United States Patent

Tanaka et al.

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[54] SINGLE POSITION DATE OR DAY CORRECTOR WITH GRAVITY CONTROLLED CLUTCH

[72] Inventors: **Kazuo Tanaka,** 3-105, Seki-machi, Nerima-ku; **Toshihiko Kanayama,** 2-217, Higashi-ohkubo, Shinjuku-ku; **Tetuya Yasuda,** 5-16-4, Higashiikebukuro, Toshima-ku; **Hidetaka Tutiya,** 1101, Fukushima-cho, Akishima-shi; **Yoshio Kikuchi,** 2-22-17, Higashiyotsugi, Katsushika-ku; **Takeo Muto,** A-143, 4-13-20, Nakameguro, Meguro-ku, all of Japan

[73] Assignee: Citizen Watch Company Limited, Iahyo, Japan

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[52] **U.S. Cl.**.....**58/58**
[51] **Int. Cl.**.....**G04b 19/24**

[58] **Field of Search**.....58/4 R, 4 A, 5, 58

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Primary Examiner—Stephen J. Tomsky
Assistant Examiner—George H. Miller, Jr.
Attorney—Sughrue, Rothwell, Mion, Zinn & Macpeak

[57] **ABSTRACT**

In a calendar correction mechanism for a timepiece a double pawl member is freely mounted on a movable pin for pivotal movement under the influence of gravity for selective engagement with a day star wheel or a date calendar dial. A mechanical motion transmitting train is arranged between an elongated operating stem and the movable pin to shift the pawl member for transmitting step motion to either the day star wheel or the date calendar dial.

1 Claims, 13 Drawing Figures

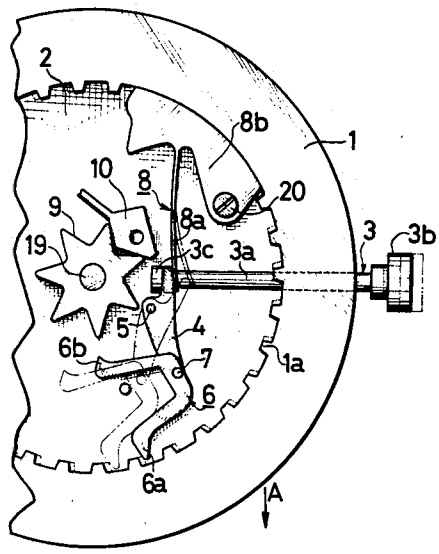


FIG. 1

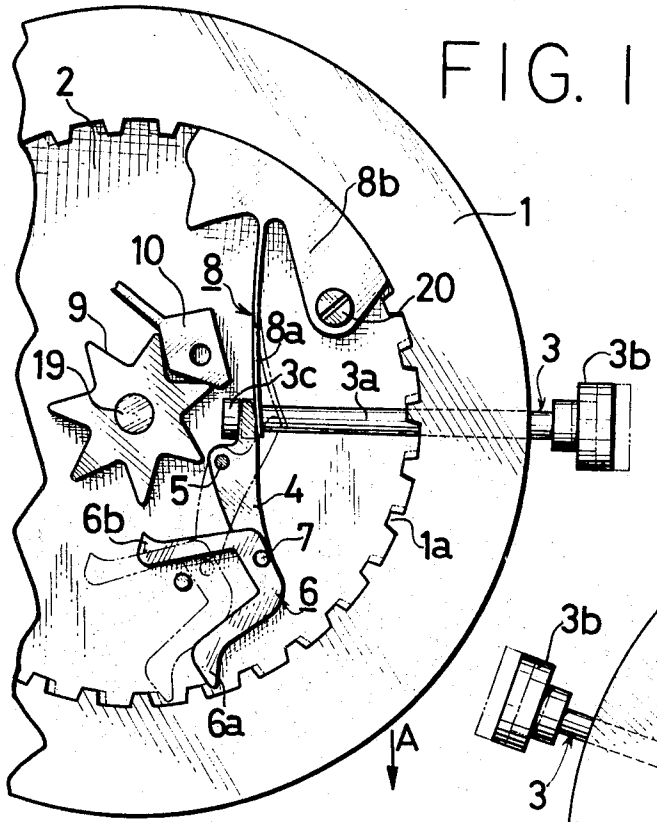


FIG. 2

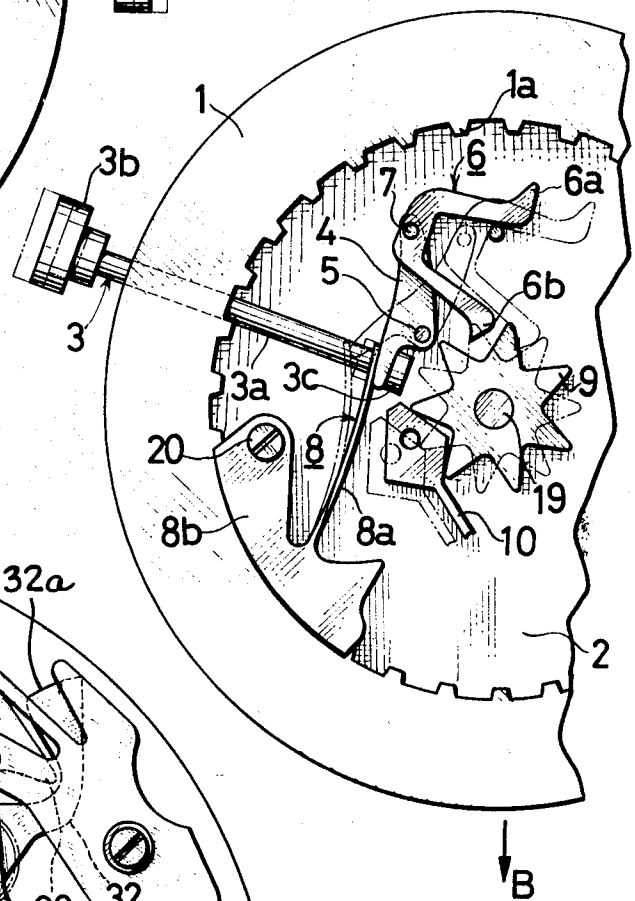
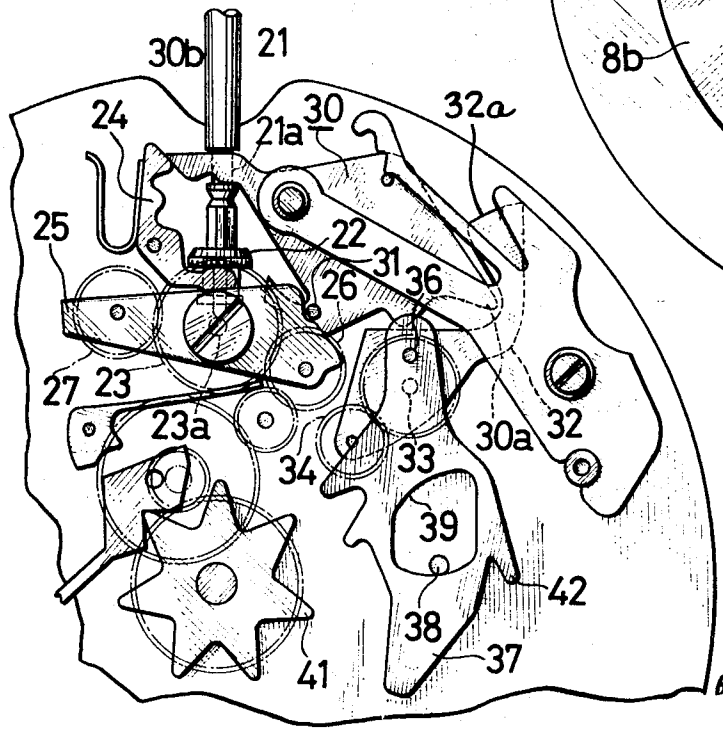


