United States Patent

Tsuzuki et al.

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[54] **CALENDAR TIMEPIECE WITH MONTH ADVANCEMENT MECHANISM FOR 29, 30, OR 31 DAY MONTHS**

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[52] **U.S. Cl.**.....**58/58,** 58/5
[51] **Int. Cl.**.....**G04b 19/24**
[58] **Field of Search**.....58/4, 5, 6, 58

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[57] **ABSTRACT**

A calendar watch comprising a date calendar display dial, a month calendar display dial and a date feed wheel, all being rotatably mounted on the movement of said watch, said wheel being driven by said movement for performing a complete revolution per 24 hours, said watch being characterized by that a spring-loaded pawl means for performing an automatic month end date feed operation to said date display dial is pivotably mounted on said wheel.

1 Claim, 7 Drawing Figures

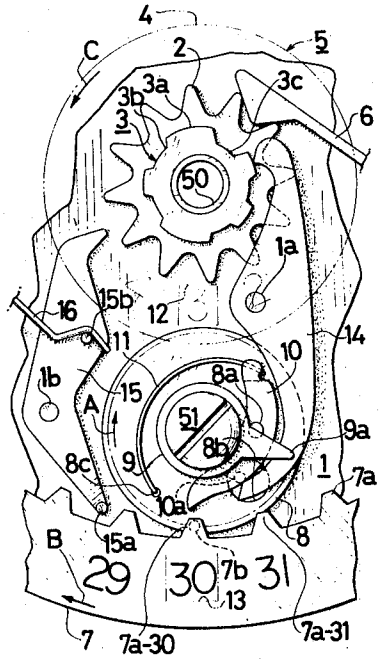

FIG. 1

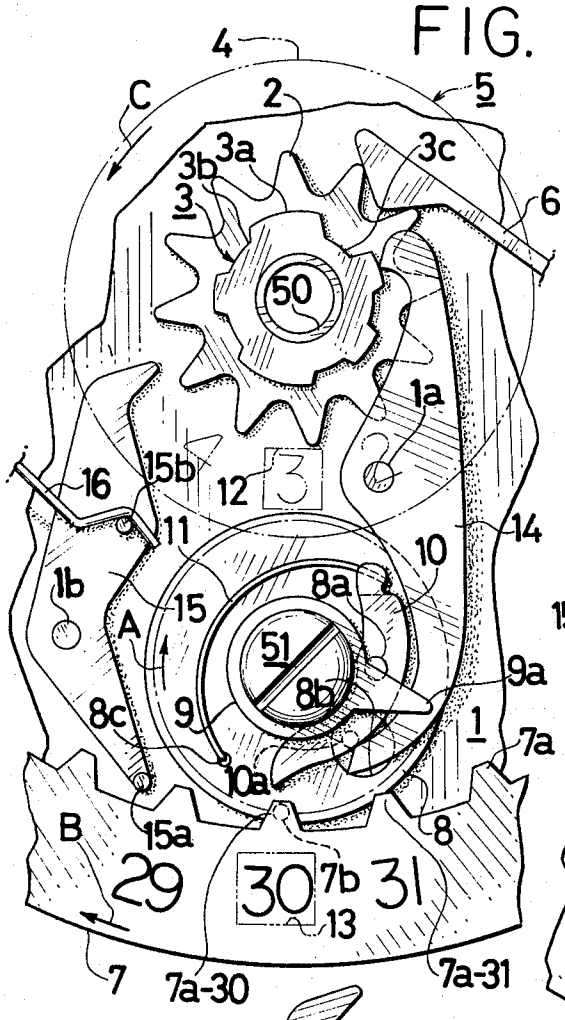

FIG. 2

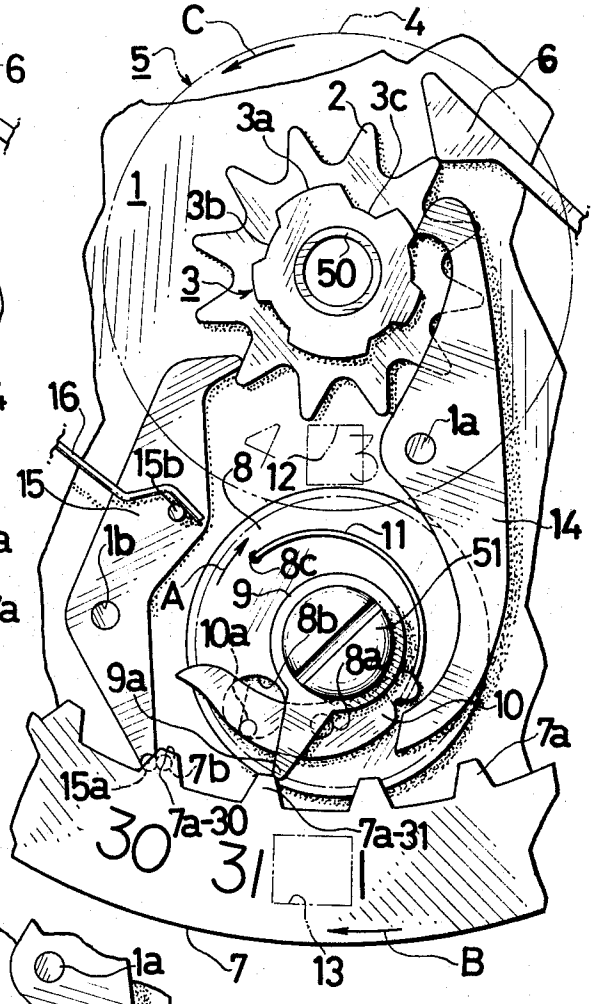

FIG. 5

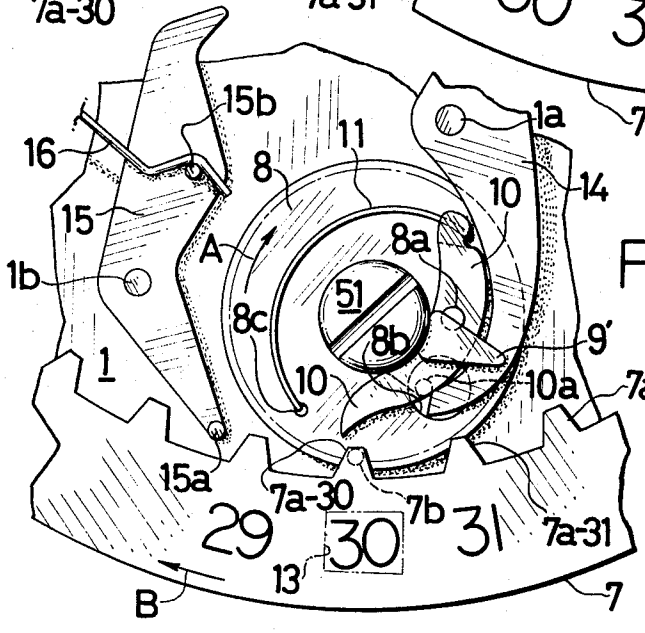

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FIG. 3

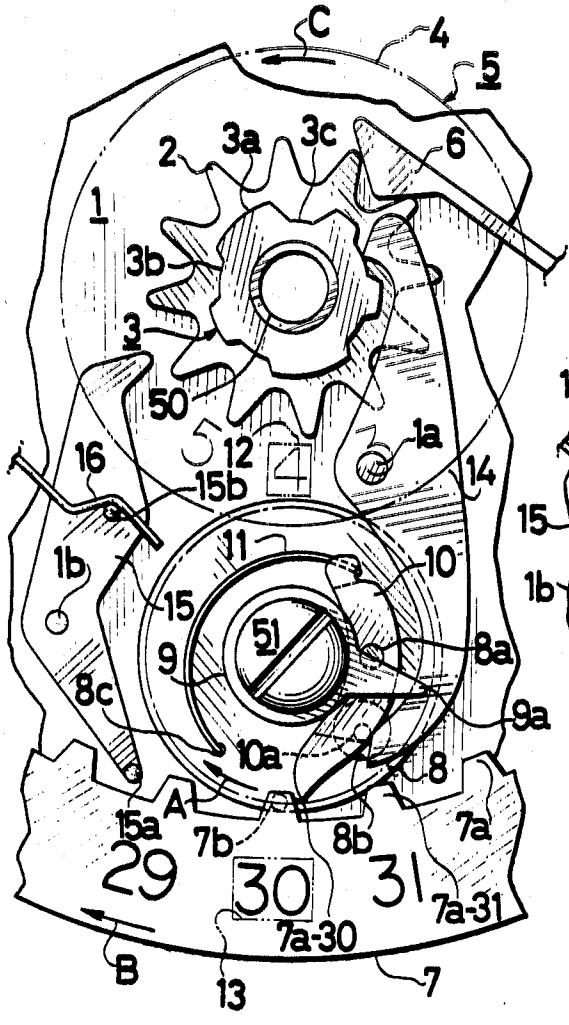
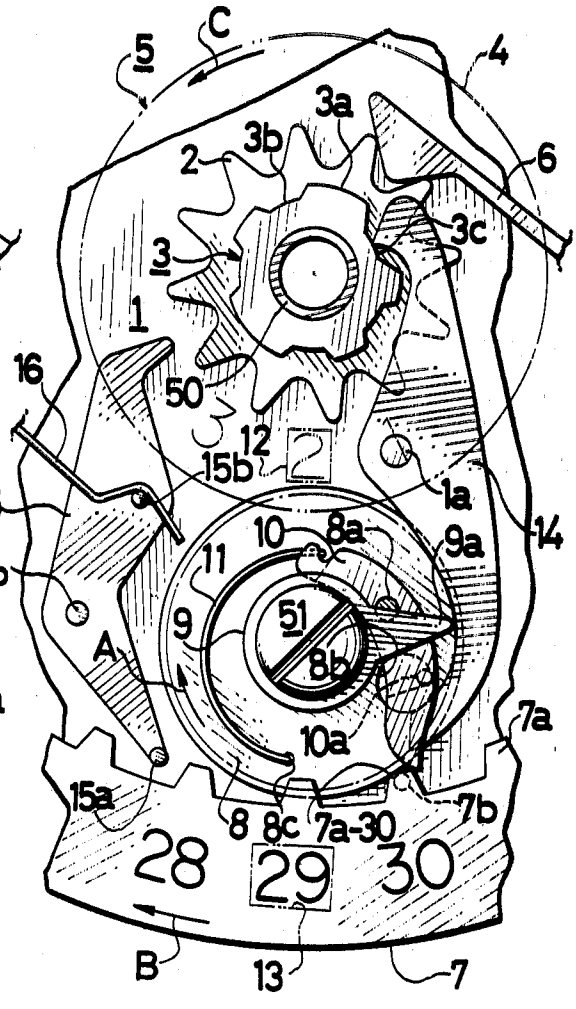

C
4
5
2
3a
3c
6
1
3b
3
50
12
4
1a
16
15b
14
11
10
1b
15
51
8a
9
9a
8c
10a
8
A
15a
7b
8b
7a
29
30
31
7a-31
7a-30
B
13
7

