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(54) WATCH OF HANDS INDICATION TYPE.

(57) A multifunctional watch of a hands indication type which can display many functions including time display, date display, timer, alarming and a chronograph by hands. The watch has a first reduction gear train for a second-hand connected with a motor A, a second reduction gear train for a minute-hand, also connected with the motor A, a third reduction gear train for the minute hand connected with a motor B, a fourth reduction gear train for an hour hand connected with the motor B, a fifth reduction gear train for a sub-hand A connected with a motor C, a sixth reduction gear train for the sub-hand A and a sub-hand B connected with the motor C, a seventh reduction gear train for the minute hand connected with the motor C, and an eighth reduction gear train for a picture-and-date dial connected with the motor C. These gear trains are supported selectively in common by the supporting part provided on a train wheel bridge and a main plate. From among these reduction gear trains, either one of the third and fourth reduction gear trains, and either one of the first and second reduction gear train and/or either one of the fifth to eighth reduction gear train are selected. By combining these selected reduction gear trains with each other, the watch of the hand indication type provided with plural selectively combined functions is obtained, using a single basic module.

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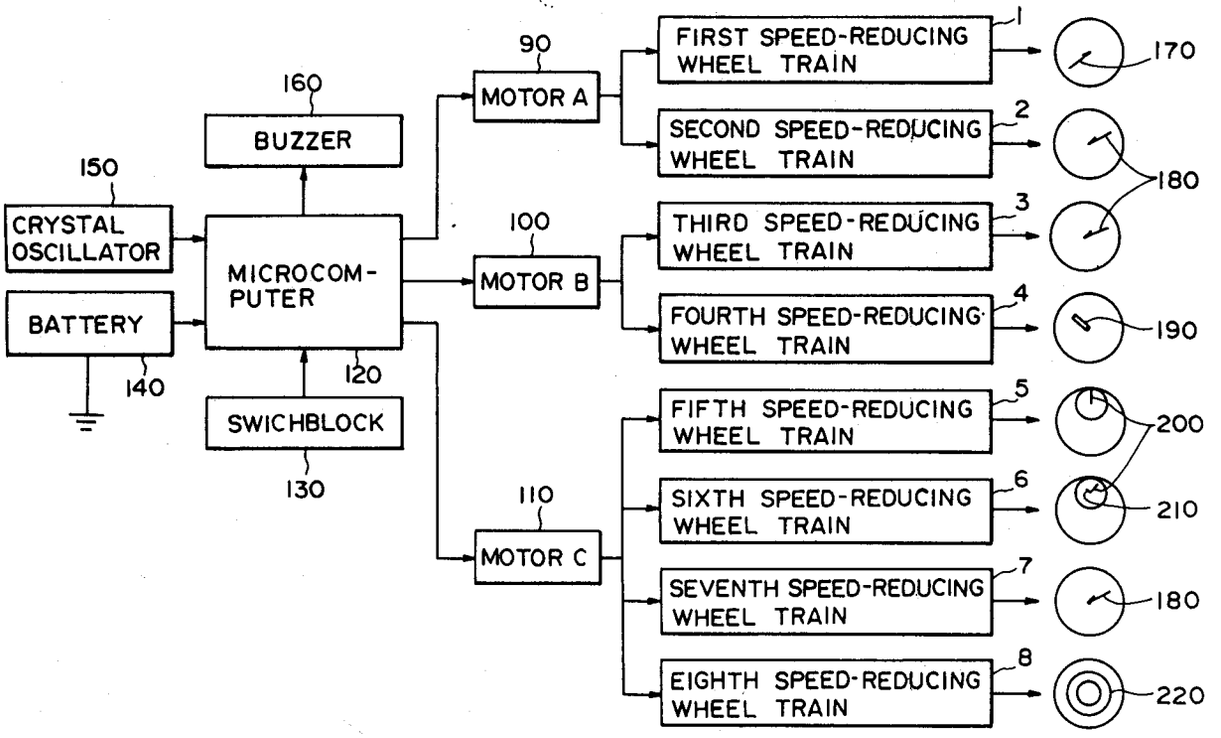
FIG. 1


160
BUZZER
150
CRYSTAL OSCILLATOR
BATTERY
140
MICROCOM-PUTER
120
SWICHBLOCK
130
90
MOTOR A
100
MOTOR B
110
MOTOR C
FIRST SPEED-REDUCING WHEEL TRAIN
1
170
SECOND SPEED-REDUCING WHEEL TRAIN
2
180
THIRD SPEED-REDUCING WHEEL TRAIN
3
FOURTH SPEED-REDUCING WHEEL TRAIN
4
190
FIFTH SPEED-REDUCING WHEEL TRAIN
5
200
SIXTH SPEED-REDUCING WHEEL TRAIN
6
210
SEVENTH SPEED-REDUCING WHEEL TRAIN
7
180
EIGHTH SPEED-REDUCING WHEEL TRAIN
8
220

Technical Filed

This invention relates to a hand-indicating type multi-function timepiece in which a variety of function, such as time indication function, timer function, alarm function or chronographic function, may be displayed by indicating hands.

Background Art

A move has come up to the surface of providing an indicating hand display or hand-indicating type multi-function timepiece by annexing a variety of functions now in extensive use in digital timepiece or composite timepiece, such as alarm, chronographic or timer functions, to an indicating hand display type timepiece, and attempts have already been made in this line in certain timepiece versions.

Recently, with propagation of micro-ICs, it has become possible to achieve a timepiece capable of displaying various functions by the same basic module by simply changing the software of the microcomputer ICs in conformity to timepiece specifications. In the case of a digital timepiece or a composite timepiece, display specifications other than the functional specifications by the software of the micro-computer IC of the digital timepiece can be changed rather easily by changing the pattern of the liquid crystal cell as timepiece display means, so that conformity to design changes can be made easily.

However, with an indicating hand display type timepiece, a set of wheel trains is customarily associated with an electric motor. As far as the present inventions are aware, indication by a plurality of hands is taken charge of by a single electric motor is disclosed only in JP Patent KOKAI Publication No. 60-147678 (1985) in which only the second-hand function is changed from a center three hands structure to a subsidiary hand structure.

However, if a single set of wheel trains is associated with a single electric motor, changes of the display specifications can not be achieved with ease, so that it is difficult to provide a timepiece with different display contents by indicating hands by a single basic module. With such timepiece, even if a timepiece of different functions could be designed by changing the software by microcomputer ICs, only timepieces of similar designs can be produced by reason of difficulties involved in changing the display specifications, such that it has been difficult to provide timepieces having display contents conforming to the various functions.

It is therefore an object of the present invention to provide a variety of types of hand-indicating timepieces in which plural functions are selectively combined on the basis of a sole basic module.

Disclosure of the Invention

The present invention provides a hand-indicating type timepiece having multiple functions. The timepiece includes a plurality of speed-reducing wheel trains selectably and commonly supported by a wheel train bridge and a support provided on a plate, namely a first speed-reducing wheel train for a second hand, a second speed-reducing wheel train for a minute hand, both connected to a motor A, a third speed-reducing wheel train for a minute-hand, a fourth speed-reducing wheel train for an hour-hand, both connected to a motor B, a fifth speed-reducing wheel train for a subsidiary hand A, a sixth speed-reducing wheel train for subsidiary hands A and B, a seventh speed-reducing wheel train for a minute hand and an eighth speed-reducing wheel train for a picture date dial, these fifth to eighth wheel trains being connected to a motor C. From these speed-reducing wheel trains, one of the third and fourth wheel trains, one of the first and second wheel trains and/or one of the fifth to eighth wheel trains is selected, and the selected wheel trains are combined to provide a hand-indicating timepiece having the various functions.

With the present hand-indicating timepiece, various timepiece systems having selectively combined functions may be provided by a single basic module.

The timepiece functions may be changed freely by changing the software specifications of the microcomputer IC so that various timepiece systems with different specifications may be provided.

Common circuit boards and mounting methods may be used to simplify the development process. Common parts other than the wheel trains, such as presser plates, may be used to improve productivity to provide a hand-indicating type multi-function timepiece at lower costs.

Brief Description of the Drawings

Fig. 1 is a block diagram showing a basic timepiece construction.

Fig. 2 is a plan view showing a multi-functional timepiece with a second speed-reducing wheel train having been selected.

Figs. 3 to 5 are plan views showing a multi-functional timepiece with a first speed-reducing wheel train 1 having been selected.

Fig. 6 is an assembly plan view showing an arrangement in which a second speed-reducing wheel train, a fourth speed-reducing wheel train and a fifth speed-reducing wheel train are selectively associated with motors A, B and C, respectively.

Fig. 7 is an assembly plan view showing an arrangement in which a first speed-reducing wheel train, a fourth speed-reducing wheel train and a seventh speed-reducing wheel train are selectively associated with motors A, B and C, respectively.

Fig. 8 is an assembly plan view showing an arrangement in which a first speed-reducing wheel train, a third speed-reducing wheel train and a sixth speed-reducing wheel train are selectively associated with motors A, B and C, respectively.

Fig. 9 is an assembly plan view showing an arrangement in which a first speed-reducing wheel train, a third speed-reducing wheel train and an eighth speed-reducing wheel train are selectively associated with motors A, B and C, respectively.

Fig. 10 is a partial cross-sectional view showing an arrangement in which a first speed-reducing wheel train and a third speed-reducing wheel train are selectively associated with motors A and B, respectively.

Fig. 11 is a partial cross-sectional view showing an arrangement in which a third speed-reducing wheel train is selectively associated with motor B.

Fig. 12 is a partial cross-sectional view showing an arrangement in which a second speed-reducing wheel train and a fourth speed-reducing wheel train are selectively associated with motors A and B, respectively.

Fig. 13 is a partial cross-sectional view showing an arrangement in which a seventh speed-reducing wheel train is selectively associated with motor C.

Fig. 14 is a partial cross-sectional view showing an arrangement in which a sixth wheel train is selectively associated with motor C.

Fig. 15 is a partial cross-sectional view showing an arrangement in which an eighth wheel train is selectively associated with motor C.

Fig. 16 is a partial cross-sectional view showing an arrangement in the vicinity of a winding stem.

Fig. 17 is a partial cross-sectional view for illustrating the general construction of a switch block.

Best Embodiment for Practicing the Invention

Referring to a block view of Fig. 1 showing a basic timepiece structure, the basic concept of a hand indicating timepiece is explained.

The hand-indicating timepiece includes three motors 90, 100, 110, a microcomputer integrated circuit 120, a switch block 130 for electrically controlling the microcomputer integrated circuit 120, a battery 140 as an energy source and a crystal oscillator 150 as a signal source.

In Fig. 1, the microcomputer IC, outputs a signal for driving motors A90, B100 and C110, and a signal for ringing a buzzer 160.