FIG. 5



INVENTORS
KAZUO TANAKA
TOSHIHIKO KANAYAMA
TETUYA YASUDA
HIDETAKA TUTIYA
YOSHIO KIKUCHI
TAKEO MUTO

BY Sughrue, Rothwell, Mion, Zinn & Macpeak
ATTORNEYS

FIG. 4

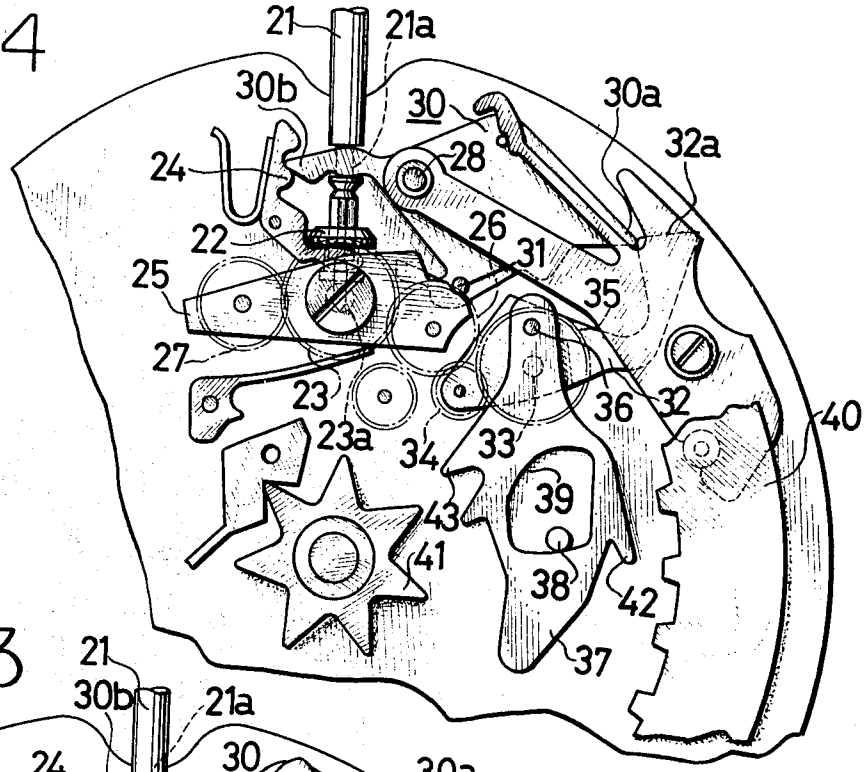

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FIG. 3

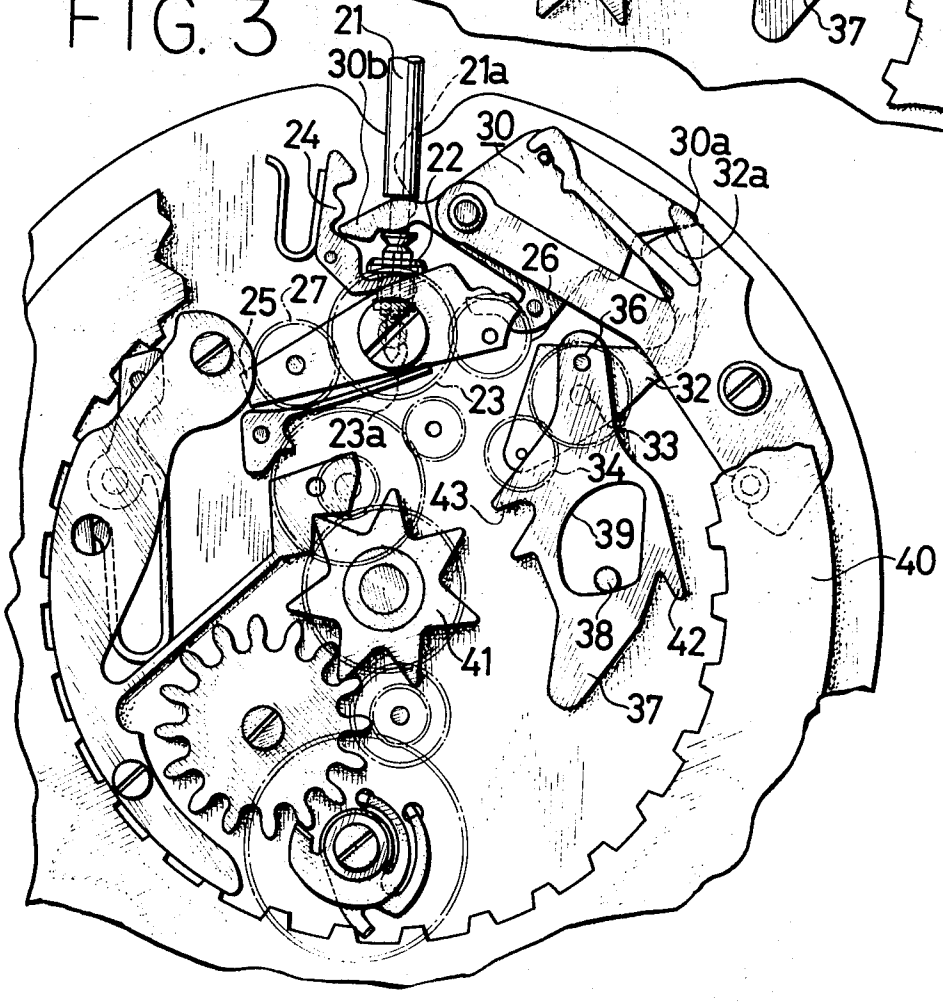
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FIG. 7