FIG. 4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C
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3b
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3c
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50
12
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15b
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15
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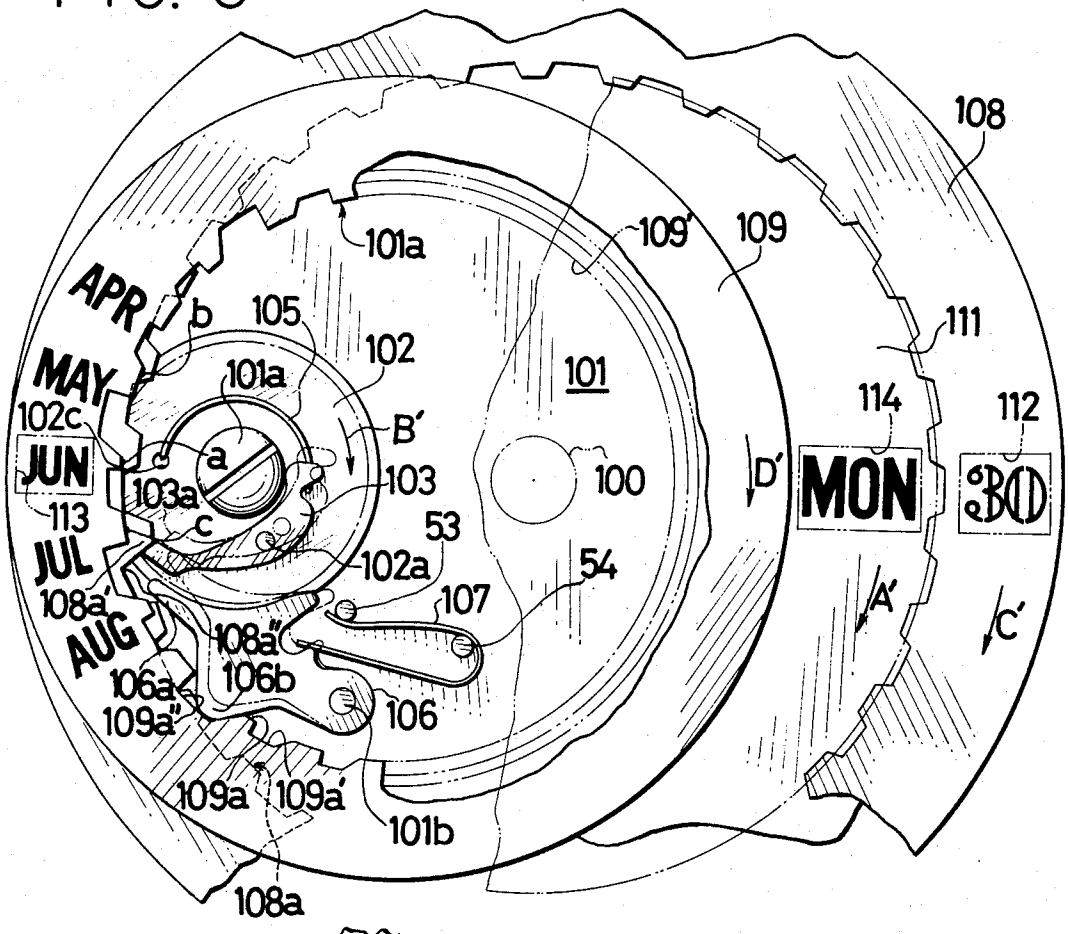
8a
9a
11
1b
9
51
8b
A
7a
10a
15a
8
8c
7a-30
7b
28
29
30
B
13
7

FIG. 6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101a
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MAY
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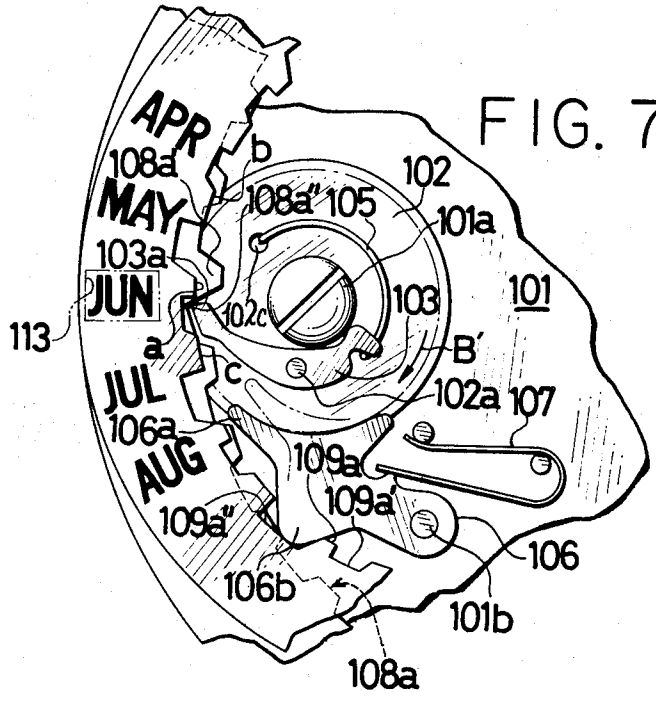
101
114
112
102c
B'
JUN
a
103a
103
100
D'
MON
BCD
113
c
53
JUL
102a
54
108a'
107
A'
C'
AUG
108a"
106a
106b
109a"
106
109a
109a'
101b
108a

FIG. 7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JUL
102a
107
106a
AUG
109a
109a'
109a"
106
106b
101b
108a

CALENDAR TIMEPIECE WITH MONTH ADVANCEMENT MECHANISM FOR 29, 30, OR 31 DAY MONTHS

This invention relates to improvements in and relating to calendar timepieces. More specifically, it concerns with an improved calendar feed mechanism in a calendar timepiece.