Rotation of the motor A90 is transmitted to a first speed-reducing wheel train 1 (second-hand driving wheel train) or a second speed-reducing wheel train 2 (minute-hand driving wheel train), which wheel trains 1 or 2 are arrayed selectably. When the first wheel train 1 or the second wheel train 2 are selected, a second hand 170 or a minute hand 180 are rotated, respectively.

Rotation of the motor B100 is transmitted to a third speed-reducing wheel train 3 or a fourth speed-reducing wheel train 4, which wheel trains 3 and 4 are arrayed selectably. When the third wheel train 3 is selected, both the minute hand 180 and the hour hand 190 are rotated, whereas, when the fourth wheel train 4 is selected, only the hour hand 190 is rotated.

Rotation of the motor C110 is transmitted to a fifth speed-reducing wheel train 5, a sixth speed-reducing wheel train 6, a seventh speed-reducing wheel train 7 or to an eighth speed-reducing wheel train 8. When the fifth speed-reducing wheel train 5 is selected, a subsidiary hand A200 is rotated, whereas, when the sixth speed-reducing wheel train 6 is selected, both the subsidiary hand A200 and a subsidiary hand B210 are rotated. On the other hand, when the seventh speed-reducing wheel train 7 is selected, only the minute hand 180 is rotated, whereas, when the eighth speed-reducing wheel train 8 is selected, a picture date dial 220 is rotated.

First referring to Figs. 6, 7, 10 and 12, the first speed-reducing wheel train 1 and the second speed-reducing wheel train 2, selectively driven by motor A90, a wheel train bridge 250 for selectively supporting these train wheels, and a plate 260, are explained.

Selection of First Speed-Reducing Wheel Train

Motor A90 is provided with a motor A coil 91, a motor A yoke 92 and a motor A rotor 93. The first speed-reducing wheel train 1 is comprised of a second intermediate wheel 11 and a second wheel 12 (see Figs. 7 and 10).

The motor A rotor 93 has a wheel pinion 93a (with the number of teeth Z equal to 6) engaged with a wheel gear 11a (with the number of teeth Z equal to 48) of the second intermediate wheel 11. The wheel 11 has a wheel pinion 11b (with the number of teeth Z equal to 12) engaged with a wheel gear 12a (with the number of teeth Z equal to 45) of the second wheel 12. The second hand 170 is fitted in a fitting part 12b of the second wheel 12 and, when the motor A rotor 93 is rotated through 180°, the second wheel 170 is rotated through 6°.

When the second hand 170 is rotated through 6° per second, rotation through 360° is achieved in one minute, so that the second hand 170 per-

forms one complete revolution.

Selection of Second Speed-Reducing Wheel Train

The second speed-reducing wheel train 2 is composed of a third wheel B21 and a second wheel B22 (see Figs. 6 and 12).

The motor A rotor 93 has a wheel pinion 93b (with the number of teeth Z equal to 6) engaged with a wheel gear 21a (with the number of teeth Z equal to 63) of the third wheel B21, which has a wheel pinion 21b (with the number of teeth Z equal to 7) engaged with a wheel gear 22a of the second wheel B22. The minute hand 180 is fitted in a fitting part 22b of the second wheel B22. When the motor A rotor A93 is rotated through 180° once every 20 seconds, the minute hand 180 is rotated through 2°.

When the minute-hand 180 is rotated through 2° every 20 seconds, rotation through 360° or one complete revolution is achieved in 60 minutes.

Wheel Train Bridge 250 and Plate 260

A wheel train bridge 250 supporting the first speed-reducing wheel train 1 and the second speed-reducing wheel train 2 and the plate 260 are so arranged that the intermediate second wheel 11 and the third wheel B21 on one hand and the second wheel 12 and the second wheel B22 on the other may be mounted exchangeably at common supporting positions.

That is, the intermediate second wheel 11 and the third wheel B21 are respectively provided with shafts 11x, 21x and attachment sections 11y, 21y, with respectively common shape, and the wheel train bridge 250 has a bearing hole 251 for supporting the shafts 11x, 21x while the plate 260 has a bridge 261 for rotatably supporting the attachment sections 11y, 21y.

The second wheel 12 and the second wheel B22 include shafts 12x, 21x and flanges 12y, 22y, respectively. The wheel train support 250 has a bearing hole 252 for supporting shafts 12x, 22x, while the plate 260 has a flange support 262 for rotatably supporting flanges 12y, 22y.

Meanwhile, the intermediate second wheel 11 is not formed with a wheel pinion engaged with a wheel gear 34a of a second wheel A34.

A presser plate 230, a circuit board 240 and a dial 280 etc. is adapted to be used with any of the first speed-reducing or second speed-reducing wheel trains which may selectively be brought into operation.

Referring to Figs. 6, 8 and 10 to 12, the third speed-reducing wheel train 3 and the fourth speed-reducing wheel train 4, selectively driven by motor B100, the wheel train bridge 250 for selectively supporting these wheel trains and the plate 260 are explained.

Selection of Third Speed-Reducing Wheel Train

The motor B100 includes a motor B coil 101, a motor B yoke 102 and a motor B rotor 103. The third speed-reducing wheel train 3 is composed of a fifth wheel 31, a fourth wheel 32, a third wheel A33, a second wheel A 34, a minute wheel A 35 and a hour wheel A36 (see Figs. 6, 8, 10 and 11).

The motor B rotor 103 has a wheel pinion 103a (with the number of teeth Z equal to 6) engaged with a wheel gear 31a (number of teeth Z equal to 48) of the fifth wheel 31, which has a wheel pinion 31b (with the number of teeth Z equal to 8) engaged with one of wheel gears 32a (with the number of teeth Z equal to 45) of the fourth wheel 32. The other wheel gear 32a of the fourth wheel 32 is engaged with a wheel gear 33a (with the number of teeth Z equal to 54) of the third wheel A33, which has a wheel pinion 33b (with the number of teeth Z equal to 27) engaged with a wheel gear 34a (with the number of teeth Z equal to 45) of the second wheel A34.

The minute hand 180 is fitted in a fitting part 34c of the second wheel A34, which has a wheel pinion 34b (with the number of teeth Z equal to 12) engaged with a wheel gear 35a (with the number of teeth Z equal to 21) of the minute wheel A35, which has a wheel pinion 35b (with the number of teeth Z equal to 7) engaged with a wheel gear 36a (with the number of teeth Z equal to 48) of the hour wheel A36. The hour hand 190 is fitted in a fitting part 36b of the hour wheel A36, so that, when the motor B rotor 103 is rotated through 180° once every 20 seconds, the minute hand 180° is rotated through 2° to cause the hour-hand to be rotated through 1/6°.

When the minute hand 180 is rotated through 2° every 20 seconds, rotation through 360° or one complete revolution is achieved in 60 minutes, while the hour hand 190 is rotated through 180° or performs one complete revolution in 12 hours.

Selection of Fourth Speed-Reducing Wheel Train

The fourth speed-reducing wheel train 4 is partially of the same construction as the third speed-reducing wheel train 3, and has the construction from the motor B rotor 103 as far as the fifth wheel 31 and the fourth wheel 32 in common with the third speed-reducing wheel train 3. That is, the fourth speed-reducing wheel train 4 is composed of a fifth wheel 31, a fourth wheel 32, a third wheel C41 and a hour wheel B42 (see figs. 6, 10 and 12).

Since the construction from the motor B rotor 103 as far as the fifth wheel 31 and the fourth

wheel 32 is the same as that for the third speed-reducing wheel train 3, the corresponding description is omitted for simplicity.

In Fig. 12, the wheel gear 32a (with the number of teeth Z equal to 45) of the fourth wheel 32 is engaged with a wheel gear 41a (with the number of teeth Z equal to 54) of the third wheel C41, which has a wheel pinion 41b (with the number of the teeth Z equal to 9) engaged with a wheel gear 42a (with the number of teeth Z equal to 30) of the hour wheel B. The hour-hand 190 is fitted in a fitting part 42b of the hour wheel B42 and, when the motor 103 is rotated through 180° once every two minutes, the hour-hand 190 is rotated through 1°.

If the hour-hand 190 is rotated through 1° once every two minutes, rotation through 360° is completed in 12 hours (= 720 minutes) so that the hour-hand 190 performs one complete revolution.

Wheel Train Bridge 250 and Plate 260

The wheel train bridge 250, axially supporting the third speed-reducing wheel train 3 and the fourth speed-reducing wheel train 4, and the plate 260, are so arranged that the third wheel A33 and the third wheel C41 on one hand and the hour-wheel C41 and the hour wheel B42 on the other hand may be mounted exchangeably at common supporting positions.

That is, the third wheel A33 an the third wheel C41 are provided with bearing holes 33x, 41x and attachment portions 33y, 41y, respectively, and the wheel train bridge 250 is provided with a shaft 253 rotatably freely fitted in the bearing holes 33x, 41x, while the plate 260 is provided with a bridge 263 for rotatably supporting the attachment sections 33y, 41y.

The hour-wheel A36 and the hour-wheel B42 are provided with bearing holes 36x, 42x of the same shape, while the plate 260 is provided with a shaft tube 264 for rotatably supporting the bearing holes 36x, 42x.

Meanwhile, the wheel train bridge 250 and the plate 260 detachably support the second wheel A34 and the minute wheel A35 making up the third speed-reducing wheel train 3.

Referring to Figs. 6 to 9 and 13 to 15, the fifth speed-reducing wheel train 5, the sixth speed-reducing wheel train 6, the seventh speed-reducing wheel train 7 and the eighth speed-reducing wheel train 8, selectively driven by the motor C110, the wheel train bridge 250 for selectively supporting these wheel trains, and the plate 260, will be explained.

Selection of Sixth Wheel Train 6

For ease in understanding, the case of selecting the sixth speed-reducing wheel train 6 is explained.

The motor C110 is provided with a motor C coil 111, a motor C yoke 112 and a motor C rotor 113. The sixth speed-reducing wheel train 6 is composed of a dual intermediate wheel 51, a dual wheel 52, a minute wheel B61 and an hour-wheel C62 (see Figs. 8 and 14).

The motor C rotor 113 has a pinion 113a (with the number of teeth Z equal to 6) engaged with a wheel gear 51a (with the number of teeth Z equal to 48) of the dual intermediate wheel 51, which has a wheel pinion 51b (with the number of teeth Z equal to 12) engaged with gear 52a (with the number of teeth equal to 45) of the dual wheel 52, which has a wheel pinion 52b (with the number of teeth Z equal to 8) engaged with wheel gear 61a (with the number of teeth Z equal to 32) of the minute wheel B61. The minute wheel B61 has a wheel pinion 61b (with the number of teeth Z equal to 9) engaged with wheel gear 62a (with the number of teeth Z equal to 54) of the hour-wheel C62. The subsidiary hand A200 is fitted in a fitting part 52C of the dual wheel 52.