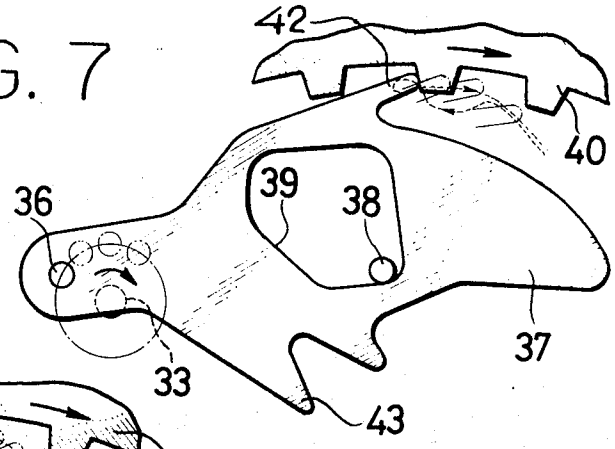


FIG. 6

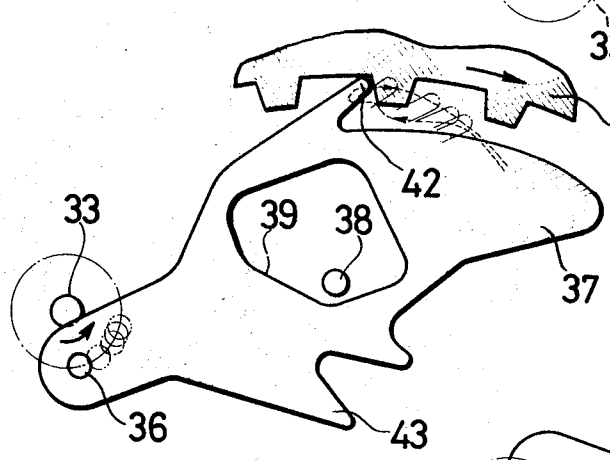


FIG. 9

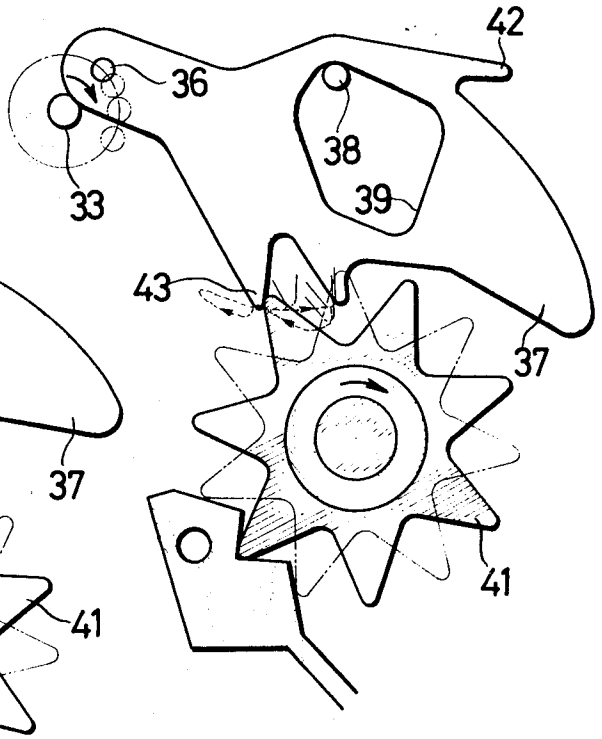


FIG. 8

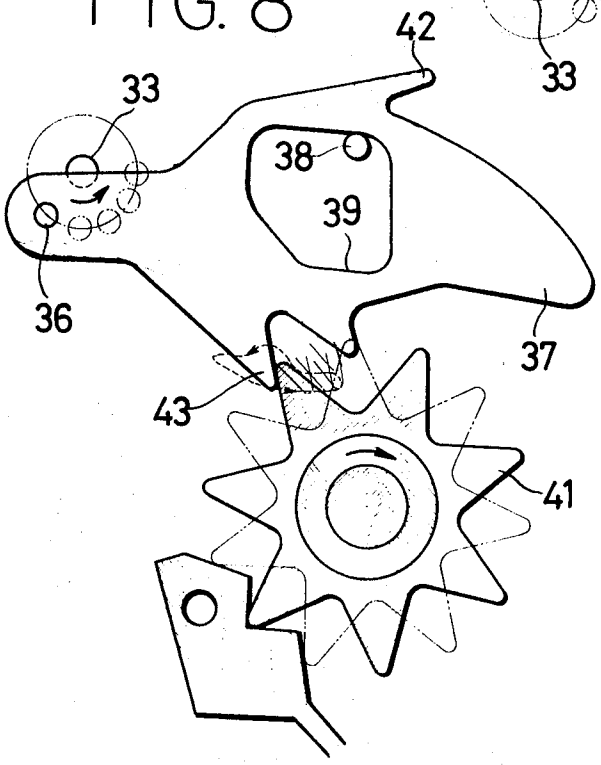
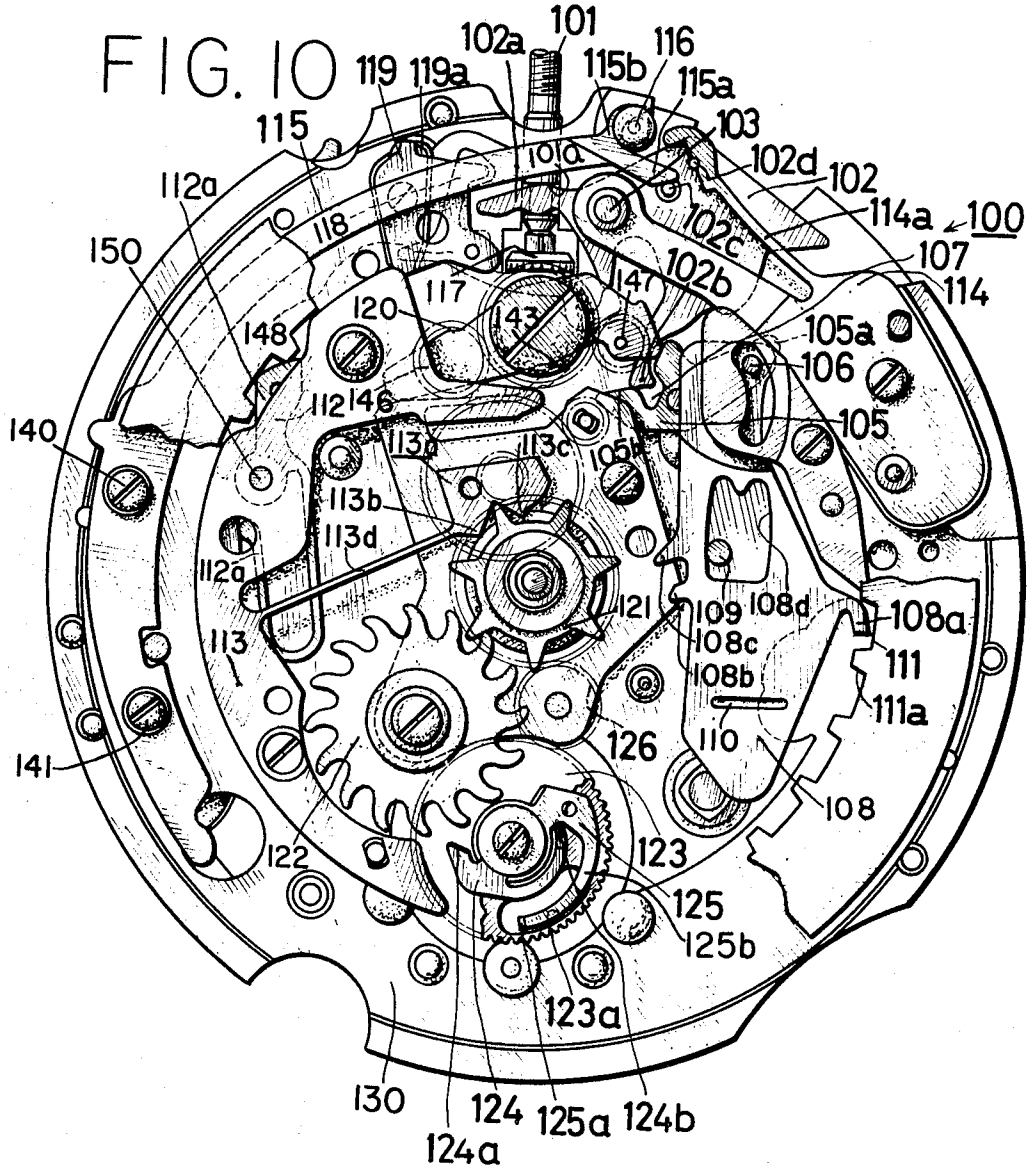


FIG. 10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115b
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119a
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112a
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102b
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113a
113c
105b
113b
113d
112a
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108d
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FIG. 11