The conventional calendar timepiece is generally so designed and arranged that its calendar feed mechanism comprises a date calendar dial representing date symbols of a large month consisting of 31 successive days and fed a date division per day when the timepiece movement operates regularly. Therefore, it is necessary to correct the date calendar dial manually at the end of every small month and February, so as to bring the first date symbol "1" visible through the transparent date window provided on the timepiece.

In order to obviate such frequently required troublesome calendar corrections at month ends, various improved date calendar feed mechanisms have already been proposed. A representative and simplest mechanism of this kind comprises a lever pivotably mounted on the plate of the timepiece movement and adapted for being operationally controlled in its pivotal movement by certain cam means destined for performing the descriminative operation between the larger months and smaller months including February. The pivotal movement of said lever for feeding the date calendar dial is performed larger or lesser depending upon the longer or shorter length of the months, respectively. Even in the above kind simplest design of the date feed mechanism, the pivotable lever has comparatively larger overall dimensions and requires further a large space area for allowing the lever to oscillate in the required manner. In addition, there must be provided a relatively strong return spring for the pivotable lever which imposes a substantial counter torque against the regular movement of the timepiece movement. In this prior proposal, said lever is arranged between the date feed wheel and the date calendar dial so that a corresponding reduction in transmission efficiency will be encountered in comparison with the common date feed mechanism wherein a direct drive is performed from the date feed wheel to the dial and thus no reliance is made upon the intermediate transmission lever. It is highly difficult to fit the above kind of feeding lever in a modernized watch which must be miniatured as possible and have a smallest overall thickness as possible. Especially, when a concentrically arranged, ring-shaped date calendar dial is used with the above kind mechanism of the prior proposal, the disadvantageous effect of the larger pivoting stroke of the lever will be still further accentuated.

It should be noted that the term "large month" as used herein throughout the specification and appended claims means the regular odd calendar month which consists of thirty one successive days.

In the similar way, the term "small month" as used herein means the regular even calendar month which consists of thirty successive days.

A main object of the invention is to provide an improved date calendar feed mechanism capable of obviating the troublesome calendar correcting operation at each of the small months and providing an easy adaptability to a watch.

A further object is to provide the date calendar feed mechanism of the above kind, capable of consuming a relatively small amount of energy for feeding the date calendar dial.

Still further object is to provide the feed mechanism of the above kind representing a relatively simple design and having only a small number of constituent parts and being easy to manufacture and highly reliable in its operation.

These and further objects, features and advantages of the invention will become more apparent when read the following detailed description of the invention by reference to the accompanying drawings illustrative of several preferred embodiments of the invention.

In the drawings:

FIG. 1 is a schematic and partial plan view of the date dial feed mechanism built in accordance with a first embodiment of the invention wherein, however, the date dial is positioned

to show the 30th day of a large month and the regular time-indicating gear train and its related several working parts have been omitted from the drawing only for simplicity.

FIG. 2 is a similar view to FIG. 1 wherein the dial is positioned at its transient position from the 31st day of the large month to the 1st day of a next succeeding month for showing the mode of dial feed at such transient period.

FIG. 3 is a similar view to FIG. 1 wherein, however, the dial is positioned at its display position corresponding to the end of a small month.

FIG. 4 is a similar view to FIG. 1 wherein, however, the dial is positioned in its further display position corresponding to the final date of February.

FIG. 5 is a similar view to part of FIG. 1, illustrating, however, a slight modification of the first embodiment.

FIG. 6 is substantially similar view to FIG. 1, showing, however, a second embodiment of the invention, wherein the date dial is positioned for display of the 30th day of June.

FIG. 7 is a similar view to part of FIG. 6, wherein the related parts of the dial are positioned at their position when seen upon one tooth feed of date dial having been performed from the position shown in FIG. 6.

Referring now to FIGS. 1–4, the first embodiment of the invention will be described hereinbelow in detail.

Numeral 1 denotes a conventional plate of a watch movement, said plate being shown only partially for simplicity. Although the plate 1 is formed with a number of milled recesses and drilled openings for mounting several conventional parts as commonly known, these have also been omitted from the drawing again for simplicity. Month star wheel 2 has 12 peripheral teeth formed thereon and is rotatably mounted as conventionally on a conventional hour wheel. A month-discrimination cam 3 is fixedly and concentrically mounted hour wheel 50, said cam being formed on its periphery with five separated high portions 3*a* two of which have each a doubled peripheral length than the remaining. Therefore, this means that there are in effect seven such high portions corresponding seven large month: January, March, May, July, August, October and December, of a year round; four separate middle height portions 3*b* corresponding to April, June, September and November; and finally, a single lowest portion 3*c* corresponding to February.

Month display dial 4 shown only in chain-dotted line and carrying thereon 12 successive month display numerals of which only 2, 3 and 4 are representatively shown and others have been omitted from the drawing for simplicity, is concentrically and fixedly mounted on the cam 3. As seen from the foregoing, these parts 2, 3 and 4 are arranged to be rotatable in unison with each other. In this way, these parts 2, 3 and 4 constitute in combination a rotatable month plate unit 5.

A springy jumper lever 6 is normally kept in pressure contact with the periphery of said month star wheel 2, said jumper being fixedly mounted by its root portion, for instance, by means of set screws on the plate 1, although it is shown only partially for convenience and the fixingly mounting means have been omitted from the drawing only for its popularity and simplicity.

A ring-shaped date calendar dial 7, only partially shown for convenience, is mounted rotatably on the plate 1 as conventionally, although the mounting means have been omitted from the drawing on account of their very popularity. This dial 7 carries thereon successive 31 numerals: 1, 2, . . . 30, 31 corresponding to 31 days contained in a large calendar month, although only 29, 30 and 31 of which have been shown as representative, said dial being formed with 31 inner teeth 7*a* corresponding to said 31 days.

