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Koide et al.

[11] **3,830,053**

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[54] **ADJUSTING MECHANISM FOR TURNING OPERATIONS OF HOUR-AND MINUTE-INDICATING LEAVES IN LEAF-TYPE CLOCK**

[75] Inventors: **Hideo Koide,** Urawa; **Koichi Kuroda; Takeshi Ito,** both of Saitama, all of Japan

[73] Assignee: **Rhythm Watch Company, Limited,** Tokyo, Japan

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[52] **U.S. Cl.** ..... **58/125 C,** 58/2 R

[51] **Int. Cl.** **G04b 19/02,** G04b 45/00

[58] **Field of Search** ..... 58/2, 4 R, 125 C; 235/1 C

[56] **References Cited**

UNITED STATES PATENTS

3,220,174 11/1965 Cappellari ..... 58/2 R

FOREIGN PATENTS OR APPLICATIONS

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Primary Examiner—Edith Simmons Jackmon

Attorney, Agent, or Firm—McGlew and Tuttle

[57] **ABSTRACT**

An adjusting mechanism of a leaf-type digital clock comprises a volute cam secured concentrically to the minute-drum frame, an adjusting pawl coming in pressed contact with the peripheral surface of said cam and an adjusting lever which is secured to said adjusting pawl through an adjusting shaft and to which lever is imparted a rotatable bias. When the adjusting lever rotates against said rotatable bias through the pressed contact of the adjusting pawl with the peripheral surface of the volute cam with the lapse of time, one end of the lever catches a pawl protruded on the inner side of the 59th minute-indicating leaf and the other catches the inner side of the hour-indicating leaf, respectively. However, at the moment when the 59th minute passes away, both ends of the lever rapidly release the hour- and minute-indicating leaves to be thereby turned over simultaneously.

