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(54) TIMEPIECE

(71) We, KABUSHIKI KAISHA SEIKOSHA, a Japanese company of 2—5 Kyobashi, 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 relates to timepieces.

In a conventional timepiece, a gear train thereof is supported by an upper plate, a middle plate and a lower plate, which are secured to a dial base on a front side and are covered by a back cover on a rear side. This construction is complex. Recently a timepiece has been proposed in which the gear train and other component parts are set between two base plates which serve as case parts as well. Although the construction is simple, it has the disadvantage that the gears become disconnected when the two base plates are disconnected from one another during repair.

According to the present invention there is provided a timepiece comprising: a first case part; a middle plate connected to but spaced from the first case part; a gear train supported between the first case part and the middle plate; a motor unit secured to said first case part and said middle plate; an electronic circuit block secured to the motor unit; and a second case part connected to said first case part.

In the preferred embodiment the circuit block includes a printed circuit board mounted in guide means connected to the first case part.

Preferably the first case part, the middle plate and the second case part are made of synthetic resin material.

The circuit block may include terminals for connection to a battery.

Said gear train, in the preferred embodiment, is arranged to transmit rotation from the motor unit to a seconds hand.

The timepiece may include a further gear train for transmitting rotation from the motor unit to minutes and hours hands, said further gear train being mounted between said middle plate and the second case part.

The timepiece preferably includes correcting means for correcting a time indication, said correcting means being mounted between the middle plate and the second case part.

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

Figure 1 is a sectional view, partially broken away of a timepiece according to the present invention,

Figure 2 is a sectional view of the timepiece of Figure 1, and

Figure 3 is an exploded perspective view illustrating a motor block, a circuit block and terminals of the timepiece of Figure 1.

Referring to the drawings, a timepiece according to the present invention has a case part 1 and a middle plate 2 connected to each other by pins 4*a*, 4*b*, 4*c* projecting from the middle plate and forced into corresponding pipes 3*a*, 3*b*, 3*c* projecting from the case part 1. A rotor 5, secured to a rotor pinion 6, a second wheel 7 and a third wheel 8 are in mesh with one another and are rotatably supported between the case part 1 and the middle plate 2. A seconds hand wheel 9, in mesh with the third wheel 8, is rotatably supported by a seconds hand arbor 10 which is, itself, rotatably supported by the case part 1 and the middle plate 2. A washer 11 is secured to the seconds hand arbor 10. A spring 12 is connected to the washer 11, and urges the seconds hand wheel 9 downwardly (Figure 2). A heart-shaped cam 13 for resetting a seconds hand (not shown) and a seconds hand pinion 14 are secured to the seconds hand arbor 10. The seconds hand wheel 9 is urged downwardly by the spring 12 to abut against the cam 13. Therefore, rotation of the seconds hand wheel 9 is transmitted to the seconds hand arbor 10, but any rotation of the seconds hand arbor 10 is not transmitted to the seconds hand wheel 9. An intermediate wheel 15, engaging with the seconds hand pinion 14, is supported by the case part 1 and the middle plate 2 and is provided integrally with an intermediate pinion 16 projecting downwardly from the middle plate 2. Thus the gear train of the timepiece extending from the rotor 5 to the intermediate pinion 16 is supported as a unit between the case part 1 and the middle plate 2.

A motor unit or block 17, best seen in Figure 2, is supported by the case part 1 and the middle plate 2. A bobbin 21, on which is wound a coil 20, is supported by an arm 18*a* of a stator 18. The stator has four magnetic poles 19 between which the rotor 5 is located. The stator 18 is provided with three holes into which a pin 22 projecting from the case part 1 and pins 23, 24 projecting from the middle plate are respectively forced.

An electronic circuit block 25 is secured to the motor block and includes a printed circuit board 26 which carries an IC 27, a quartz crystal oscillator 28, a trimmer capacitor 29 and other circuit elements. The circuit board 26 is provided with a cut-out portion 26*a* into which the bobbin 21 fits. Four pairs of projections 30 are provided on end plates of the bobbin 21 and each pair of the projections holds the circuit board 26 therebetween. Both ends of the coil 20 are respectively connected to predetermined positions on the printed circuit on the printed circuit board 26. Terminals 32, 33 for a battery 43 are secured to both end portions of the circuit board 26 with respective forked portions 32*a*, 33*a* engaging with the circuit board. Both ends of the circuit board 26 are inserted between guides 31 projecting from the case part 1.