One of these inner teeth 7*a* which corresponds to the numeral 30 and denoted specifically with 7*a*–30, is formed with a projection 7*b*, preferably by a press job, and adapted for performing an automatic month-end feed of the date dial 7 by cooperation with a month feed lever 15, as will become apparent as the description proceeds. Although not shown, a jumper is pivotably mounted on the plate 1 so as to hold provi-

sionally the date dial 7 by pressure contact therewith, in the similar way of the foregoing jumper 6 relative to month star wheel 2.

Numeral 8 represents only schematically a conventional date feed wheel which is rotatably mounted on plate 1 by means of a stepped stud 51. This wheel 8 is kept in engagement with a member of the regular gear train, not shown, of the watch movement and performs a complete revolution per 24 hours in clockwise direction as hinted by an arrow "A". A first feed pawl 9 is fixedly and concentrically attached to the date feed wheel 8, a second feed pawl 10 is being pivotably mounted on the same wheel 8 around a pivot 8*a* rigid therewith. A wire spring 11 is provided for urging the second feed pawl to turn counterclockwise. For this purpose, one end of the spring 11 is held in a retaining opening 8*c* formed in the wheel 8, while the opposite end of the spring is held in position by engagement with the tail part of the second pawl 10. And the actuating end at 9*a* of the first feed pawl 9 is adapted for driving engagement with one of the teeth 7*a* of the dial 7, so as to feed it a tooth pitch per 24 hours. On the other hand, pawl 10 is provided with a depending pin 10*a* which is positioned within the teritory of a circular opening 8*b* formed through the wheel 8, thereby the movable range of second pawl 10 being properly limited.

Numeral 12 and 13 represent in phantom manner a month- and a date display window formed on the conventional time-indicating dial plate, not shown, to the watch movement.

A month discriminator lever 14 formed into a bell crank lever is pivotably mounted on a pivot pin 1*a* studded on plate 1, one arm of said lever being kept in pressure engagement with the periphery of cam 3 and the other arm being kept in pressure contact with second feed pawl 10 for controlling the working mode of the latter, as will be described more fully hereinafter.

The discriminator lever 14 is so designed and dimensioned that when its upper or motion-receiving arm is brought into contact with one of the high parts 3*a* of cam 3, the lever is urged to swivel clockwise and the lower or actuating arm of the lever will act upon second feed pawl 10 to swivel a certain degree in clockwise direction against spring force at 11 thereby the pawl being receded from contact with the tooth 7*a* of date dial 7 as shown in FIG. 1.

On the contrary, when the motion-receiving arm of lever 14 is brought into contact with either of middle height portions 3*b* or lowerst portion 3*c* of cam 3, the lever 14 is swiveled counterclockwise from the position shown in FIG. 1, the second feed pawl 10 being thereby brought into its operating position ready for engagement with the tooth 7*a* on date dial 7.

A month feed lever 15 formed again into a bell crank lever, is mounted pivotably on a pivot 1*b* which is studded on plate 1. On the lower or actuating arm of lever 15, there is provided an actuating pin 15*a* formed rigidly therewith and capable of engaging with said month-end feeding projection 7*b* on the tooth 7*a*–30. A stop pin 15*b* is further formed rigidly on lever 15 and receives the urging end of a spring 16 which is only schematically and partially shown. The root end of this spring 16 is fixedly attached onto the plate 1 by means of set screws, although not shown. By the provision of these spring 16 and stop pin 15*b*, the lever 15 is held normally in position shown in FIG. 1.

With advancing rotation, shown by an arrow "B", of date dial 7, the pin 7*b* thereon will be brought into engagement with the pin 15*a* on lever 15 so that the latter is urged to swivel in clockwise direction from the position shown in FIG. 1, thereby the month-feed star wheel 2 being turned counterclockwise by such angle which corresponds to a calendar month. Upon disengagement of pin 7*b* from pin 15*a*, the spring force at 16 will become effective again and the lever 15 will be returned back to its stable position shown in FIG. 1.

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

When the watch movement, not shown, operates regularly, first date feed pawl 9 fixedly mounted on the date feed wheel 8 which is driven to perform a complete revolution per 24 hours will act upon date dial 7 through on of its inner teeth 7*a* to advance the dial by a tooth pitch corresponding to a calendar day for the alteration of the day display visible through the day window 13, when the calendar time does not corresponds to a month's end and irrespective of the occasional positioning of second date feed pawl 10.

When it is now assumed that the calendar time is a certain date of March, for instance, which is naturally a large month, the motion-receiving arm of discriminator lever 14 is kept in contact with one of high portions 3*a* on the cam 3, as shown in FIG. 1. With rotation of date feed wheel 8 under these operational conditions and as the second date feed pawl 10 comes at the proximity to date dial 7, the pawl is urged by discriminator lever 14, thereby the lower or actuating end of said pawl 10 receding from its working position towards the center of wheel 8. Under these conditions, the actuating end of pawl 10 can not be brought into engagement with the feed projection or pin 7*b* on the specific tooth 7*a*–30, even at the end of the month of March. Therefore, in this case, first date feed pawl 9 alone operates to feed the dial 7 tooth by tooth per day, as in the regular way as above mentioned.

In the transient period from the 31st day of the month to the first day of the next succeeding month or April as shown in FIG. 2, the month-end feeding projection 7*b* will act upon the month-feed lever 15 through its pin 15*a* and thus, the lever is swiveled clockwise, thereby star wheel 2 being fed a tooth pitch corresponding to a month concurrently in the direction shown by an arrow "C". The star wheel 2 is held firmly in position under the action of jumper lever 6, so as to display the number of the next month or April through the viewing window 12. Discriminator cam 3 is also rotated concurrently and the month-discriminator lever 14 is brought finally into contact with the specifically attributed one of middle height portions 3*b* on the cam 3 to the calendar April. Thence, the projection 7*b* will pass over the pin 15*a* and month-feed lever 15 is returningly brought into its stabilized off-service position under the influence of spring force at 16.