4 Claims, 6 Drawing Figures

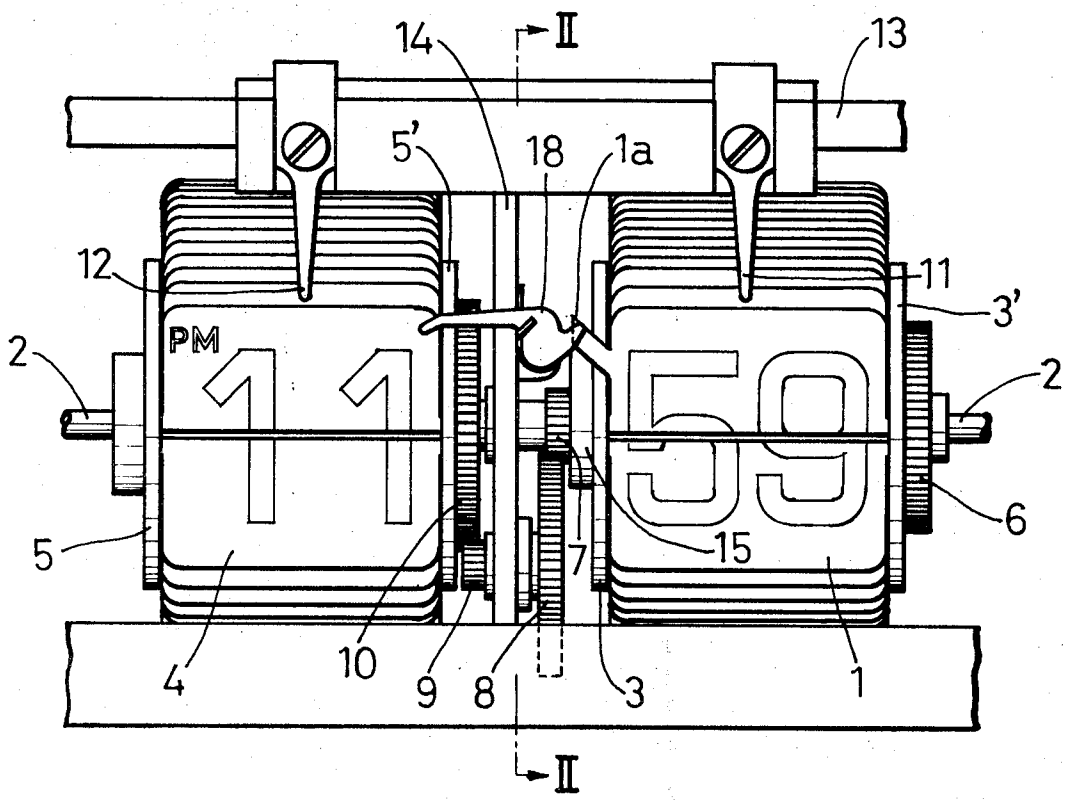


FIG. 1

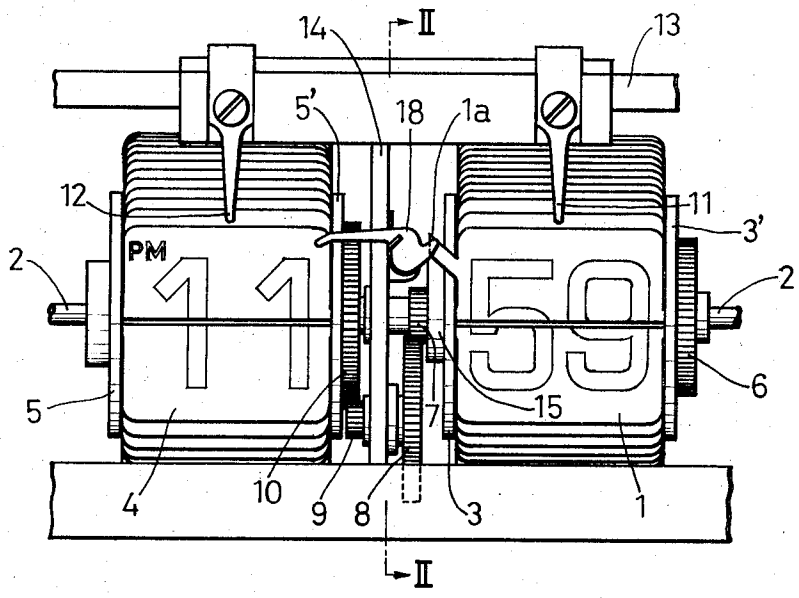


FIG. 2

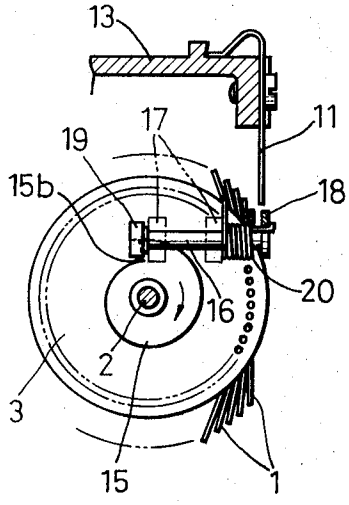


FIG. 3

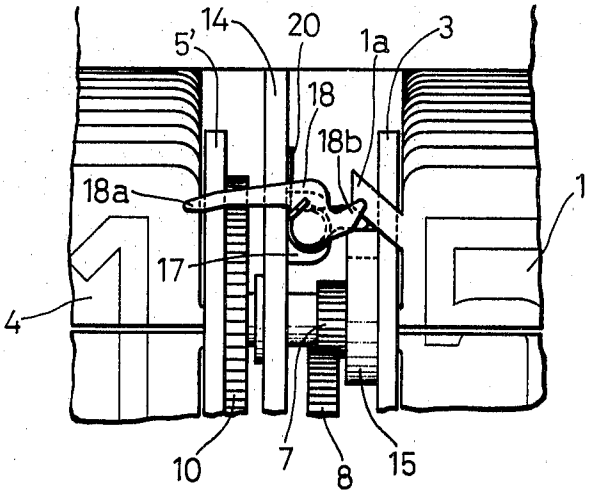


FIG. 4

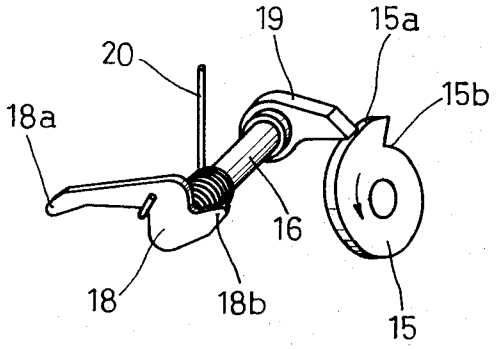


FIG. 6

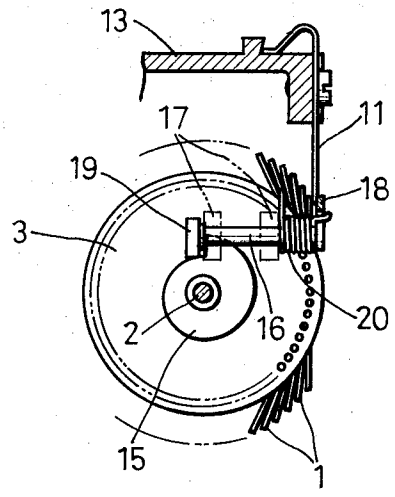
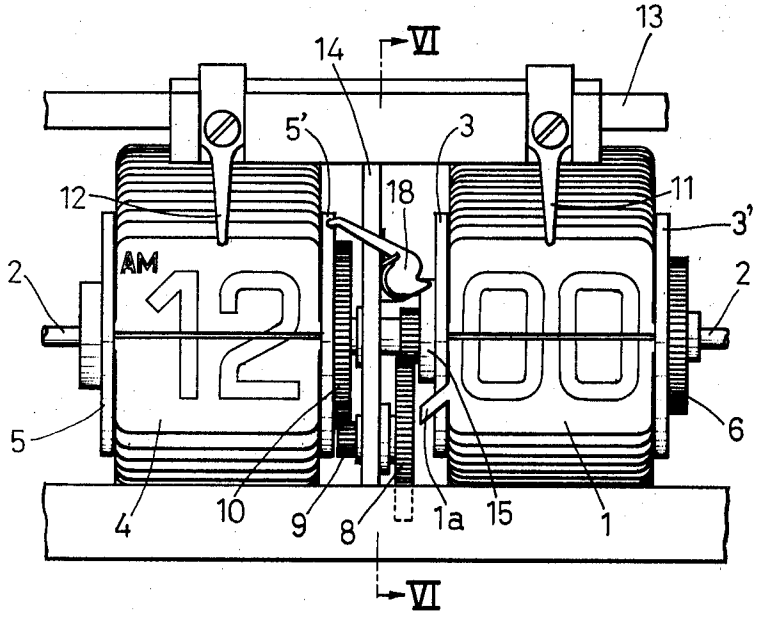


FIG. 5



ADJUSTING MECHANISM FOR TURNING OPERATIONS OF HOUR-AND MINUTE-INDICATING LEAVES IN LEAF-TYPE CLOCK

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a so-called digital type clock in which figures showing time and the like are indicated in individually separated windows on the front surface of the clock. More particularly, the invention relates to an adjusting mechanism for turning of the leaf-plates in turning in a so-called leaf-type clock (e.g. in U.S. Pat. No. 3,220,174) consisting of a plurality of tilting leaf-plates hinged on horizontally oriented drums and carrying the hours-, minutes-, dates-indications and the like.

In the leaf-type clock, indicating figures and letters can be made much larger in comparison with those of other kinds of digital-type clocks, in which hours, minutes and dates, etc., are marked on the cylindrical surface of drums, and further there is the advantage that continuous sixty figures of minutes or thirty-one figures of dates can be indicated with only one rotary drum.

2. Prior Art

In general, in the leaf-type clock it is necessary to synchronize the turning operation of a hour-indicating leaf accurately with that of the last (i.e., 59th) minute-indicating leaf. There has hitherto been known a type of clock having an adjusting mechanism such as a resilient pressing member which is arranged between the minute-indicating leaf and the hour-indicating leaf, one end of which pressing member is pressed by pawls protruding on several minute-indicating leaves respectively (e.g., on the **50-59**th minute-indicating