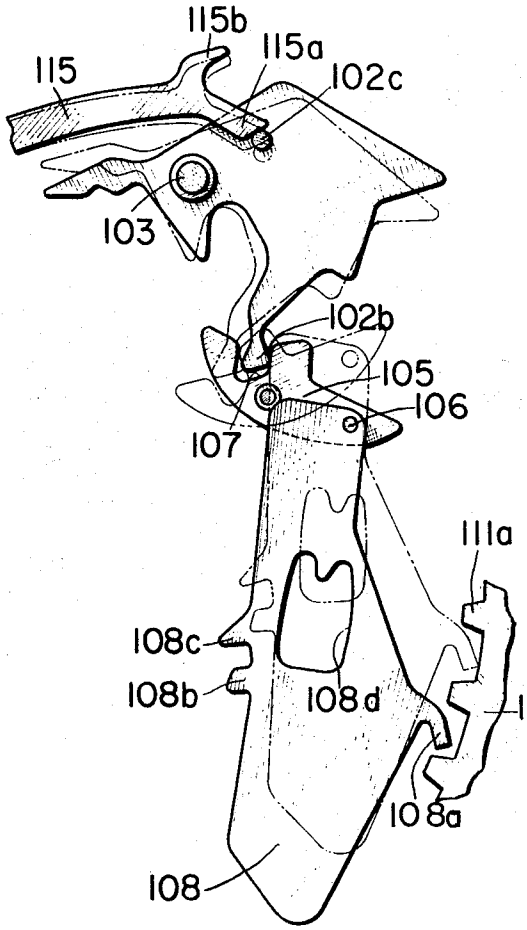


FIG. 12

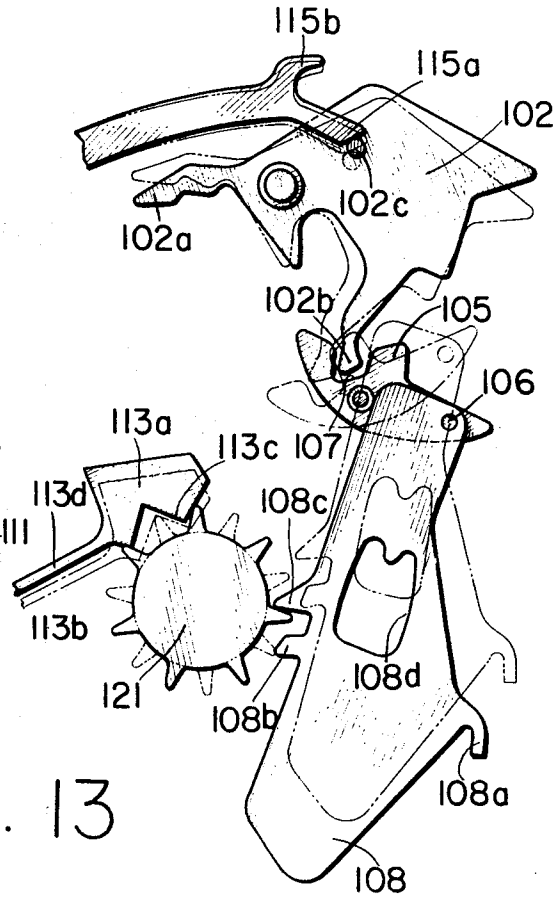
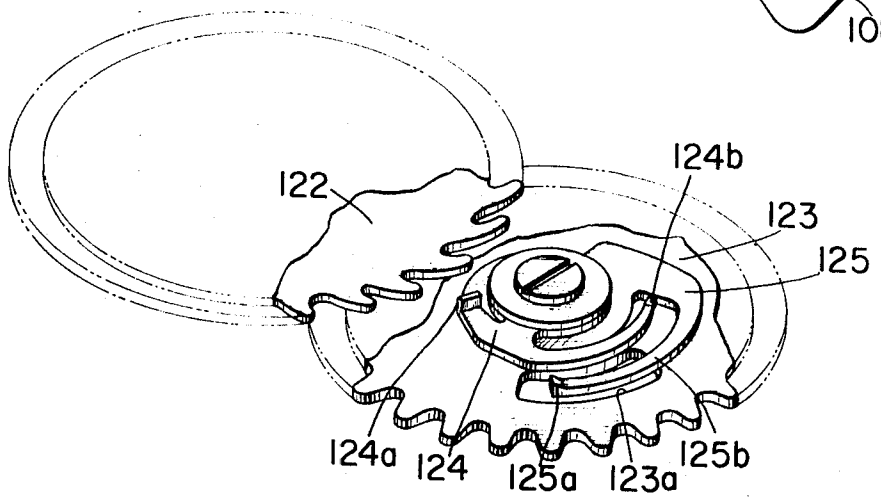


FIG. 13



SINGLE POSITION DATE OR DAY CORRECTOR WITH GRAVITY CONTROLLED CLUTCH

This invention relates to improvements in and relating to the calendar correction mechanism for a timepiece, comprising a stationary member, preferably a plate, a date calendar dial rotatably mounted thereon, a day star wheel for a day calendar dial and rotatably mounted on said plate, an elongated operating stem at least slidably mounted on said plate and motion-transmitting means provided between said operating stem, on the one hand, and said date calendar dial and said star wheel, on the other hand.

The main object of the invention resides in the provision of a unique mechanism by which the day- or date calendar correction can be automatically and mechanically switched on by alteration of the special timepiece position so as to alter the gravity-acting direction on the timepiece.

This and further objects of the invention will become more apparent as the description proceeds by reference to the accompanying drawings illustrative of several preferred embodiments of the invention.

In the drawings:

FIG. 1 is a plan view of essential parts of a first embodiment of the invention.

FIG. 2 is a plan view of several preferred parts of the first embodiment wherein a date calendar correcting operation is being carried out.

FIG. 3 is a plan view of main working parts of a second embodiment of the invention.

FIG. 4 is a schematic and simplified plan view, illustrative of a correcting operation by pulling out a manipulating member to a first stage position.

FIG. 5 is a similar view to FIG. 4, wherein, however, the manipulating member has been pulled out to its second operating position for attaining the time-setting position.

FIGS. 6 and 7 are plan views for the explanation of the date calendar-correcting operation of the second embodiment.

FIG. 8 and 9 are similar views to FIGS. 6 and 7, illustrating, however, the day calendar-correcting operation of the second embodiment.

FIG. 10 is a plan view of a third embodiment of the invention.

FIGS. 11 and 12 show several main working members of the third embodiment, for illustrating the date- and day calendar correcting operations, respectively.

FIG. 13 is a perspective view, illustrating mainly the mutual relationship among day drive wheel, date drive wheel, day drive pawl, date drive pawl and the like, as employed in the third embodiment of the invention.

Referring now to the accompanying drawings, preferred several embodiments of the invention will be described in detail.

In FIGS. 1 and 2, illustrative of the first embodiment wherein the novel teachings are applied to the correction of date and day dial displays, the numeral 1 represents a conventional date dial ring, only partially shown, having an inner teeth 1*a* and being rotatably mounted on the conventional lower plate 2, although the latter is also only partially shown and the necessary mounting means have been omitted on account of its very popularity.

A push button type operating rod 3 is shiftable axially between two points as denoted by respective full line and imaginary chain-dotted line, said rod comprising an elongated stem 3*a*, a button head 3*b* made integral therewith at its outer end, and an enlarged inner end 3*c*. This operating rod 3 can be replaced by a conventional winding stem, if necessary. The said rod 3 is slidably mounted in a conventional timepiece case which has been omitted from the drawing only for simplicity.

Numeral 4 denotes a correction lever which is pivotably mounted at 5 on the plate 2, a correction member 6 being pivotably mounted by a pivot pin 7 on the lever 4. The member 6 is formed with a date feed pawl 6*a* and a day feed pawl 6*b*, these pawl parts being thickened relative to the remaining part of the member 6, thereby providing respective weight mass effects, as will become more clear as the description proceeds.