The subsidiary wheel B210 is engaged in a fitting part 62b of the hour-wheel C62 and, when the motor C rotor 113 is rotated through 180° once every one minute, the subsidiary hand A200 is rotated through 6° to cause the subsidiary hand B210 to be rotated through 1/4°.

If the subsidiary hand A200 is rotated through 6° every one minute, it is rotated through 360° in 60 minutes, or completes one revolution, while the subsidiary hand B210 is rotated through 360° in 24 hours, or completes one revolution.

Selection of Fifth Speed-Reducing Wheel Train 5

The above mentioned fifth speed-reducing wheel train 5 is explained. The fifth speed-reducing wheel train 5 means a wheel train which corresponds to the sixth speed-reducing wheel train 6 shown in Fig. 14 less the minute wheel B61, hour-wheel C62 and the subsidiary hand B210.

Thus the fifth speed-reducing wheel train 6 has only the function of rotating the subsidiary hand A200 in the sixth speed-reducing wheel train 6.

Selection of Seventh Speed-Reducing Wheel Train 7

The seventh speed-reducing wheel train 7 is composed of a minute transmitting wheel A71, a minute transmitting wheel B72, a minute transmitting wheel C73 and a minute wheel 74 (see Figs. 7 and 13). The motor C rotor 113 has a pinion 113a (with the number of teeth Z equal to 6) engaged with a wheel gear 71a (with the number of teeth Z

equal to 63) of the minute transmitting wheel A71, which has a wheel pinion 71b (with the number of teeth Z equal to 7) engaged with wheel gear 72a (with the number of teeth Z equal to 60) of the minute transmitting wheel B72. The minute transmitting wheel B72 has a wheel gear 72a engaged with a wheel gear 73a (with the number of teeth Z equal to 27) of the transmitting wheel C73 having a wheel pinion 73b (having the number of teeth Z equal to 27) engaged with wheel gear 74a (with the number of teeth Z equal to 45) of the minute wheel 74. The minute-hand 180 is fitted in a fitting part 74b of the minute wheel 74. When the motor C rotor 113 is rotated through 180° once every 12 seconds, the minute-hand 180 is rotated through 1.2°.

When the minute-hand 180 is rotated through 1.2° every 12 seconds, it is rotated through 360°, or completes one full revolution, in 60 minutes.

Selection of Eighth Speed-Reducing Wheel Train 8

The eighth speed-reducing wheel train 8 is composed of a picture date dial transmitting wheel A81, a picture date dial transmitting wheel B82, a picture date dial transmitting wheel C83 and a picture date dial transmitting wheel D84 (see Figs. 9 and 11).

The motor C rotor 113 has a wheel pinion 113a (with the number of teeth Z equal to 6) engaged with wheel gear 81a (with the number of teeth Z equal to 48) of the picture date dial transmitting wheel A81, which has a wheel pinion 81b (with the number of teeth Z equal to 12) engaged with wheel gear 82a (with the number of teeth Z equal to 45) of the picture date dial transmitting wheel B82. The wheel B82 has a wheel pinion 82b (with the number of teeth Z equal to 45) engaged with wheel gear 83a (with the number of teeth Z equal to 30) of the picture date dial transmitting wheel C83 having its wheel pinion 83b (with the number of teeth Z equal to 9) engaged with a wheel gear 84a (with the number of teeth Z equal to 54) of the picture date dial transmitting wheel D84. The wheel D84 has a wheel, pinion 84b (with the number of teeth Z equal to 10) engaged with a wheel gear 220a (with the number of teeth Z equal to 120) of the picture date dial 220, which makes a rotation through 0.125° when the motor C rotor 113 is rotated through 180°.

The picture date dial 220 is rotated through 180° by 2880 steps (2886 STEP/one round).

Wheel Train Bridge 250 and Plate 260

The wheel train bridge 250 axially supporting the fifth speed-reducing wheel train 5 to the eighth speed-reducing wheel train 8 and the plate 260 are so arranged that one of the dual intermediate wheel 51, minute transmitting wheel A91 and the picture date dial transmitting wheel A81 and one of the dual wheel 52, minute transmitting wheel B72 and the picture date dial transmitting wheel B82 are selectively and exchangeably mounted at common supporting positions. The minute wheel B61, picture date dial transmitting wheel C83 and the hour-wheel C62 as well as the picture date dial transmitting wheel D84 are also adapted to be selectively and exchangeably mounted at common supporting positions.

That is, the dual intermediate wheel 51, the minute transmitting wheel A71 and the picture date dial transmitting wheel A81 are provided with similarly shaped shafts 51x, 71x and 81x and similarly shaped attachment sections 51y, 71y and 81y. The wheel train bridge 250 has a bearing hole 254 for axially supporting shafts 51x, 71x and 81x, while the plate 260 is provided with a bridge 265 for rotatably supporting the attachment sections 51y, 71y and 81y.

The dual wheel 52, minute transmitting wheel B72 and the picture date dial transmitting wheel B82 are provided with similarly shaped shafts 52x, 72x and 82x and similarly shaped attachment sections 52y, 72y and 82y. The wheel train bridge 250 has a bearing hole 255 for supporting the shafts 52x, 72x and 82x, while the plate 260 has a bridge 266 for rotatably supporting the attachment sections 52y, 72y and 82y.

The minute wheel B61 and the picture date dial transmitting wheel C83 are provided with similarly shaped shafts 61x, 83x and attachment sections 61y, 83y. The wheel train bridge 250 has a bearing hole 256 for axially supporting the shafts 61x, 83x, while the plate 260 is provided with a bridge 267 for rotatably supporting the attachment sections 61y, 83y.

The hour-wheel C62 and the picture date dial transmitting wheel D84 are provided with similarly shaped bearing holes 62x, 84x, while the plate 260 has a shaft tube 268 for supporting the bearing holes 62x, 84x.

Meanwhile, the wheel train bridge 250 and the plate 260 are adapted for detachably supporting the minute transmitting wheel C73 of the seventh wheel train 7.

For exchange and removal of the components of the above described speed-reducing wheel trains, a tube 260a and a screw 270 securing the wheel train bridge 250 to the plate 260 are dismantled for detaching the wheel train bridge 250 from the plate 260.

the above mentioned switch block 130 is provided with three pushbuttons 132, 133 and 134. When these pushbuttons 132, 133 and 134 are pressed, presser plate switching spring sections

230b, 230c and 230d, forming parts of a presser plate 230, associated with the pushbuttons 132, 133 and 134, are pressed and electrically connected to pushbutton switch patterns 240c, 240d and 240e printed on a circuit board 240, associated with the pushbuttons 132, 133 and 134, so that the switch is turned on.

Although not shown, the pushbuttons 132, 133 and 134 are supported by a watch case.

The switch block 130 is provided with a winding stem 131 which is switched by a push/pull operation. As shown in Figs. 2,6 and 16, the winding stem 131 has three positions, namely a normal position P1, a pushed-in position P2 and a pulled-out position P3.

When the winding stem 131 is pushed to the pushed-in position P2, a mode spring 135 (shown in Fig. 16) contacted with a mode spring pushing section 131a of the winding stem 131 is thrust and rotated about a dowel 260b as a center of rotation. At this time, a mode lever 136 contacted with the mode spring 135 is also rotated about the dowel as a center of rotation. A mode wheel 138 is rotated by a mode wheel feed part 136a of the mode lever 136 thrusting teeth of the mode wheel 138. When the teeth of the mode wheel 138 skip the skip position of a mode wheel jumper section 137 of a jumper lever 137, adapted for controlling the position of the mode wheel 138, the mode wheel 138 is rotated by one tooth.

This causes rotation of a function indicating hand 30 fitted in a fitting part 138b of the mode wheel 138 shown in Fig. 16, along with a mode changeover switching spring 13a engaged with a mode wheel dowel 138a of the mode wheel 138.

Since the mode wheel has eight teeth, the mode wheel 138 and the mode changeover switch spring 139 are rotated by one-eighth of the full rotation, or through 45°, by each feed operation of the mode lever 136.

The mode changeover switch spring 139 has two contacts 139a. Eight mode states are created depending on which of the four mode switch patterns 240a printed on the circuit board 240 is connected to the contacts 139a.

When the winding stem 131 is released, the winding stem 131, mode spring 135 and the mode lever 136 are returned, by the spring force of the mode spring thrusting section 137a of the mode jumper lever 137 and the mode lever thrusting section 137b, to a state in which the winding stem 131 is in its normal position P1.

When the winding stem 131 is pulled to its pull-out position P3, the mode spring 135 is rotated, under the force of the mode spring thrusting section 137a of the mode jumper lever 137, about the dowel 260b as a center of rotation. On rotation of the mode spring 135, the mode spring contact part 135a is contacted with the winding stem switch pattern 240b printed on the circuit board 240 and is electrically connected so that electrical signals are sent to the microcomputer IC 120 for establishing the correcting state.

When the winding stem 131 is pulled to the pulled-out position P3, a link 131b of the winding stem 131 rides over a link 230a of the presser plate 230.

A variety of multi-function timepieces are explained.

A multi-functional timepiece A510 has a minute hand 180, an hour-hand 190, an auxiliary hand A200, a dial plate 280 and a case 320. Roman letters I to XII for indicating the calendar months and time are inscribed on a circumference 320a of the case 320.

In a circumferential graduated part 280a of the dial 280, 60 graduations indicating the minutes and date numbers "1" to "31" indicating the date are inscribed. The date numerals "1" to "29" are inscribed at every two graduations and the date numerals "30"and "31"are inscribed at each graduation.

On a circumferential graduated part 330a of a small dial 330, 60 graduations indicating the seconds, letters and numerals Ly, +1, +2, +3, indicating the calendar leap year, and letters "ON" and "OFF" indicating alarm ON and OFF, are inscribed.

The plan view of Fig. 6 is an assembly plan view of a movement of a multi-functional timepiece A510 shown in Fig. 2. As described above, the minute-hand 180, the hour-hand 190 and the subsidiary wheel A200 are adapted to be driven independently by the motor A90 and the second speed-reducing wheel train 2, the motor B100 and the fourth speed-reducing wheel train 4 and by the motor C110 and the fifth speed-reducing wheel train 5, respectively.

The function indicating section 310 is provided with seven function indicating sections 310a to 310g, inclusive of a time indicating section 310a and a calendar indicating section 310b, and a zero-position setting section 310b. By pushing the winding stem 131 from the normal position P1 to the pushed-in position P2, the function indicating hand 300 cyclically point to the function indicating sections 310a and 310b, zero position setting section 310h and the function indicating sections 310e to 310d.

When the function indicating hand 300 points to the function indicating section 310a, the multi-function timepiece A510 indicates the usual time, the hour-hand 190 indicating the usual hour, the minute hand 180 indicating the usual minute and the subsidiary hand A200 indicating the usual second.