leaves), to thereby cause the other end of the pressing member to restrain the turning of the hour-indicating leaf. However, the operating torque of the conventional adjusting mechanism is directly charged (based) on the above-mentioned 50–59th minute-indicating leaves themselves, so that, though it has been possible to apply such a mechanism to the leaf-type electric clock driven by an alternating current or to the leaf-type clock with the mainspring, various troubles have been caused by application of the mechanism to the leaf-type electric clock driven by batteries which have essentially a much smaller torque-producing capacity.

SUMMARY OF THE INVENTION

The invention is directed to a mechanism for the adjustment of the turning operations of hour- and minute-indicating leaves in the above leaf-type clock, and which can readily be operated with a small torque.

OBJECTS OF THE INVENTION

An object of the invention is, accordingly, to provide an adjusting mechanism for the turning operations of hour- and minute-indicating leaves of the leaf-type clock, in which such adjustment can readily be performed using a small torque without any troubles.

Another object of the invention is to provide an adjusting mechanism for the turning operations of hour- and minute-indicating leaves in the leaf-type clock having a simple construction and ease of operation.

Still another object of the invention is to inexpensively provide an adjusting mechanism for the turning operations of hour- and minute-indicating leaves in the leaf-type clock having longer durability.

Still further objects of the invention will be understood from the detailed explanation of the invention in reference to the accompanying specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front view of an embodiment of the leaf-type clock mechanism according to the invention, showing the condition in which the 59th minute-indicating leaf appears.