In the course of a small month such as April, the lever 14 is kept in contact with a specifically attributed one of middle height portions 3*b* on discriminator cam 3, as shown in FIG. 3. Therefore, the lower or actuating end of second date feed pawl 10 is shifted nearer towards the toothed periphery of dial 8 than before. Under these conditions, when the projection 7*b* is brought to its position shown in FIG. 3 where the date display of "30 " on dial 7 is visible through date window 13, the pawl 10 will act upon the projection 7*b*, so as to perform automatically a month-end feeding operation. Thus, the dial 7 is fed a calendar day to show now a further advanced date display of "31". Next, first date feed pawl 9 acts upon the dial 7, so as to feed it still a further calendar day, thus the next succeeding date display of "1" of the next calendar month being visible at the window 13. Concurrently, and in the similar way as described above in the case of large month, month star wheel 2 is fed a tooth pitch under the action of month feed lever 15. The discriminator cam 3 rigid with star wheel 2 will be correspondingly rotated, until discriminator lever 14 will have been brought into engagement with a specifically attributed one of high portions 3*a* on said cam 3, to the next succeeding calendar month or May, in this preferred example.

In the course of the smallest calendar month or February, discriminator lever 14 is kept in contact with the sole lowest part 3*c* on cam 3 and the pawl 10 is further swiveled counter clockwise from the foregoing position under the influence of spring force at 11. At arrival of the 29th day of February, the pawl 10 starts definitely to engage the pin 7*b* and then feed the dial 7 successively two calendar days, so as to display of 31st day of the same month through the window 13. (See, FIG. 4.) Then, the first date feed pawl 9 is brought into actuation to feed the dial 7 still a further calendar day so that the display "1" corresponding to the first calendar day of the next suc-

ceeding month or March is presented through the window **13** to a viewer. In the course of the transient period from the 31st to the 1st calendar display, month display dial **4** is also fed by a step corresponding to a calendar month. Therefore, the viewer can observe the next following month display "3" which corresponds to the calendar month: March through display window **12**. Therefore, no manual calendar correction must be needed at the end of February of each leap-year. Such manual correction must be carried out only at the end of February, if the year is of the common.

Under occasion, month star wheel **2** can be so modified that the tooth valleys formed between successive tooth projections thereof represent three different radii as measured from the center of the star wheel, as in the similar way to the specifically designed peripheral undulations formed on the discriminator cam **3**, the star wheel can perform the service of the latter, in addition to its own month feed operation, although not specifically shown.

The first and second date feed pawls **9** and **10** are so modified in their design and arrangement to perform their dial feed operations in the reversed successive order from that employed in the foregoing embodiment, although not shown on account of easy occurrence to any person skilled in the art when he has read the foregoing description.

In addition, when necessary, the month display dial **4** can be dispensed with by placing the month display symbols or numerals directly on the discriminator cam.

In order to reduce the amount of energy consumed at every calendar correcting operation, the mechanism can be so modified that at the end of February two successive and automatic date dial feed steps are introduced as at every small or even month in the foregoing embodiment. Or alternatively, the mechanism can be modified, only a single date correcting step is performed at the end of February, as performed at the end of every large or odd month in the foregoing embodiment.

In the modified arrangement shown in FIG. **5**, the first date feed pawl at **9'** is fixedly mounted, as by welding or the like conventional fixing measure, on the second date feed pawl **10**. As may be easily understood from the foregoing description, the engaging degree between the tooth **7***a* and the first feed pawl **9'** is not subjected to alteration practically in any way even with pivotal movement of the second feed pawl **10**, this modified first pawl **9'** can perform the same operational function as before. Structural and operational features of other parts appearing in FIG. **5** are substantially same and thus denoted with same respective reference numerals as before regardless of occasional minor difference in configuration.

Next, referring to FIGS. **6** and **7**, second embodiment of the invention will now be described hereinbelow.

In this embodiment, numeral **101** represents the conventional plate of a watch movement and is shown partially and in a simplified form as before. A date feed wheel **102** is rotatably mounted on the plate **101** by means of a shaft **101***a*, preferably formed into a stepped screw, said feed wheel being adapted for performing a complete revolution per 24 hours in the direction shown by an arrow B', since it is kept in cooperation with a certain proper member of the conventional time-keeping gear train, not shown, of the watch movement.

Date feed means comprising a pivotable date feed pawl **103** and an urging wire spring **105** are mounted on the wheel **102**, said pawl being pivotable around a pivot pin **102***a* studded on the wheel. One end of said wire spring **105** is held in position by being received in a retaining hole **102***c* formed in said wheel **102**, while the opposite end of spring **105** is kept in engagement with the upper or idle arm of pawl **103** for urging the latter to rotate in counter clockwise direction in FIG. **6**. In this way, the pawl **103** is normally held in its contacting position with the shaft **101***a* and occupies a most offset position in its counter clockwise swiveling position as shown in FIG. **6**. Although not specifically shown, the pawl **103** has a thickness enough for engagement with date calendar dial **108** and month calendar dial **109**.

A discriminator lever **106** is pivotable around a pin **101***b* which is studded on the plate **101**, and formed with a projection **106***b* at an intermediate position between pivot pin **101***b* and the free end **106***a* of the lever.

A wire spring **107** is provided which acts upon the lever **106** so as to urge the latter to swivel normally in counter clockwise direction. In this way, the spring **107** can act as a jumper for month calendar dial **109** to be described more in detail. This spring **107** is kept in position by means of a pair of positioning pins **53** and **54** which are studded on the plate **101**.