The seconds hand arbor 10 penetrates through a bearing 34 and projects downwardly from the middle plate 2. A minutes hand pipe 35 is rotatably supported on the bearing 34. A minutes hand wheel 36 is frictionally supported on the minutes hand pipe 35 and engages with the intermediate pinion 16. A minutes hand pinion 37, integral with the minutes hand pipe 35, engages with a transmission wheel 38 mounted for rotation about an arbor 40 projecting from the middle plate 2. The transmission wheel 38 engages with an hours hand wheel 39 integral with an hours hand pipe 39*a*.

The case part 1 and the middle plate 2 are made of synthetic resin material such as polycarbonate which is low in dimensional change and can be moulded precisely. A case part 41 is made of synthetic resin material such as ABS (acrylonitrile-butadiene-styrene copolymer) which is elastic and stress resistant. The case part 1 is provided with two screw holes 42*a*, 42*b*, and the case part 41 is provided with two pins (not shown) which face the screw holes and which are formed with interior screw holes. Thus the case part 1 and the case part 41 are connected to each other by means of screws.

A correcting lever 45 is rotatably supported between the case part 1 and the middle plate 2. A correcting shaft 50 is supported by a guide portion 46 provided on the middle plate 2 and a guide pin 49 projecting upwardly from the case part 41 facing the guide portion. The correcting shaft 50 is also supported by a cut-out portion 47 in the case part 1 and a cut-out portion 48 in the case part 41. A correcting pinion 51 is secured to the end portion of the correcting shaft 50. The correcting pinion 51 is located between pins 52*a*, 52*b* projecting from the correcting lever 45. The transmission wheel 38 is provided with a crown gear 53, which is engageable with the correcting pinion 51. A coil spring 54 is provided around the correcting shaft 50 between the correcting pinion 51 and the guide portion 46.

When the correcting shaft 50 is pulled leftwards (as seen in Figure 1) against the action of the coil spring 54, the correcting pinion 51 actuates the correcting lever 45 and the cam 13 is turned to a predetermined position to reset the seconds hand, that is, to direct the seconds hand to zero. In order to correct the minutes hand and the hours hand, the correcting shaft 50 is pulled outwardly and rotated. The correcting pinion 51, engaged with the crown gear 53, rotates the transmission wheel 38 and accordingly the minutes hand pinion 37 is rotated.

When the timepiece is assembled, the gear train from the rotor 5 to the intermediate wheel 15 and the connecting lever 45 are mounted between the case part 1 and the middle plate 2. The motor block 17 and the circuit block 25 are connected to each other, and the terminals 32, 33 are secured to the circuit board 26. Then both ends of the circuit board 26 are inserted into the guides 31 and, at the time, the pins 22, 23, 24 are inserted into the respective holes in the stator 18. Thus the motor block 17 and the circuit block 25 carrying the terminals 32, 33 are secured to the case part 1 and the middle plate 2.

In this condition, inspection and adjustment of the timepiece are performed. Then, the correcting shaft 50 and the gear train from the minutes hand wheel 36 to the hours hand wheel 39 are assembled and the case part 41 is connected to the case part 1 to complete assembly.

When repair is required, the case part 41 is disconnected and a battery is mounted between the terminals 32, 33. The timepiece is then inspected whilst it is running.

The timepiece described above is of simple construction and the gear train from the rotor 5 to the intermediate wheel 15 is not disassembled when the part 41 is removed during repair. Thus repair and inspection are facilitated.

WHAT WE CLAIM IS:—

1. A timepiece comprising: a first case part; a middle plate connected to but spaced from the case part; a gear train supported between the first case part and the middle plate; a motor unit secured to said first case part and said middle plate; an electronic circuit block secured to the motor unit; and a second case part connected to said first case part.

A motor unit or block 17, best seen in Figure 2, is supported by the case part 1 and the middle plate 2. A bobbin 21, on which is wound a coil 20, is supported by an arm 18*a* of a stator 18. The stator has four magnetic poles 19 between which the rotor 5 is located. The stator 18 is provided with three holes into which a pin 22 projecting from the case part 1 and pins 23, 24 projecting from the middle plate are respectively forced.

An electronic circuit block 25 is secured to the motor block and includes a printed circuit board 26 which carries an IC 27, a quartz crystal oscillator 28, a trimmer capacitor 29 and other circuit elements. The circuit board 26 is provided with a cut-out portion 26*a* into which the bobbin 21 fits. Four pairs of projections 30 are provided on end plates of the bobbin 21 and each pair of the projections holds the circuit board 26 therebetween. Both ends of the coil 20 are respectively connected to predetermined positions on the printed circuit on the printed circuit board 26. Terminals 32, 33 for a battery 43 are secured to both end portions of the circuit board 26 with respective forked portions 32*a*, 33*a* engaging with the circuit board. Both ends of the circuit board 26 are inserted between guides 31 projecting from the case part 1.