FIG. **2** is a cross section taken on the line II—II in FIG. **1** but with the 2nd wheel pinion and minute wheel are removed.

FIG. **3** is an enlarged view of the fragmental portion of the mechanism in FIG. **1.**

FIG. **4** is a perspective view of the volute cam, spring and the adjusting shaft removed from the mechanism according to the invention.

FIG. **5** is a front view of the same embodiment of the mechanism according to the invention as that in FIG. **1,** but showing the condition in which the minute-indicating leaf indicates 00 minute.

FIG. **6** is a cross section taken on the line VI—VI in FIG. **5** except that the second wheel pinion and minute wheel are removed.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now in particular to FIGS. **1, 2, 3, 5** and **6,** the numeral **1** designates the minute-indicating leaves hinged on the peripheries of the two minute-drum frames **3, 3'** which are secured to both sides of the minute-drum (not shown in the Figures) and which are pivoted on the main shaft **2**; **4** designates the hour-indicating leaves hinged on the peripheries of 2 hour-drum frames **5, 5'** which are secured to both sides of the hour-drum (not shown in the Figures) and which are pivoted on the main shaft **2**; **6** and **7** designate the 2nd wheel and 2nd wheel pinion respectively, both of which are secured to the minute-drum frames **3', 3.** Pinion **7** is connected with the hour wheel **10** secured to the hour-drum frame **5'** through the minute wheel **8** and minute wheel pinion **9. 11** and **12** represent the catching springs for the minute-indicating leaves and for hour-indicating leaves respectively both of which being secured to the upper pillar **13**; and **14** represents the middle plate arranged between the 2nd wheel pinion **7** and hour wheel **10.**

In addition to the above-described general construction of the leaf-type clock, referring to the mechanism according to the invention, a volute cam **15** is concentrically secured to the minute-drum frame **3** and said cam has the highest portion **15***a* and the adjacent lowest portion **15***b* on the periphery of the minute drum frame. The adjusting shaft **16** is supported between the bearings **17, 17** equipped on the middle plate **14,** and an adjusting lever **18** and an adjusting pawl **19** are secured to the right end and on the left end of said shaft **16,** respectively (refer to FIG. **2**). To the adjusting shaft **16** is imparted a clockwise bias by the spring **20** hooked between the adjusting lever **18** and the middle plate **14** (refer to FIG. **4**), thereby the adjusting pawl **19** comes in pressed contact with the peripheral surface of the volute cam **15.** That is, the pawl **19** is so designed that it slowly rotates counterclockwise or rapidly rotates

clockwise with the rotation of the cam **15**, against or according to the resilience of the spring **20**, and it therefore causes the shaft **16** and the lever **18** to rotate in similar directions.

On the other hand, (as shown in FIGS. **1** and **3**), a pawl **1***a* so protrudes and is arranged on the left side of the 59th minute-indicating leaf **1** in such fashion that it is caught by the right end **18***b* of the lever **18**, while the left end **18***a* of the lever **18** is caught simultaneously on the right side of the hour-indicating leaves **4**.

Explaining the operation of the mechanism according to the invention as described above, primarily, the hour-drum frames **5**, **5'** are rotated once per 24 hours through the time-driving movement (not shown in the Figures) to turn over the hour-indicating leaves **4**, which are hinged on the hour-drum frames **5**, **5'** one by one, and further more, the rotation of said hour-drum frames **5**, **5'** rotates the minute-drum frames **3**, **3'** once an hour through the hour wheel **10**, minute wheel pinion **9**, minute wheel **8** and 2nd wheel pinion **7**, thereby the minute-indicating leaves **1**, which are hinged on the minute-drum frames **3**, **3'** are turned over one by one from the 0 minute to the 58th minute.

During the above-mentioned operation, the volute cam **15** secured to the minute-drum frame **3** is also rotated once an hour in the direction of arrow (in FIG. **2**), thereby the adjusting pawl **19** secured to the adjusting shaft **16** and coming in pressed contact with the peripheral surface of said cam **15** is gradually rotated counterclockwise against the spring **20** by being held up with the higher portion of the periphery of the cam **15**. And when the pawl **19** comes in contact with the highest portion **15***a*, the left end **18***a* of the lever **18** secured on the shaft **16** catches the right side of the hour-indicating leaf **4** to repress the turning of said leaf **4**, and on the other hand the right end **18***b* of the lever **18** catches the protruded pawl **1***a* of the 59th minute-indicating leaf **1** to repress the turning of said leaf **1** (refer to FIGS. **1–4**). At the instant when the 59th minute passes away, a moment before said instant the 59th minute-indicating leaf **1** and hour-indicating leaf **4** having been released from the catching springs **11** and **12** respectively, the end pawl **19** secured to the adjusting shaft **16** falls rapidly into the lowest portion **15***b* of the volute cam **15** from the highest portion **15***a*, and the shaft **16** as well as the lever **18** are rapidly rotated clockwise by the resilience of the spring **20**, thereby the hour-indicating leaf **4** and 59th minute-indicating leaf **1** are, as seen in FIGS. **5–6**, released from the both ends, **18***a* and **18***b*, of the lever **18** to turn over simultaneously.