A ring-shaped conventional date calendar dial **108** is rotatably and concentrically mounted on the plate **101** and carries thereon a series of calendar date display symbols 1–31 of which only the symbol "30" corresponding to the 30th day of a month is representatively shown. This dial **108** is formed with 31 inner teeth **108***a* corresponding respectively to the 31 date display symbols.

One of the inner teeth **108***a* which corresponds to the 31st calendar day and is specifically demonstrated by attaching with a primed reference **108***a'*, has been designed to have a larger tooth height than others. As seen, the tooth bottom **108***a''* defined between the high tooth **108***a'* and a next following tooth **108***a* corresponding to the first day of the next calendar month is designed to have a lower bottom than others, said high tooth adapted for acting as a month-end feed projection as will become more apparent as the description proceeds.

Numeral **109** represents a month display dial acting however simultaneously as a month-discriminator cam, and carrying thereon two successive series of month display symbols covering 24 successive months and is rotatably mounted on the plate **101** by means of conventional shaft and bearing means, not shown. The rotating center of the dial **109** is positioned on a diameter which passes through the center of shaft **101***a* and the bearing center **100** of date dial **108** and the month dial or cam is mounted eccentrically relative to the latter and the watch movement as seen from the drawing.

The month dial or cam **109** is formed with **24** successive inner teeth **109***a* having a tooth pitch substantially similar to that of those at **108***a* on the date dial. As will become more apparent as the description proceeds, the tooth gaps of the teeth **109***a* is modified so as to provide the month-discriminating cam function. More specifically, the bottom **109***a'* for each of the teeth corresponding to the large or odd months has a smaller height as measured from the tooth top, and represents a shorter tooth gap length than those at **109***a''* attributed to each of the teeth to the small or even months, thereby providing a kind of discriminator cam means.

The projection **106***b* on month discriminator lever can advance into the tooth gap **109***a*. In the even month, the lever projection is brought into a deeper engaging position as shown in full line shown in FIG. **6**, while in the odd month, it will occupy its off-engagement position as shown in chain-dotted line in the same figure.

In the large or odd month, the lever end **106***a* will occupy a position situated within the actuating zone of the pawl end **103***a* when the pawl **103** is positioned at its utmostly counter-clockwise swiveled position. On the other hand, in the small or even month, the lever end **106***a* will be positioned at its receded position from the actuating zone of pawl end **103***a*.

Therefore, it will be seen from the foregoing that the month display dial **109** can serve for the following three different functions:

1. month feed operation by its own in cooperation with pawl **103**;
2. jumper action for its own and in cooporation with lever **106**;
3. position control of month discriminator lever **106**.

For these purposes, the inner teeth **109***a* are designed to have different tooth gaps and different tooth bottom heights as referred to above.

It should be noted at stage that both calendar display dials **108** and **109** are so arranged that the dedendum circle, not

shown, of inner teeth **108***a* on the date dial **108** and the addendum circle **109'** of inner teeth **109***a* of month dial **109**, having naturally different radii of curvature from each other, overlap with each other at least within the operational range of the date feed pawl **103** and that the circle described by the tip end of the latter intersects each of said addendum and dedendum circles at two different points, although not shown, said points being positioned substantially in an overlapped way when seen relative to the both calendar dials on the drawing. It should be further noted that between each pair of said intersection points, the addendum circle establishes a tangential relationship to the dedendum circle or occupies a slightly outer locus position outside the latter. In other words, the tip of each of inner teeth **109***a* can not be brought to an inner position relative to the dedendum circle of inner teeth bottoms, with exception of the specific tooth bottom **108***a''* defined by and between the two successive teeth corresponding to the 31st and 1st date dial displays.

Numeral **111** represents partially and imaginally a conventional day display dial which is rotatably mounted on the conventional hour wheel, not shown, of the watch movement, said dial **111** being positioned at a higher level than the month display dial **109** in FIG. **6** for avoiding otherwise invited operational interference. This dial **111** is fed a step in the direction shown by an arrow A' under influence of the regular time-keeping operation of the watch movement through conventional transmitting mechanism, not shown, at the end of each day. Numeral **112**, **113** and **114** represent schematically the respective viewing windows for the date-, month- and day calendar displays, respectively.

The operation of the second embodiment so far shown and described is as follows:

The date feed wheel **103** performs a complete revolution per 24 hours under the influence of regular operation of the time-keeping gear train, not shown, of the watch movement.

In an even month such as June, a day display symbol "JUN" will be visible through the window **113** as shown in FIG. **6**. The projection **106***b* of discriminator lever **106** will advance in this case into the tooth space partially defined by the deeper tooth bottom **109***a''*, thus operatable in its small month display operation.

In every day of the month except the end thereof, the date feed pawl **103** rotating in the direction B' shown in FIG. **6**, will be brought into engagement with a specific one of the inner teeth **108***a* which corresponds to that positioned in close proximity to a specific point denoted "a", so as to feed the date dial **108** by a single step in the direction shown by arrow C' and corresponding to a calendar day for 24 hours, and the thus fed position of dial **108** is provisionally held by the spring pressure exerted thereupon by the conventional jumper lever, not shown. This date calendar feed operation will be successively executed at every end of the successively following days in the similar way as above. In this way, the thus fed successive date displays will appear through the window **112**. Since there is a specific geometrical relationship between the dedendum circle of the inner teeth **108***a* and the adendum circle of those at **109***a* as above described, the pawl **103** can not engage in this case with the inner teeth **109***a* and thus, no feed of the month display dial is not performed at all.