When the function indicating hand 300 points to the function indicating section 310b, the multi-function timepiece A510 indicates the calender, the subsidiary needle A200 indicates past year after leap year, the hour-hand 190 indicating the month and the minute hand 180 indicating the date.

When the function indicating hand 300 points to the function indicating section 310c, the multi-function timepiece A510 indicates a one-shot alarm. If the one-shot alarm is set, the hour-hand 190 and the minute-hand 180 indicate the set hour and the set minute of the one-shot alarm, respectively, the subsidiary hour A200 indicating the current zero-second position. If the one-shot alarm is not set, the hour-hand 190 and the minute-hand 180 indicate the current hour and minute, respectively, while the subsidiary hand A200 indicates the current time.

If the function indicating hand 300 points to the function indicating part 310d, the functional timepiece A510 indicates daily alarm, the hour-hand 190 and the minute-hour 180 indicating the hour and the minute of alarm setting and the subsidiary hour A200 indicating alarm ON/OFF.

When the function indicating hour 300 points to the function indicating section 310e, the multi-function timepiece A510 indicates chronographic time, the hour-hand 190 and the minute-hand 180 indicating chronographic minute and second and the subsidiary hour A200 indicating chronographic 1/20 second.

When the function indicating hand 300 points to the function indicating section 310f, the multi-function timepiece A510 indicates a timer, the hour-hand 190 and the minute hand 180 indicating timer minute and second and the subsidiary hour A200 indicating timer setting time.

When the function indicating hand 300 points to the function indicating section 310g, the multi-function timepiece A510 indicates local time, the hour-hand 190, the minute-hand 180 and the subsidiary hand A200 indicating local time hour, minute and second, respectively.

When the function indicating hand 300 points to the function indicating section 310h, the multi-function timepiece A510 indicates the zero-setting state, the hour-hand 190, minute-hand 180 and the subsidiary hand A200 indicating a 12 o'clock position, a zero minute position and a zero second position, as zero positions, respectively. If, in the respective functional states, indicated by the function indicating sections 310a to 310g and the zero-setting section 310h, the winding stem 131 is pulled to its pulled-out position P3, the correcting state is established, so that correction may be made by pushbuttons 132 to 134.

A multi-function timepiece B520 shown in Fig. 3 includes an hour-hand 190, a minute hand 180 and a second hand 170. The assembly plan view of Fig. 7 shows the multi-function timepiece B520 shown in Fig. 3. As described above, the second-hand 170, hour-hand 190 and the minute-hand 180 are adapted to be driven independently by the motor A90 and the first speed-reducing wheel train 1, the motor B100 and the fourth speed-reducing wheel train 4 and by the motor B110 and the fourth speed-reducing wheel train 4, respectively. The remaining construction is substantially the same as the construction of the multi-function timepiece A510 shown in Fig. 2.

Thus the timepiece B520 has the same function indicating section 310 as that of the multi-function timepiece A510, so that, if the function indicating hand 300 points to the function indicating section 310a of the function indicating section 310, the multi-function timepiece B520 indicates usual time, the hour-hand 190, minute-hand 180 and the second-hand 170 indicating the usual hour, usual minute and the usual second, respectively.

When the function indicating hand 300 points to the function indicating section 310d of the function indicating section 310, the multi-function timepiece B520 indicates daily alarm, the hour-hand 190 and the minute-hand 180 indicating the alarm-setting hour and alarm-setting minute, respectively. The second-hand 170 indicates an alarm type indicating section 280B on the dial 280 for enabling the alarm ON/OFF or the alarm sound volume to be selected as desired.

The multi-function timepiece C530 of Fig. 4 has an hour-hand 190, a minute-hand 180, a second-hand 170 and subsidiary hands A200 and B210. The assembly plan view of Fig. 8 shows-the multi-function timepiece C530 of Fig. 4. As described above, the second-hand 170 is driven independently by the motor A90 and the first speed-reducing wheel train 1, while the minute-hand 180 and the hour-hand 190 are driven independently by the motor B100 and the third speed-reducing wheel train 3 and the subsidiary hands A200 and B210 are driven independently by the motor C110 and the sixth wheel train 6. The remaining construction is substantially the same as the construction of the multi-function timepiece A510 shown in Fig. 2.

Thus the multi-function timepiece C520 has the same function indicating section 310 as that of the multi-function timepiece A510 and, when the function indicating hand 300 points to the function indicating section 310a of the function indicating section 310, the multi-function timepiece C530 indicates the usual time or home time, the hour-hand 190, the minute-hand 180 and the second-hand 170 indicating usual hour, usual minute and the usual second, respectively, and the subsidiary hours A200 and B210 indicating the local time minute and the local time second, on the 24-hour

basis, respectively.

When the function indicating hand 300 points to the function pointing section 310g of the function indicating section 310, the multi-function timepiece C530 indicates the local time, the hour-hand 190 and the minute-hand 180 indicating the local time hour and the local time minute, respectively, and the subsidiary hands A200 and B210 indicating the home time minutes and hours, on the 24-hour basis, respectively.

A multi-function timepiece D540 shown in Fig. 5 has an hour-hand 190, a minute-hand 180, second-hand 170 and a picture date dial 220. The assembly plan view of Fig. 9 shows the multi-function timepiece D540 shown in Fig. 5. As described previously, the second-hand 170 is driven independently by the motor A90 and the first speed-reducing wheel train 1, while the minute-hand 180 and the hour-hand 190 are driven independently by the motor B100 and the third speed-reducing wheel train 3 and the picture date dial 220 is driven independently by the motor C110 and the eighth speed-reducing wheel train 8. The remaining construction is the same as that of the multi-function timepiece A510 shown in Fig.2. Thus the multi-function timepiece C540 has the function indicating section 310 substantially identical with that of the multi-function timepiece A510 and, when the function pointing hand 300 points to the function indicating section 310a of the function indicating section 310, the timepiece D540 indicates the usual time, the hour-hand 190, the minute hand 180 and the second-hand 170 indicating the usual hour, usual minute and usual second, and the picture date dial 220 indicating the date.

Claims

1. A hand-indicating type timepiece comprising

a first speed-reducing wheel train for a second-hand and a second speed-reducing wheel train for a minute hand, selectably and commonly supported by a wheel train bridge and a support provided on a plate, said first and second wheel trains being connected to a motor A, and

a third speed-reducing wheel train for a minute-hand and a fourth speed-reducing wheel train for an hour-hand, selectably and commonly supported by said wheel train bridge and said support provided on the plate, said third and fourth wheel trains being connected to a motor B,

one of said first and second speed-reducing wheel trains and one of said third and fourth wheel trains being arranged selectably.

2. A hand indicating type timepiece comprising

a third speed-reducing wheel train for a minute hand and a fourth speed-reducing wheel train for a hour hand, selectably and commonly supported by a wheel train bridge and a support provided on a plate, said third and fourth wheel trains being connected to a motor B,

a fifth speed-reducing wheel train for a subsidiary hand A, a sixth speed-reducing wheel train for subsidiary hands A and B, a seventh speed-reducing wheel train for a minute hand and an eighth speed-reducing wheel train for a picture date dial, said fifth to eighth speed-reducing wheel trains being selectably and commonly supported by said wheel train bridge and said support and being connected to a motor C,

one of said third and fourth speed-reducing wheel trains and one of said fifth to eighth speed-reducing wheel trains being arranged selectably.

3. A hand indicating type timepiece comprising

a first speed-reducing wheel train for a second-hand and a second speed-reducing wheel train for a minute hand, selectably and commonly supported by a wheel train bridge and a support provided on a plate, said first and second wheel trains being connected to a motor A,

a third speed-reducing wheel train for a minute-hand and a fourth speed-reducing wheel train for an hour-hand, selectably and commonly supported by said wheel train bridge and said support provided on the plate, said third and fourth wheel trains being connected to a motor B, and

a fifth speed-reducing wheel train for a subsidiary hand A, a sixth speed-reducing wheel train for subsidiary hands A and B, a seventh speed-reducing wheel train for a minute hand and an eighth speed-reducing wheel train for a picture date dial, selectably and commonly supported by said wheel train bridge and said support, said fifth to eighth speed-reducing wheel trains being connected to a motor C,

one of said first and second speed-reducing wheel trains, one of said third and fourth speed-reducing wheel trains and one of said fifth to eighth speed-reducing wheel trains being arranged selectably.

4. A hand-indicating type timepiece as claimed in claims 1 to 3 wherein said first and second speed-reducing wheel trains comprise an intermediate wheel gear having a common shaft and attachment section and an intermediate

wheel gear having a common shaft and flange and wherein said wheel train bridge and said support provided on the plate comprise a bridge supporting said attachment section and a bearing hole supporting said common shaft and a bridge supporting said flange and a bearing hole supporting said common shaft.

5. A hand-indicating type timepiece as claimed in claims 1 to 3 wherein said third and fourth speed-reducing wheel trains comprise an intermediate wheel gear having a common shaft and attachment section and an intermediate wheel gear having a common bearing hole, and wherein said wheel train bridge and said support provided on the plate comprise a shaft loosely fitted in said common bearing hole,

a bridge supporting said attachment section and a shaft tube supporting said common bearing hole.

6. A hand-indicating type timepiece as claimed in claim 2 or 3 wherein said fifth speed-reducing wheel train, sixth speed-reducing wheel train ,seventh speed-reducing wheel train and said eighth speed-reducing wheel train are provided with intermediate wheel gears (51, 71, 81) provided with common shafts (51x, 71x, 81x) and attachment sections (51y, 71y, 81y) and intermediate wheel gears (52, 72, 82) provided with common shafts (52x, 72x, 82x) and attachment sections (52y, 72y, 82y), and wherein said wheel train support and the support provided on the plate comprise a bearing hole (254) for supporting said common shafts (51x, 71x, 81), a bridge (265) supporting said attachment sections (51y, 71y, 81y), a bearing hole (255) supporting said common shafts (52x, 72x, 82x) and a bridge (266) supporting said attachment sections (52y, 72y, 82y).

7. A hand-indicating type timepiece according to claim 6 wherein said sixth speed-reducing wheel train and said eighth speed-reducing wheel train comprise intermediate wheel gears (62, 84) having common bearing holes (62x, 84x) and wherein said support provided on the plate comprises a shaft tube (268) supporting said bearing holes (62x,84x).