The seconds hand arbor 10 penetrates through a bearing 34 and projects downwardly from the middle plate 2. A minutes hand pipe 35 is rotatably supported on the bearing 34. A minutes hand wheel 36 is frictionally supported on the minutes hand pipe 35 and engages with the intermediate pinion 16. A minutes hand pinion 37, integral with the minutes hand pipe 35, engages with a transmission wheel 38 mounted for rotation about an arbor 40 projecting from the middle plate 2. The transmission wheel 38 engages with an hours hand wheel 39 integral with an hours hand pipe 39*a*.

The case part 1 and the middle plate 2 are made of synthetic resin material such as polycarbonate which is low in dimensional change and can be moulded precisely. A case part 41 is made of synthetic resin material such as ABS (acrylonitrile-butadiene-styrene copolymer) which is elastic and stress resistant. The case part 1 is provided with two screw holes 42*a*, 42*b*, and the case part 41 is provided with two pins (not shown) which face the screw holes and which are formed with interior screw holes. Thus the case part 1 and the case part 41 are connected to each other by means of screws.

A correcting lever 45 is rotatably supported between the case part 1 and the middle plate 2. A correcting shaft 50 is supported by a guide portion 46 provided on the middle plate 2 and a guide pin 49 projecting upwardly from the case part 41 facing the guide portion. The correcting shaft 50 is also supported by a cut-out portion 47 in the case part 1 and a cut-out portion 48 in the case part 41. A correcting pinion 51 is secured to the end portion of the correcting shaft 50. The correcting pinion 51 is located between pins 52*a*, 52*b* projecting from the correcting lever 45. The transmission wheel 38 is provided with a crown gear 53, which is engageable with the correcting pinion 51. A coil spring 54 is provided around the correcting shaft 50 between the correcting pinion 51 and the guide portion 46.

When the correcting shaft 50 is pulled leftwards (as seen in Figure 1) against the action of the coil spring 54, the correcting pinion 51 actuates the correcting lever 45 and the cam 13 is turned to a predetermined position to reset the seconds hand, that is, to direct the seconds hand to zero. In order to correct the minutes hand and the hours hand, the correcting shaft 50 is pulled outwardly and rotated. The correcting pinion 51, engaged with the crown gear 53, rotates the transmission wheel 38 and accordingly the minutes hand pinion 37 is rotated.

When the timepiece is assembled, the gear train from the rotor 5 to the intermediate wheel 15 and the connecting lever 45 are mounted between the case part 1 and the middle plate 2. The motor block 17 and the circuit block 25 are connected to each other, and the terminals 32, 33 are secured to the circuit board 26. Then both ends of the circuit board 26 are inserted into the guides 31 and, at the time, the pins 22, 23, 24 are inserted into the respective holes in the stator 18. Thus the motor block 17 and the circuit block 25 carrying the terminals 32, 33 are secured to the case part 1 and the middle plate 2.

In this condition, inspection and adjustment of the timepiece are performed. Then, the correcting shaft 50 and the gear train from the minutes hand wheel 36 to the hours hand wheel 39 are assembled and the case part 41 is connected to the case part 1 to complete assembly.

When repair is required, the case part 41 is disconnected and a battery is mounted between the terminals 32, 33. The timepiece is then inspected whilst it is running.

The timepiece described above is of simple construction and the gear train from the rotor 5 to the intermediate wheel 15 is not disassembled when the part 41 is removed during repair. Thus repair and inspection are facilitated.

WHAT WE CLAIM IS:—

1. A timepiece comprising: a first case part; a middle plate connected to but spaced from the case part; a gear train supported between the first case part and the middle plate; a motor unit secured to said first case part and said middle plate; an electronic circuit block secured to the motor unit; and a second case part connected to said first case part.

* C L M S *

2. A timepiece as claimed in claim 1 in which the circuit block includes a printed circuit board mounted in guide means connected to the first case part.

3. A timepiece as claimed in claim 1 or 2 in which the first case part, the middle plate and the second case part are made of synthetic resin material.

4. A timepiece as claimed in any preceding claim in which the circuit block includes terminals for connection to a battery.

5. A timepiece as claimed in any preceding claim in which said gear train is arranged to transmit rotation from the motor unit to a seconds hand.

6. A timepiece as claimed in claim 5 including a further gear train for transmitting rotation from the motor unit to minutes and hours hands, said further gear train being mounted between said middle plate and the second case part.

7. A timepiece as claimed in any preceding claim including correcting means for correcting a time indication, said correcting means being mounted between the middle plate and the second case part.

8. A timepiece substantially as herein described with reference to and as shown in the accompanying drawings.

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