A pressure spring means 8 comprises a leaf spring 8*a* made integral with an enlarged base portion 8*b*, the latter being detachably, yet fixedly attached to the plate 2 by means of a plurality of set screws 20 of which only one is shown as a representative one. The tip end of the leaf spring 8*a* is kept in pressure contact with said correction lever 4, so as to urge the latter to rotate in counter clockwise direction about pivot pin 5. Numeral 9 represents a conventional day star wheel which is rotatably mounted on the plate 2 by its shaft 19. Although not shown, this star wheel 9 is kept in meshing with a conventional day display dial, not shown. A conventional jumper lever 10, only partially shown, is mounted by its root portion on the plate 2 and kept by its acting tip end in pressure contact with the star wheel 9 for positioning positively each correctingly driven position thereof.

The operation of the first embodiment so far shown and described is as follows.

When the timepiece is so positioned that the gravity force acts in the lower direction as shown by arrow A shown in FIG. 1, the correction member 6 is partially rotated about its pivot pin 7 on lever 4 in counter clockwise direction in FIG. 1 (compare with the disengaged position of the member 6 shown in FIG. 2), so that the member is brought into meshing with inside teeth 1*a* on date dial 1, the representation shown in FIG. 1 corresponding to such meshing position. When, under these conditions, the operating rod 3 is manually pulled axially outwards from its full line position to chain-dotted position by gripping the pushbutton head 3*b* by a finger's end of an operator, the inner enlarged end 3*c* will act upon the correction lever 4 against the action of spring 8 in clockwise direction in FIG. 1 so that the pawl part 6*a* is shifted from its full line to its chain-dotted line position, which means that the date dial 1 is fed substantially a tooth pitch, a toggle-like action being performed whereby between the teeth 1*a* and the pivot pin 7. The thus corrected position of the dial 1 is provisionally fixed by a certain jumper lever, not shown, which is arranged to act springly upon the dial, as the jumper 10 acts upon the day calendar dial as known per se. Therefore, by repeating such pulling actions by the pushbutton rod 3 as desired, the date dial can be corrected in its display position according to the operator's will.

When the timepiece is placed substantially up-and-down from the position shown in FIG. 1 to that shown in FIG. 2, thus the gravity force acting in the direction of an arrow B in place of A, the correction member 6 is brought under gravity action into engagement with day star wheel 9.

When, under these operative conditions, the pushbutton rod is pulled as before, motion is transmitted therefrom through members 4 and 6 and pawl part 6*b* to the star wheel 9 which is fed substantially a tooth pitch, as seen clearly by comparing its full line position with its chain-dotted line one. In this newly fed position, the star wheel 9 is held firmly under the action of jumper lever 10.

When the date and day dials are driven as usual by the action of the timepiece movement, not specifically shown, in clockwise direction as usual, the correction member can recede easily and automatically from the motion-checking position, since the correction member 6 is freely rotatable and the engageable pawl parts 6*a* and 6*b* are so designed and arranged that they can easily recede from their engaging position with the teeth 1*a* and star wheel 9, when the pawls are subjected to a drive force transmitted thereto reversedly from the respective display dials.

Next, referring to FIGS. 3–5, the second embodiment of the invention will be described in detail.

The numeral 21 represents a conventional winding stem, only partially shown, a clutch wheel 22 being mounted on the stem 21 as usual and kept in meshing engagement with a setting wheel 23, as known per se. This meshing engagement is maintained by a conventional clutch lever 24. A change-over

lever 25 is pivotably mounted on the shaft 23*a* of setting wheel 23 and carries in turn a first and a second change-over wheel shown at 26 and 27, respectively, these wheels being kept in meshing engagement with said setting wheel 25.

A setting lever 30 is pivotably mounted on the conventional lower plate, not shown, of the timepiece movement by a pivot pin 28, an engaging projection 30*b* being formed integral with the setting lever and kept in engagement with a peripheral groove 21*a* formed on the stem 21 as known per se. Thus, an axial movement exerted manually on the stem 21 can be transmitted as usual to the setting lever 30 which carries a pin 31. The thus invited pivotal movement of the setting lever 30 will be transmitted through said pin 31 to the lever 25 which is caused thereby to perform a pivotal motion about the shaft 23*a*.

A correction lever 32 is pivotably mounted on a shaft 33, said lever being resiliently urged by a spring, not shown, so as to perform a counter clockwise direction when seen in FIGS. 3 and 4. A resilient and elongated end projection 32*a* is formed integrally on the correction lever, said projection being kept in pressure and resilient abutment with an end 30*a* formed on the setting lever 30.

A correction-transmitting wheel 34 is rotatably mounted on lever 32 and kept in meshing engagement with a correction wheel 35 carried by a shaft 33. A pin 36 is fixedly mounted on correction wheel 35, a correction-feed pawl 37 being pivotably mounted on said pin 36, said pawl being formed with an irregularly shaped opening 39 kept in contact with a pin 38 fixed on the lower plate. Feed pawl 37 is formed integrally with two separate pawls 42 and 43 which are adapted for engagement, respectively, with date dial 40, only partially shown, and day star wheel 41.

The operation of the second embodiment will be described hereinbelow by further reference to FIGS. 5–9.

FIG. 5 shows a relative position of main working parts when the winding stem 21 has been pushed-in to the first or regular or innermost position thereof.

When the winding stem is turned under these operational conditions, clutch wheel 22, setting wheel 23 and second change-over wheel 27 being rotated in synchronism one after another to the conventional spring barrel, not shown, as known per se.

When the winding stem 21 is pulled upwards to a predetermined second or intermediate position, motion is transmitted therefrom to setting lever 30 to rotate the latter about its pivot pin 28 in clockwise direction. Motion is further transmitted therefrom through pin 31 to change-over lever 25, thereby the latter being rotated in turn and in clockwise direction. At the same time, lever end 30*a* acts on correction lever 32 through its end part 32*a*, thereby the latter lever being pivotingly moved in clockwise direction, resulting in the engagement of first change-over wheel 26 with correction transmission wheel 34, as shown specifically in FIG. 4.