FIG. 1

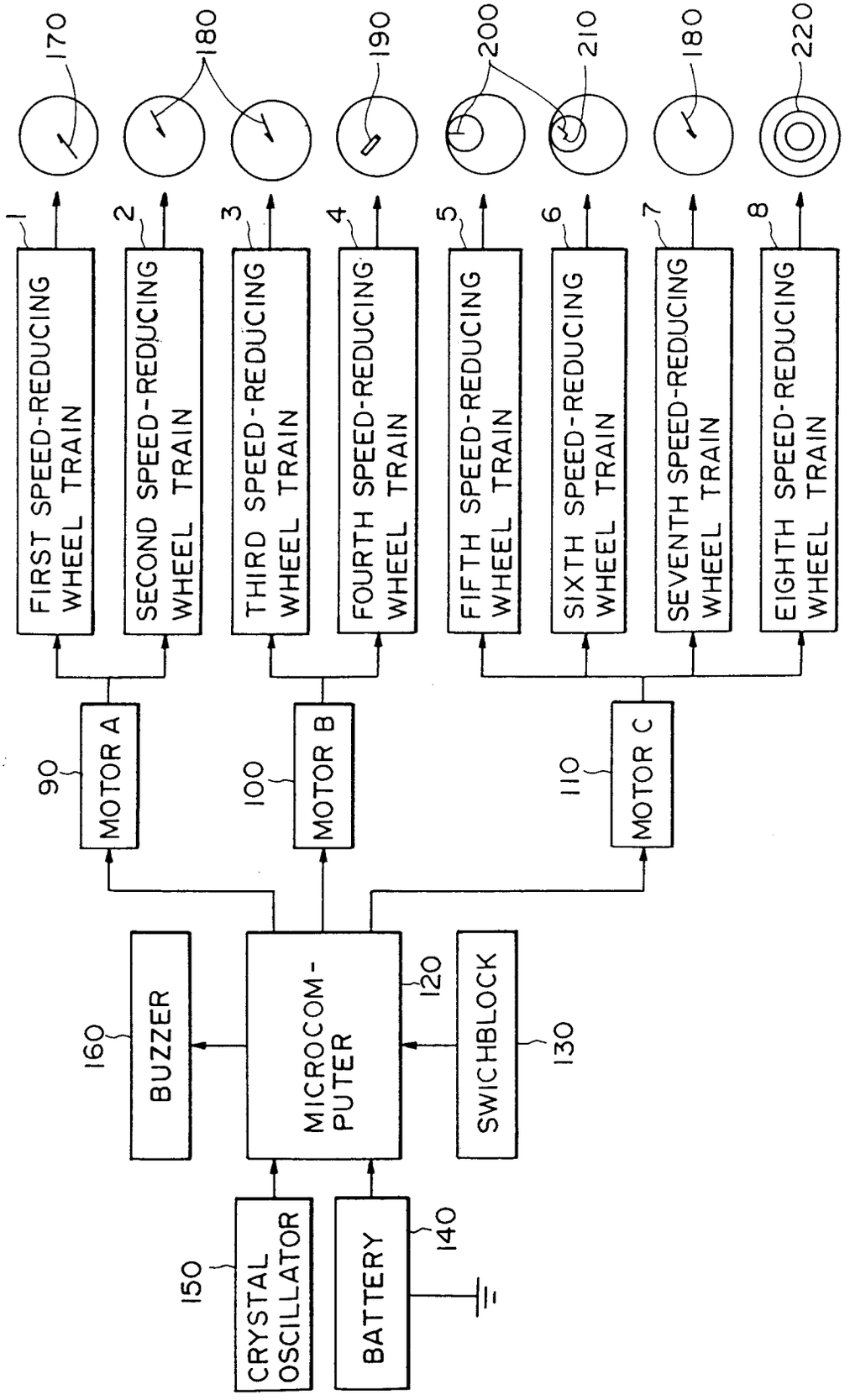

170
180
190
200
210
180
220
1
2
3
4
5
6
7
8
FIRST SPEED-REDUCING WHEEL TRAIN
SECOND SPEED-REDUCING WHEEL TRAIN
THIRD SPEED-REDUCING WHEEL TRAIN
FOURTH SPEED-REDUCING WHEEL TRAIN
FIFTH SPEED-REDUCING WHEEL TRAIN
SIXTH SPEED-REDUCING WHEEL TRAIN
SEVENTH SPEED-REDUCING WHEEL TRAIN
EIGHTH SPEED-REDUCING WHEEL TRAIN
90
MOTOR A
100
MOTOR B
110
MOTOR C
160
BUZZER
MICROCOM-PUTER
120
SWICHBLOCK
130
150
CRYSTAL OSCILLATOR
BATTERY
140

FIG. 2

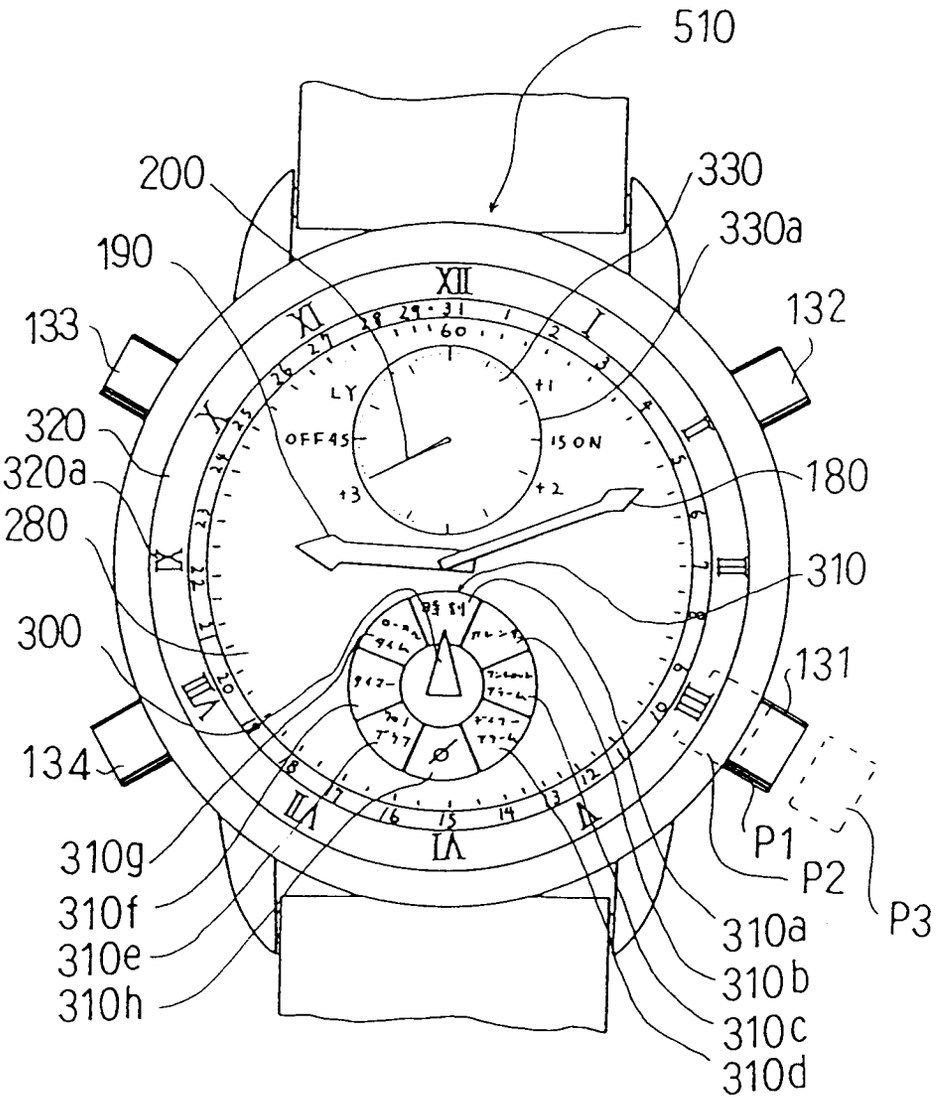

510
200
330
330a
190
132
133
320
320a
180
280
310
300
131
134
P1
P2
P3
310g
310f
310e
310h
310a
310b
310c
310d