Nearly at the end of the 30th day of June, the high tooth **108***a'* is positioned at a tooth pitch distance in advance of the said point "*a*", as shown by "*c*". At this stage, the day calendar display "30" is visible at the window **112**. It will be seen from the foregoing that the tip end **103***a* of date feed pawl **103** at this stage will be brought into engagement with high tooth **108***a'*, so as to feed the dial **108** while sliding along the related tooth flank towards the tooth bottom **108***a''*. When the pawl end **103***a* occupies the position in close proximity to said point "*a*" as shown in FIG. **7**, it will then engage additionally with the related one of the teeth **109***a*, thereby both date- and month dials being fed each a respective step. In effect, the date dial has thus been fed by 2 calendar days and the month dial has been fed by 1 month.

Then, the pawl **103** will disengage from contact with the related inner tooth **109***a* and the high tooth **108***a'*, but the month dial **109** is held resiliently in position by pressure contact with the discriminator lever **106** and the date dial **108** by the jumper lever, not shown. Through the month window **113**, the display: "JUL" will now be seen; and through the date window **112**, the numeral "1" corresponding to the first day of the month may now be observed by the viewer, respectively. In the dial feeding period at the end of this even month: July, even when the pawl end **103***a* should engage specific one of the inner teeth **109***a* which is now positioned at the point "*c*", it will contact only the related tooth top and slide therealong, thus performing no dial feed. In the course of a small month and even when one of the teeth **108***a* except the high tooth **108***a'* occupies the closest position to a point "*c*", the date feed pawl end **103***a* will only slide along the related tooth top; thus no feed of date dial **108** being invited in this case.

When, as an example, the calendar displays show the date of July 1st upon execution of a calendar feed at the end of a small month, such as June as was above referred to, then the lever projection **106***b* will invade into the tooth gap corresponding to the shallow tooth bottom **109***a'*. Thus, the month discriminator lever **106** will occupy its chain-dotted line position corresponding to the large month from its full line one corresponding to the small month as shown in FIG. **6**, upon making a clockwise swivel motion. Therefore, the actuating end **106***a* of lever **106** will invade into the operational zone of pawl **103** when it occupies its utmost counterclockwise rotated offset position.

At the end of each date, the date dial **108** is fed a step through the feed engagement of one of the inner teeth **108***a* which occupies the position "*a*" as in the similar way to the case of large month as above referred to.

Since the discriminator lever **106** occupies the chain-dotted line position in the case of a large month such as July, as was referred to above, and when assuming that the high tooth **108***a'* will be brought to the position close to the point *c* at the 30th day of the month, the pawl **103** will perform a clockwise turning movement by the action of the lever **106** through its actuating end **106***a* and thus can not be brought into cooperation with the high tooth now occupying its position closest to the point *c*. Therefore, the date feed pawl **103** can cooperate with the tooth **108***a* which is situated at the point "*a*." Thus, the date display at the window **112** will be "31" and the high tooth **108***a'* will be brought to the point "*a*."

Next, at the end of the 31st date of the month, date feed pawl end **103***a* will invade into the tooth gap corresponding to the deep tooth bottom **108***a''* on date dial **108**, thus the high tooth **108***a'* occupying the position at "*a*" and the related one of inner teeth **109***a* are subjected to respective one step feed. Therefore, the calendar displays will be "AUG. 1" and the discriminator lever **106** will engage the shallow tooth bottom **109***a'*.

In the present second embodiment, the drive of month display dial **109** is performed directly through the date feed wheel, thus minimizing the transmission energy lost appearing in this respect. The number of the main operating constituents of the mechanism is also minimized by the fact that there are only the date dial, the month dial, the date feed wheel and the month discriminator lever and the whole mechanism is of utmost simple design. Therefore, the date- and month calendar display symbols can be designed to relatively large dimensions. Even if the mechanism should be made smaller, it is highly easy to prepare.

In the present second embodiment; the month dial **109** carries the month display symbols covering two successive years and the inner teeth **109***a* are provided precisely in correspondence thereto, the invention should not be limited only thereto. These symbols may cover only one year or even cover three successive years when necessary. In addition, the mechanism can be independently designed of the presence or unpresence of the day calendar display dial.

In the second embodiment, the depths of the inner teeth of month dial **109** can be designed so as to be uniform overall when the depth is properly large, by only varying suitably the tooth gaps of these teeth, as will be seen from the foregoing detailed description of the second embodiment.

In either of both embodiments shown, the conventional quick feed means can be embodied in the mechanism so far as the feed period of the date dial by the date feed wheel, for the purpose of shortening substantially the date correcting period of the mechanism.

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

1. A calendar feed mechanism for a watch movement, comprising in combination of:

a date calendar display dial rotatably mounted on said watch movement;

a series of 31 date calendar symbols carried on said dial;

a series of feeding teeth formed on said dial and in correspondence to said date calendar symbols;

a month end feed projection formed on said dial;

a month calendar display dial rotatably mounted on said movement, said month dial being adapted for making partial rotation of a step for a complete revolution of said date dial;

a series of month calendar symbols covering at least a year and carried on said month dial;

a month discriminator cam made integral therewith;

a date feed wheel for making a complete revolution for 24 hours by being driven by said movement; and

a day feed pawl means pivotably mounted on said date feed wheel;

said day feed pawl means being controlled by said discriminator cam and adapted for advancing said date dial daily by a date calendar step and engaging said projection at each end of a 29, 30, or 31 day month to advance the month calendar display dial.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,673,789 Dated July 4, 1972

Inventor(s) Akira TSUZUKI and Choken SUZUKI

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the Heading:

The Application Serial No. is incorrect:

should read:

--Appl. No.: 152,142

Signed and sealed this 17th day of October 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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