When the timepiece movement is inclined to the right or left, as the case may be, relative to a neutral line N passing through the center of pin 36 (see FIG. 3), the feed pawl 37 is rotated under gravity action about pivot pin 36 and brought into meshing engagement with date dial ring 40, only partially shown as before, or with day star wheel 41, as the case may be.

Next, the display correction of the date dial 40 will be described hereinbelow in detail.

By rotating the winding stem 21 in one or other direction, as the case may be, motion is transmitted therefrom to setting wheel 23, first change-over wheel 26, correction-transmitting wheel 34 and correction wheel 35 one after another, thereby these wheels being rotated correspondingly and in synchronism with each other. In this case, pin 36 will perform a circular movement. It should be noted that rotation of the winding stem in either direction can provide a corresponding correction without difficulty.

The operational positions shown in FIGS. 6 and 7 are illustrative of such stages of several main working parts of the second embodiments that when the pin 36 has been rotated in opposite directions, illustrating the possibility of performing the necessary corrective feed of date dial 30 for either directional rotation of the pin, resulting in specific movement of the pawl 42 by virtue of uniquely combined movement of the pin guided by contact with the peripheral guide wall surface of the irregularly shaped guide opening 39, as shown by respective chain-dotted lines shown in these figures.

Similar representations shown in FIGS. 8 and 9 are such stages wherein the day star 41, only partially shown in these figures, is being driven for performing the necessary display correction. It will be noted that again in this case, either rotational movement of the pin 36 may invite well the necessary correction of the star wheel.

In the stage shown in FIG. 5, the winding stem 21 has been further pulled outwards to its predetermined third or outermost position adapted for performing a time-setting operation when desired. With such pull of the winding stem 21, setting lever 30 is further rotated as will be noted from FIG. 5, thereby change-over lever 25 being rotated still further clockwise from the position shown in FIG. 4. On the other hand, correction lever 32 is rotated in counter clockwise direction in FIG. 5 and correction-transmitting wheel 34 is disengaged from first change-over wheel 26 which is then brought into meshing with a conventional minute wheel, not shown.

Under these conditions, a rotation of the winding stem 21 will cause a corresponding rotational movement of the first change-over wheel 26 to take place. Thus, the desired time-setting operation can be performed.

Next, referring to FIGS. 10–13, the third embodiment of the invention will be described in detail.

In these figures, numeral 100 generally denotes a wrist watch movement fitted with the calendar correction mechanism constructed in accordance with said third embodiment.

In these figures, the numeral 101 denotes a conventional winding stem which is rotatably and axially slidably mounted through a watch casing, not shown, on the conventional lower plate 130. For simplicity, necessary sealing means and bearing means have substantially omitted from the drawing, this feature being also applicable to the foregoing several embodiments.

Winding stem 101 is formed with a peripheral recess, same as before, shown at 101*a*, with which an integrally projecting part 102*a* of conventional setting lever 102 is kept in engagement, as known per se, said lever being pivotably mounted on the plate 130 by a pivot pin 103. It will be seen, therefore, that an upward or lowerward axial movement of winding stem 101 will turn the setting lever to rotate partially about its pivot pin 103 in one or the other direction, as the case may be.

Setting lever 102 is formed integrally with a further projection 102*b* which is held pivotable by means of a pin 103 fixedly mounted on the plate 130.

Numeral 105 denotes a quick correction-transmitting lever which carries a pin 106 positioned in proximity of one end 105*a* thereof. A recess 107 is formed on the lever 105 in proximity of another end 105*b* of said lever 105, said arm 102*b* being kept in cooperative engagement with said recess 107.

Setting lever 102 is further formed with a pin 102*c* which is kept in contact with one of the fork fingers 115*a* and 115*b* formed one end of an elongated curve-shaped setting lever spring 115 fixedly attached to the plate 130 by means of set screws 140 and 141. This spring 115 has such configuration and arrangement that it exerts a clockwise urging force by its forked end when seen in FIG. 10. Exertion of this clockwise urging force by the spring 115 is normally checked by the pressure contact arrangement between its another fork end finger 115*b* and a stationary pin 116 which is fixedly mounted on the plate 130. As will become more clear as the description proceeds, the said urging force will be released in case of calendar display correction and transmitted to said pin 102*c* for swiveling the setting lever 102 in counter clockwise direction in FIG. 10.

Numeral 114 represents a pressure plate which is formed with an elongated resilient arm 114*a* formed at its end portion with recess means kept in pressure engagement with a pin 102*d* fixedly mounted on setting lever 102, thereby the latter being normally kept in its suitable position destined for power spring wind-up operation, as is commonly known.

Conventional clutch wheel 117 is mounted on the winding stem 101 as before. In close proximity to the clutch wheel, a change-over lever 142 is pivotably mounted as before and carries rotatably in turn first and second change-over wheels 146 and 147. Conventional setting wheel 143; clutch lever 118; clutch lever spring 119 and its integral resilient arm 119*a* are arranged as conventionally.

Quick correction lever 108 is pivotably mounted on said pin 106, said lever 108 being shaped into a kind of gravity-actuated pendulum and formed at its both sides with pawls 108*a* and 108*b*; 108*c*, respectively, which are adapted for engagement with the inside teeth 111*a* of date calendar dial ring 111 and day star wheel 121 having seven radial teeth, respectively.

Quick correction lever 108 is formed with a guide opening 108*d* and a stationary pin 109 fixedly mounted on the plate 130 projects into said opening and kept normally in contact with the peripheral wall thereof for limiting the range of pivotal movement of the quick correction lever 108.

As seen, this lever 108 is formed in proximity of its free or depending end with a horizontally extending, pressed-in recess 110 the rear surface of which is kept in slidable contact with the surface of the plate 130, so as to minimize the frictional resistance during pivotal movement of the correction lever.

As was referred to above, the date calendar dial ring 111 is fitted with inside teeth 111*a* which are formed along its whole inside peripheral surface, said dial ring being rotatably mounted on the plate 130 through a number of antifriction balls, rollers and the like conventional means known per se, although not specifically shown.