FIG.3

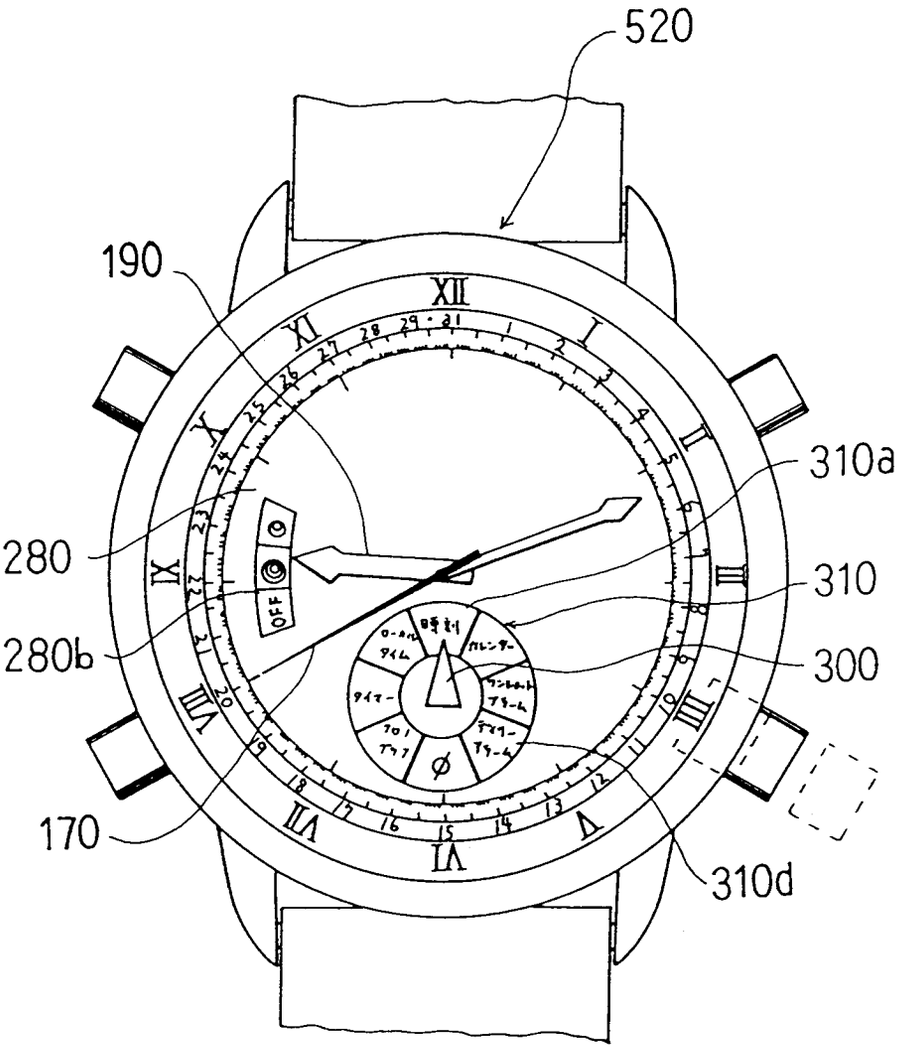


FIG.4

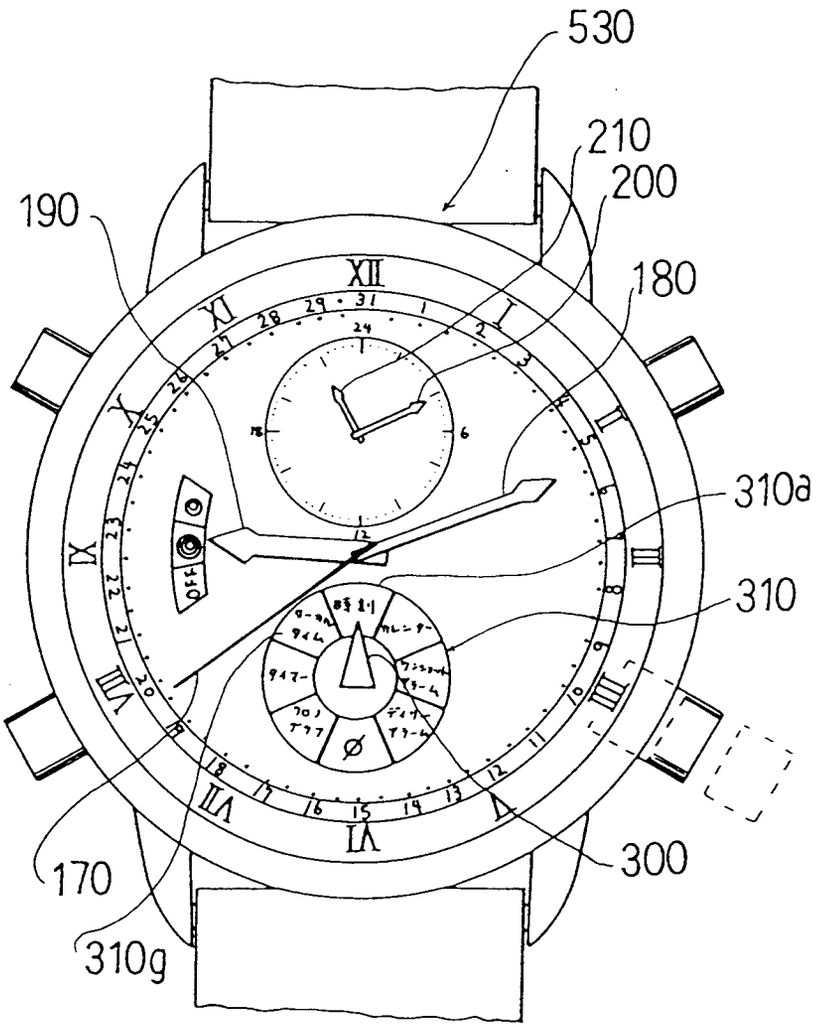


FIG.5

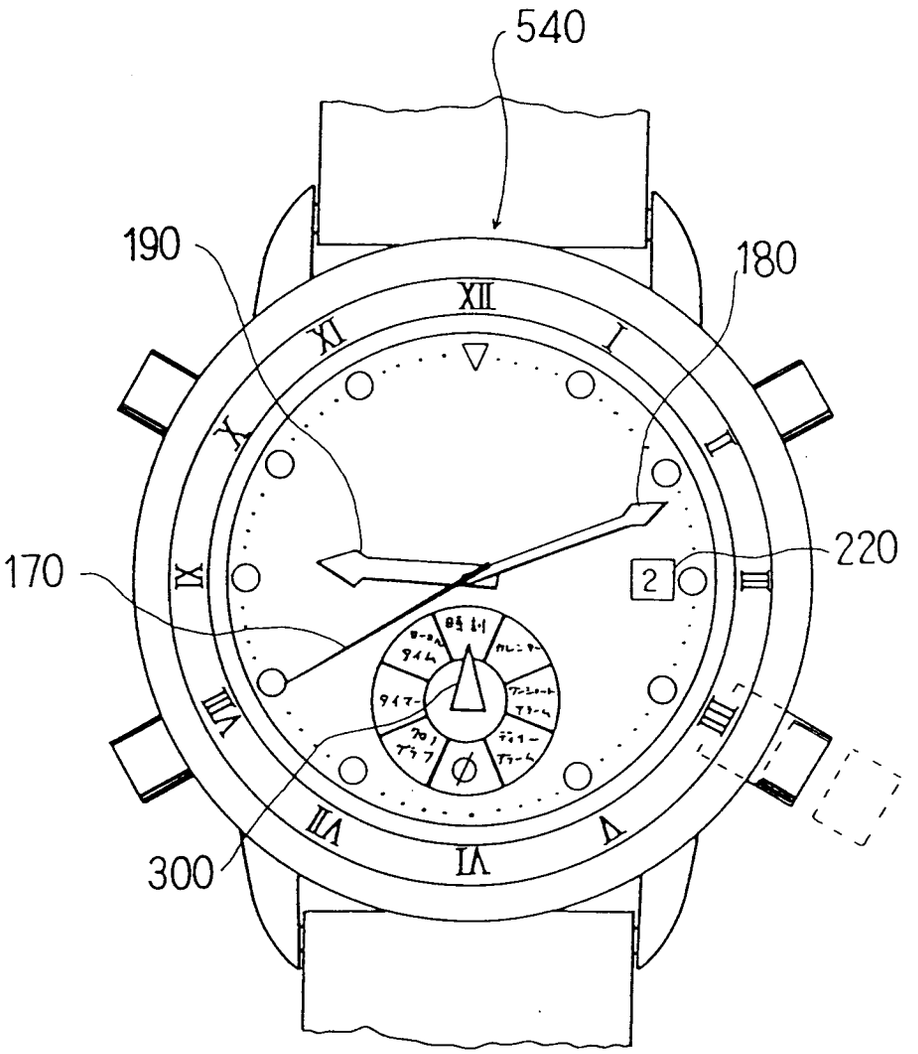


FIG.6

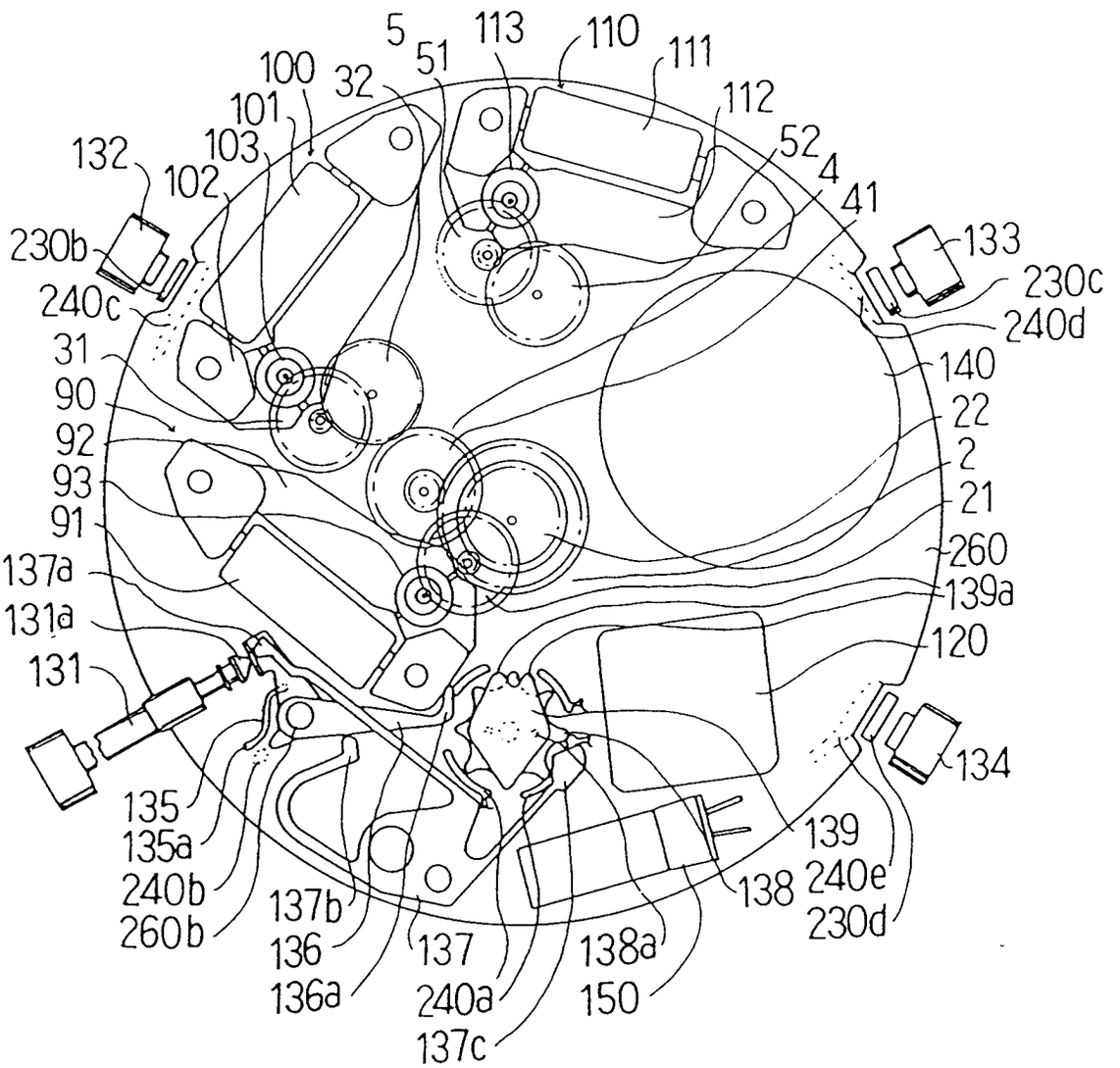

5
113
110
111
100
32
51
112
101
52
103
4
132
102
41
230b
133
240c
230c
240d
31
140
90
22
92
2
93
21
91
260
137a
139a
131a
120
131
134
135
139
135a
240e
240b
138
137b
230d
260b
136
137
138a
136a
240a
150
137c