In the present invention, the diameter of the cam **15**, that is, the distance between the highest portion **15***a* on the periphery and the center thereof, is made to be shorter than the diameter of the minute-drum frame **3**, especially to be one-fourth – one-half of the diameter of the latter. The difference (or head) between the highest portion **15***a* and the lowest portion **15***b* on the periphery of the cam **15** is so designed that, when the adjusting pawl **19** has fallen into the lowest portion **15***b* from the highest portion **15***a*, the both ends, **18***a* and **18***b*, of the adjusting lever **18** will release the hour-indicating leaf **4** and the protruded pawl **1***a* of the 59th minute-indicating leaf **1**.

In the embodiment of the invention explained above, the bearings **17**, **17** of the adjusting shaft **16** are fitted on the surface of the middle plate **14**, however, such bearings **17**, **17** may be arranged on any other immovable portion in the clock. And in the above embodiment, the adjusting pawl **19** is secured to the end of the adjusting shaft **16**, however, such pawl **19** may be anchored on the middle of the shaft **16**, between the both bearings **17**, **17**.

Furthermore, the main shaft **2** in the embodiment may, of course, be divided into the minute-drum shaft and the hour-drum shaft, to which the minute-drum frames **3**, **3'** and hour-drum frames **5**, **5'** are secured respectively.

Summarizing the detailed explanation as described in the above, the adjusting mechanism according to the invention is essentially operated by the volute cam **15** which is concentrically secured to the minute-drum frame **3** and said volute cam having a smaller diameter than said drum frame **3**, the adjusting pawl **19** coming in pressed contact with said volute cam **15** and the adjusting lever **18** which is secured to said pawl **19** through the adjusting shaft **16**, so that there is the advantage that the mechanism can be applied even to the leaf-type clock having a time-driving movement of small torque without any troubles.

What we claim is:

1. In a leaf-type digital clock having respective drums carrying hour-indicating leaves and minute-indicating leaves, an adjusting mechanism for the turning operations of the hour-indicating leaf and the 59th minute-indicating leaf, comprising, in combination, a volute cam secured concentrically to the minute-drum frame and having the highest portion as well as the adjacent lowest portion on the peripheral surface of said cam, the diameter of said cam being shorter than that of the minute-drum frame; an adjusting shaft which is supported between bearings equipped on an immovable member and to which a rotatable bias for a direction is imparted by a spring; an adjusting lever and a pawl both secured to said shaft respectively, said pawl coming in pressed contact with the peripheral surface of the volute cam, means for gradual counterclockwise rotation of said pawl and rapid clockwise rotation depending on the position of the volute cam; and a pawl protruded on the inner side of the 59th minute-indicating leaf, which protruded pawl is caught by an end of the lever to repress the turning of said 59th minute-indicating leaf, while the other end of the lever catching simultaneously the inner side of the hour-indicating leaf to repress the turning of said hour-indicating leaf.

2. A digital clock comprising a frame, a first drum frame and a second drum, each of said first drum and said second drum frame being mounted rotatably on said frame, leaves for indicating hours mounted on said first drum frame and leaves for indicating minutes mounted on said second drum frame, one of said leaves indicating the 59th minute and having a pawl protruding thereon, gear means for rotating said first drum frame in timed relation to said second drum frame, an adjusting lever pivotally mounted on said frame adjacent said first drum frame and said second drum frame and having respectively first and second portion holding leaves for indicating hours and said pawl protruding on said leaf for indicating the 59th minute against movement, a spring providing a rotatable bias to the adjusting lever and cam means concentrically mounted with said second drum frame being connected to said gear means and engageable with said adjusting lever to pivot said lever to release said pawl and to release one

of said leaves indicating hours and only when said pawl releases said 59th minute leaf.

3. The digital clock according to claim **2,** wherein said cam means comprises a volute cam whose diameter is less than that of said second drum.

4. The digital clock according to claim **3,** wherein the diameter of said cam is from about one-fourth to about one-half of the diameter of said second drum frame.

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