A jumper lever 112 is pivotably mounted on the plate 130 by means of a pivot 150 fixedly mounted thereon, a spring projection 112*a* of the jumper lever being kept in pressure contact with the dial ring teeth 111*a* for exerting a slight spring pressure thereon and thus firmly holding each corrected position of the date dial ring 111. Said jumper lever 112 is formed with a U-shaped spring projection 112*b* the extreme free end of which abuts against a part of the plate 130.

Numeral 113 denotes a checking member which is adapted for checking disadvantageous vertical movement of jumper lever 112, setting lever 114 and the like. The vertical movement is meant by that which directs perpendicular to the drawing paper. A further jumper lever 113*a* to be described is made integral with the checker 113, the jumper 113*a* comprising a spring arm 113*d* and adapted for exerting springy checking action upon the day star wheel 121 so as to positively, yet provisionally positioning the latter at each adjusted position thereof.

At the center of the watch movement, said star wheel 121 is rotatably mounted on the plate 130 and kept in meshing with a day dial driven wheel 122 equally mounted rotatably on the plate 130. As shown, the star wheel is provided with seven radial teeth or projections corresponding to a week.

The teeth of day drive wheel 122 is arranged to be engaged intermittently by a rising tooth projection 124*a* formed on the free end of day drive pawl member 124 which is arranged concentrically with said wheel 123, thereby the wheel 122 being adapted for being driven. By this arrangement, the star wheel can be rotated when desired.

Day drive wheel 123 is provided with a date drive pawl 125 comprising an elongated resilient arm 125*b* having a rising end part 125*a*, in addition to and at a somewhat lower level from that of said day drive pawl 124.

The resilient arm 125*b* extends partially over an elongated and curved slot 123*a*, so as to be driven by its tip portion into the latter when received a downwardly urging force exerted by any one of inside teeth 111*a* upon contact thereof with said rising tip end 125*a*, as met in the course of a date-correcting operation to be described.

Day drive pawl 124 is formed with an end portion 124*b* opposite to said rising end 124*a*, said portion 124*b* being bent downwards slightly and being kept in abutment with date driven pawl 125.

When the watch movement operates in normal way for time-keeping purposes, torque is transmitted from a barrel spring, not shown, through part of the regular time-indicating gear train, not shown, and said day drive transmission wheel 126 to day drive wheel 123 so that the latter is rotated at a constant rate in clockwise direction in FIG. 10, thereby both pawls 124 and 125 being rotated correspondingly, to feed the day- and date calendar dials, respectively.

When corrections for both calendar dial indications should be made under such conditions that the end parts 124*a* and 125*a* are situated in respective tooth gaps, and in the manner to be described, so that the calendar dials are rotated rather rapidly, motion will be transmitted from star wheel 121 through wheel 122 to the rising end 124*a* which is thus subjected to a clockwise turning torque so that the end part 124*b* will recede from contact with the date drive pawl. On the other hand, a certain tooth of date dial 111 will be brought into pressure contact with end part 125*a* from behind thereof, the latter will descend a small distance from engagement with the related dial tooth 111*a*. Therefore, the desired calendar corrections in both senses can be effected without troubles even under the specifically difficult operating conditions as referred to above.

When it is desired to perform a quick date calendar correcting operation, a manual finger pressure is axially applied to the winding stem 101, so as the watch movement 100 is positioned so that the right-hand side thereof, when seen in FIG. 10, directs downwards, so that pawl 108*a* on the member 108 may be brought into engagement with dial teeth 111*a* under the influence of gravity action upon the member 108. Thus, it will be seen that the member 108 acts as a kind of gravity-operated clutch member.

Next, a manual finger pressure is applied axially upon the outer end or head of winding stem 101 for depressing the latter, so as to shift the setting lever 102 from its chain-dotted line to full line position in FIG. 11.

By this operation, the setting lever is rotated in counter clockwise direction in FIG. 11, thereby pin 102*c* urges setting lever spring 115 to move in counter clockwise direction therein against its owned biasing force, while arm 102*b* of the lever 102 kept in engagement with a recess 107 formed on lever 105 is brought into pressure contact with the right-hand side wall of said recess so that quick correction-transmitting lever 105 is rotated in clockwise direction. In this way, pin 106 on the opposite end of said lever 105 is subjected to such rotational effort as to shift the lever 108 downwards in FIG. 11. Therefore, the dial 111 is shifted substantially a tooth pitch in its feeding direction.

Upon release of the finger pressure from the winding stem, the setting lever is returned to its chain-dotted line position in FIG. 11 under the influence of the biasing force so that levers 105 and 108 and the like working parts of the mechanism can be restored their initial position. By repeating the depressing operation of the winding stem referred to above, any desired degree of correction can be performed.

When it is desired to perform a day calendar correcting operation, the watch movement is so positioned that the left-hand side thereof directs downwards, so as to bring the gravity-operated clutch element 108 swivels in the opposite direction to that in the case of the date calendar correction. By this preparatory operation, either of the projections 108*b* and 108*c* is brought into engagement with one of the teeth on day star wheel 121. Therefore, a reciprocating operation of the winding stem will feed the star wheel by a half tooth pitch, as most clearly be seen from FIG. 12. By a next reciprocating operation of the winding stem, the other of the tooth projections 108*b* and 108*c* will become effective to engage the star wheel and feed it the remaining half tooth pitch.

By performing a number of said stem reciprocating operations, the day calendar dial can be adjusted as desired. This

two stage feed for the star wheel is highly advantageous to represent the day displays on the latter dial can be effected in two different languages such as English and German alternatively provided on the day dial.

Upon release of the finger pressure from the winding stem, the main working parts of the correction mechanism can restore automatically their initial position.

The embodiments of the invention in which an exclusive property or privilege is claimed are as follows:

1. A calendar correction mechanism for a calendar timepiece, comprising a stationary member, preferably a plate, a date calendar dial rotatably mounted thereon, a day star wheel for a day calendar dial and rotatably mounted on said plate, an elongated operating stem at least slidably mounted on said plate and motion-transmitting means provided between said operating stem, on the one hand, and said date calendar dial and said star wheel, on the other hand, said correction being characterized by a gravity-operated clutch provided in said transmitting means for selectively cooperating either of said dial or said star wheel depending upon the acting direction of gravity force upon said timepiece.

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