FIG.7

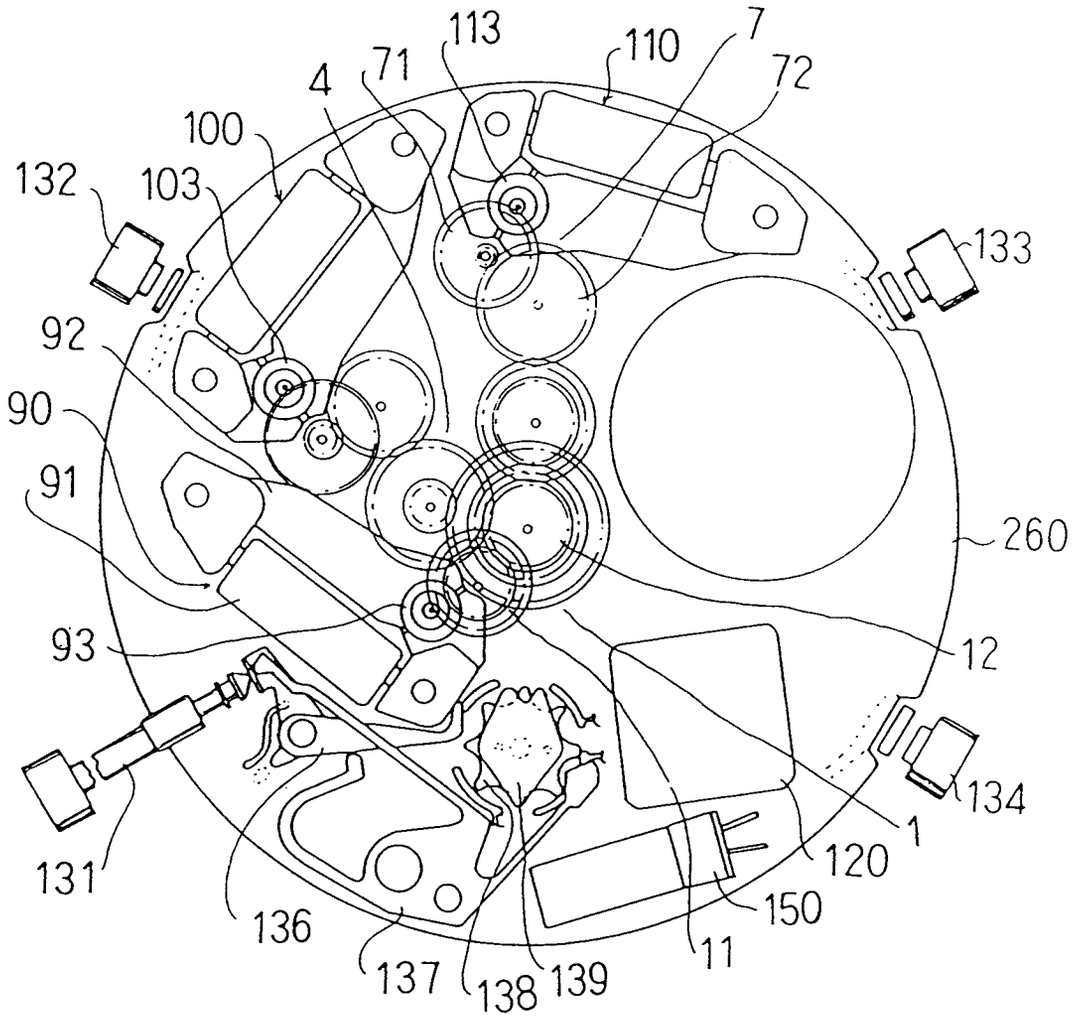

113
110
7
4
71
72
100
132
103
133
92
90
91
260
93
12
134
1
131
120
150
136
11
137
138
139

FIG.8

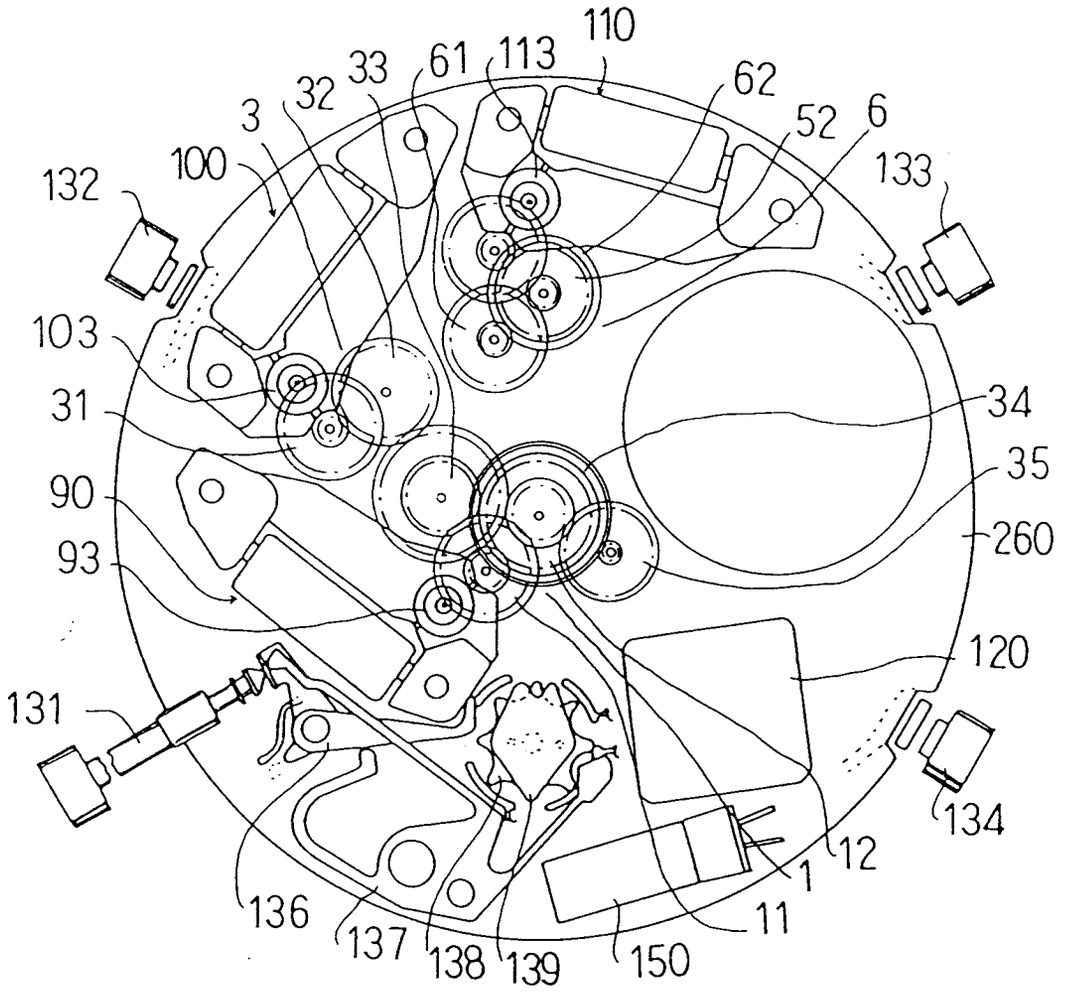

110
113
61
33
32
3
100
132
62
52
6
133
103
31
34
35
90
260
93
120
131
134
12
1
11
136
137
138
139
150

FIG.9

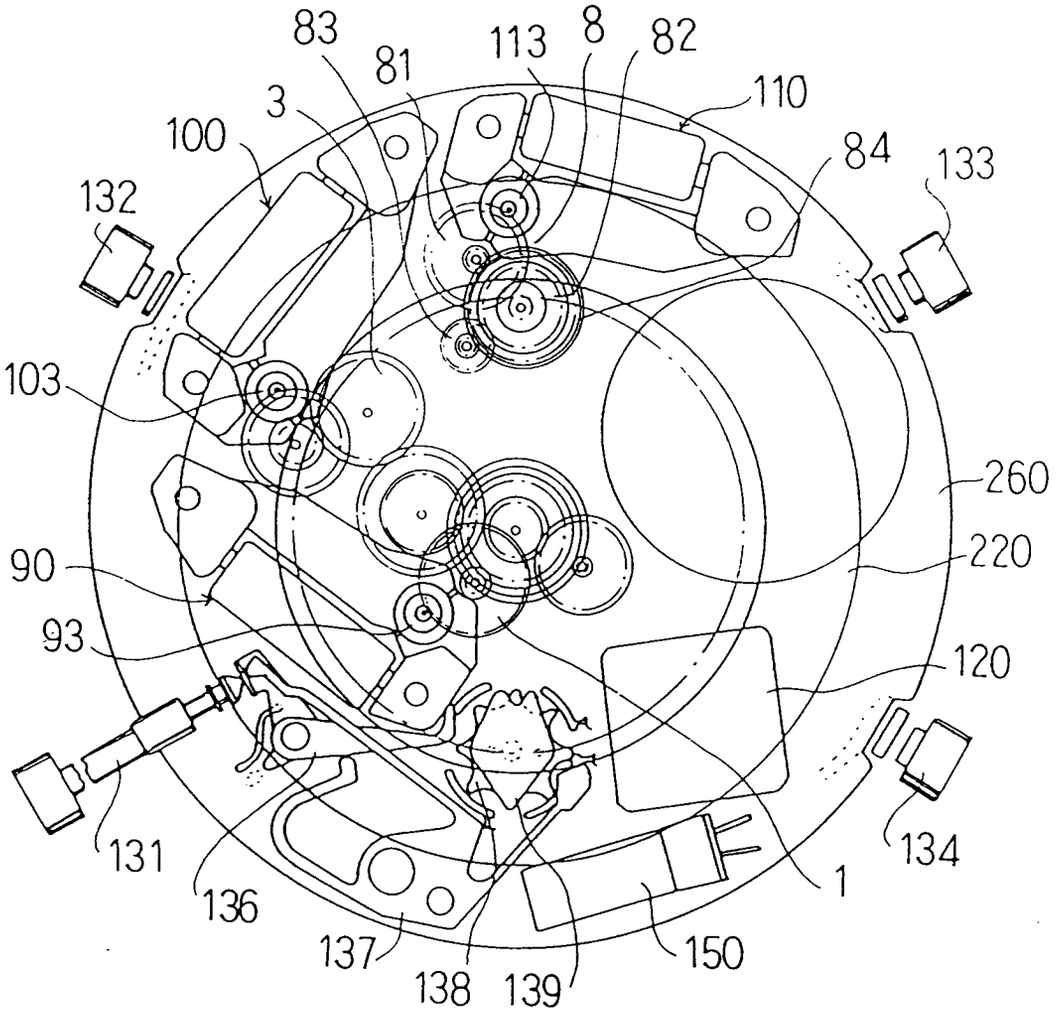

83
81
113
8
82
110
3
100
84
133
132
103
260
90
220
93
120
131
136
137
138
139
150
1
134

