz crystal oscillator.

10. A timepiece movement as claimed in claim 1 and substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

11. A timepiece provided with a movement as claimed in any preceding claim.

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the tubular member 21 downwardly towards the wheel 23, whereby to urge the pins 43 into the apertures 44.

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The invention is especially useful in the case of a very high precision electronic watch using a quartz crystal oscillator or a tuning fork oscillator. In such a watch the first and second hour hands 13, 15 very rarely need to be corrected at the same time. As, however, the second hour hand 15 will at times need to be corrected with respect to the first hour hand 13, the stem 34 may be provided with three positions such that when pulled out to its second or intermediate position, the first hour hand 13 is corrected and when pulled out to its first or outermost position, the second hour hand 15 is corrected. The click from the innermost position to the intermediate position may be made weak, while the click from the intermediate position to the outermost position may be made strong.

If desired, when the stem 34 is set at the position for adjusting the hands 11 to 13, the seconds hand 11 may be stopped by the operation of a mechanism not shown.

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position of the third wheel with respect to the second wheel.

2. A movement as claimed in claim 1 in which the first, second and third wheels are coaxially mounted.

3. A movement as claimed in claim 1 or 2 comprising a rotatable stem which is movable axially into and out of a first position in which the hour hand and minute hand are simultaneously corrected on predetermined rotation of the stem, and a second position in which the hour hand is corrected with respect to the minute hand on predetermined rotation of the stem.

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5. A movement as claimed in claim 3 or 4 in which, when the stem is in the said second position, rotation of the stem in one angular sense adjusts the hour hand with respect to the minute hand, and rotation of the stem in the opposite angular sense adjusts a calendar member.

6. A movement as claimed in any preceding claim in which the said hour hand is a second hour hand, the movement having a first hour hand which is driven by said second wheel.

7. A movement as claimed in any preceding claim in which the clutch comprises a toothed member and a jumper spring, one end of the jumper spring being drivingly connected to the third wheel and the other end of the jumper spring resiliently engaging the teeth of the toothed member, the toothed member forming part of the said second wheel.

8. A movement as claimed in any of claims 1 to 6 in which one of said second and third wheels is provided with at least one projection which is adapted to enter into and to be withdrawn from a plurality of angularly spaced apart recesses in a member drivingly connected to the other wheel, the said spring urging the or each projection into a said recess.

9. A movement as claimed in any preceding claim in which the movement is provided with a quartz crystal oscillator.

10. A timepiece movement as claimed in claim 1 and substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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