FIG. 10

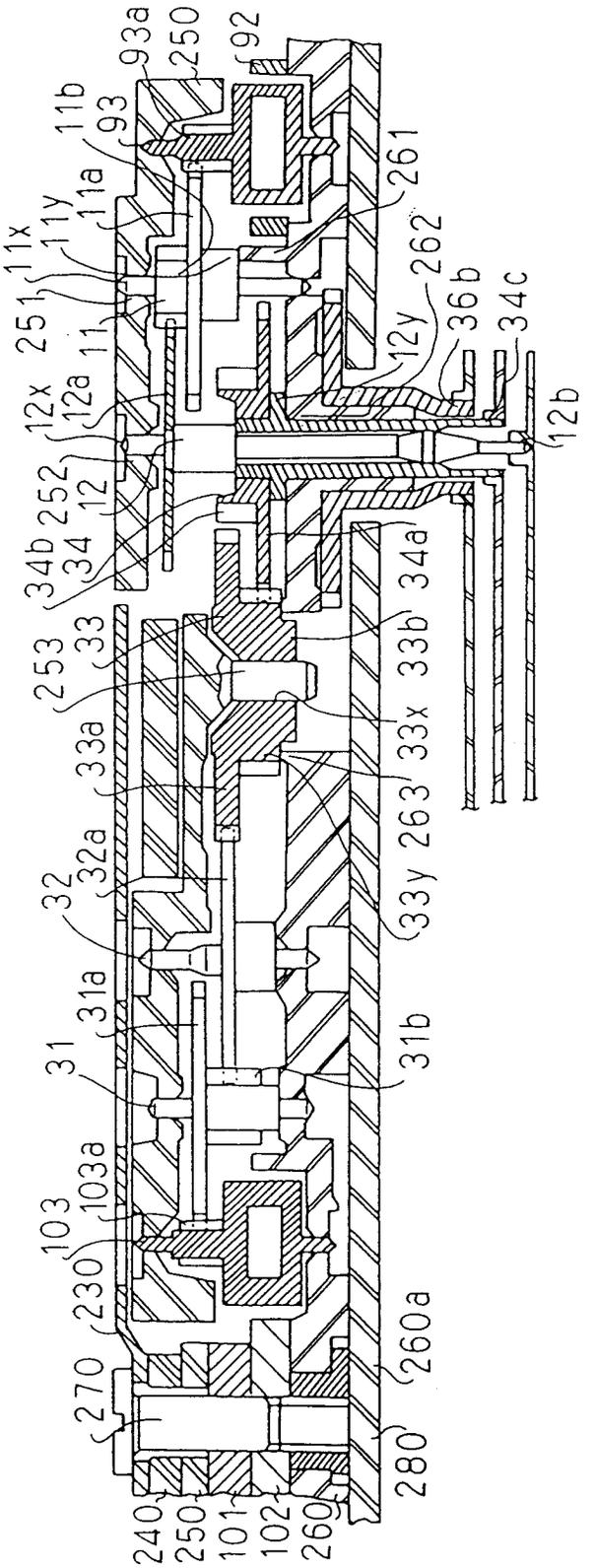

93a
250
92
11b
93
261
11a
11y
11x
262
251
36b
34c
11
12y
12x
12a
12b
252
12
34b
34
34a
253
33
33b
33a
33x
263
32a
33y
32
31a
31
31b
103a
103
230
260a
270
280
240
250
101
102
260

FIG.12

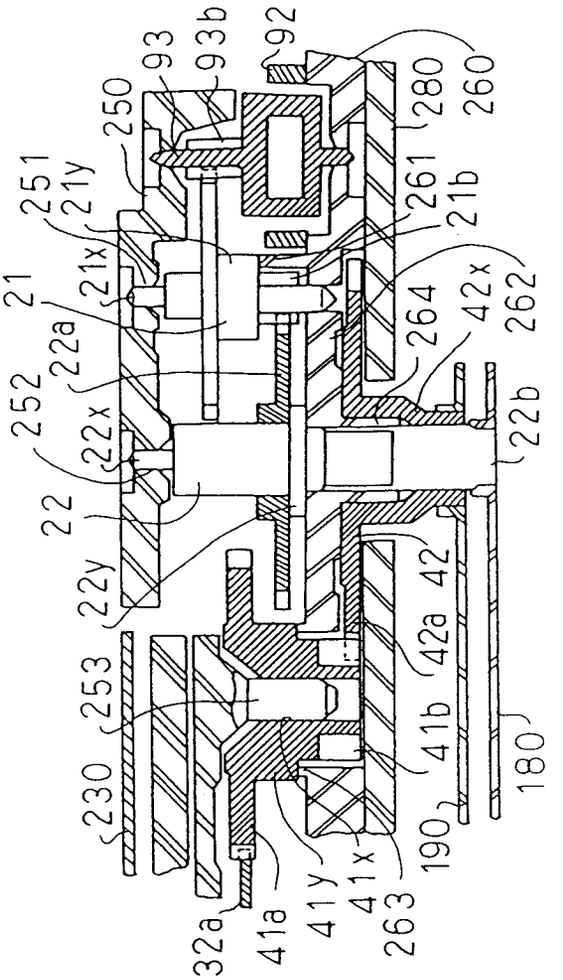

92
93b
93
250
251
21y
21
21x
22a
252
22x
22
22y
253
230
32a
41a
41y
41x
263
190
41b
180
42a
42
22b
262
42x
264
261
21b
280
260

FIG.11

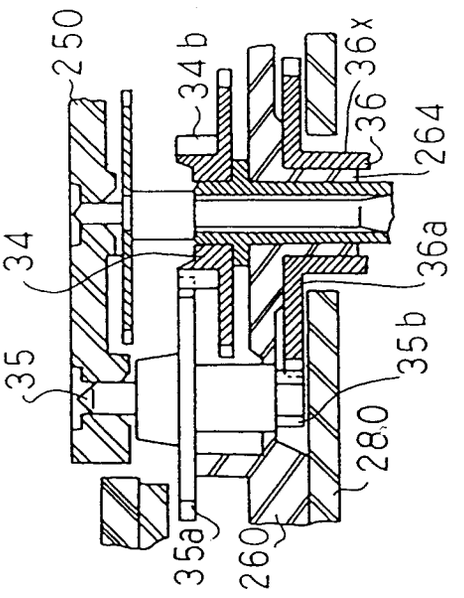

250
34b
36x
36
264
34
36a
35
35b
280
35a
260

FIG.13

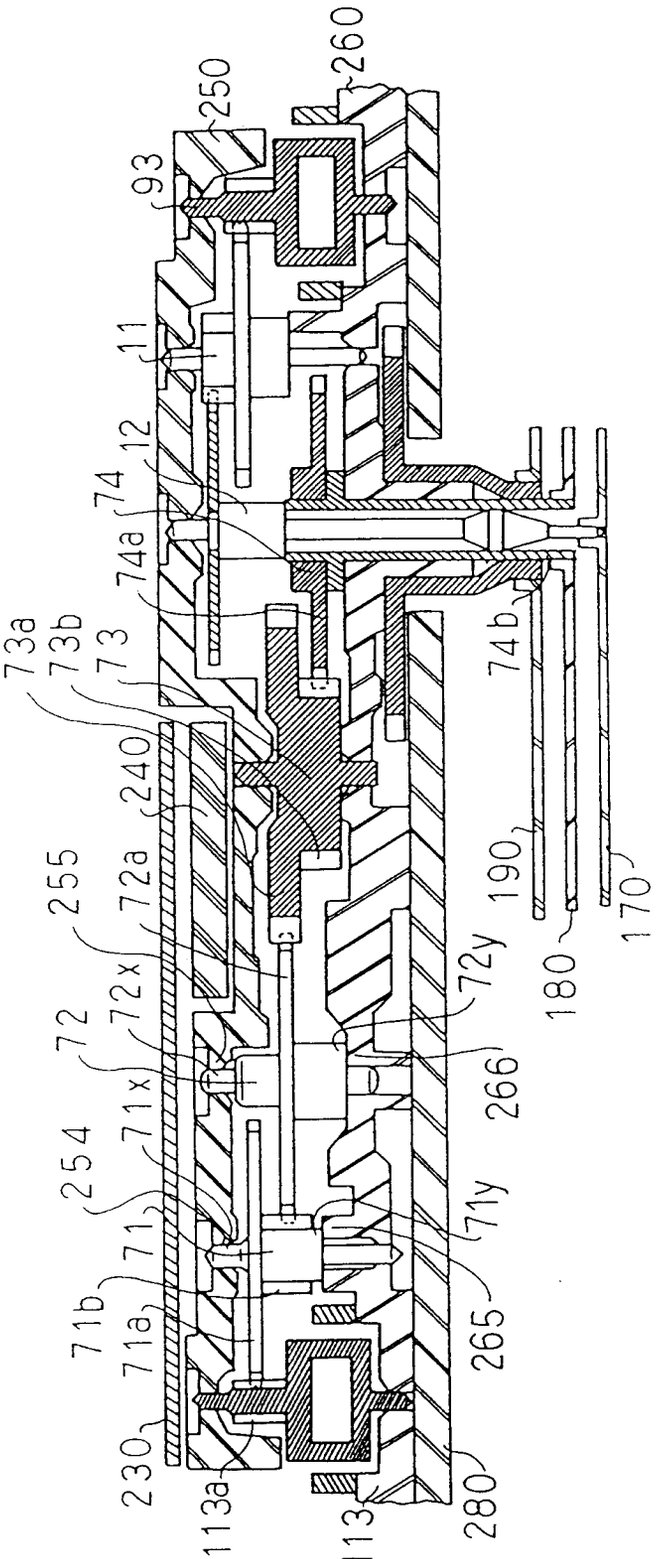

260
250
93
11
12
74
74a
73a
73b
73
74b
240
255
72a
72x
72
71x
254
71
71b
71a
230
113a
113
280
265
71y
266
72y
180
190
170

FIG.15

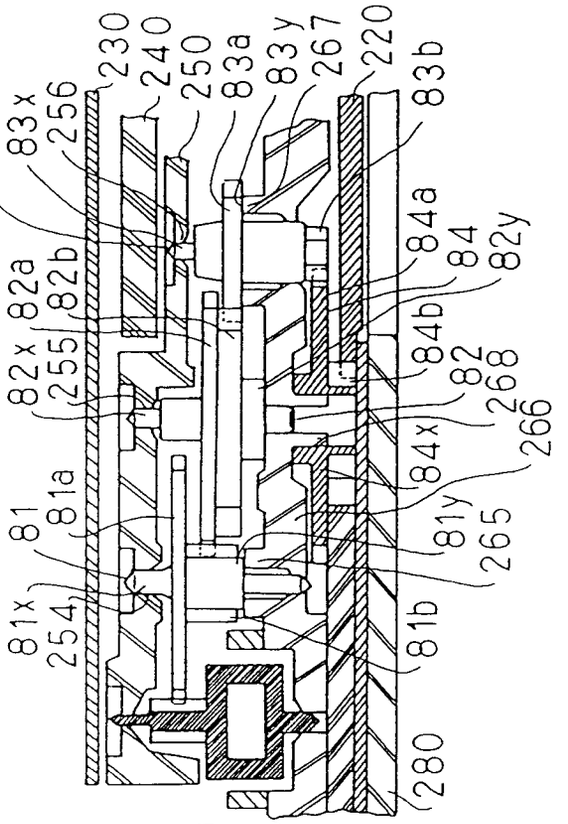

230
240
250
83a
83y
267
220
83b
83
83x
256
84a
84
82y
82a
82b
84b
82x
255
82
268
84x
266
81
81a
81y
265
81x
254
81b
280

FIG.14

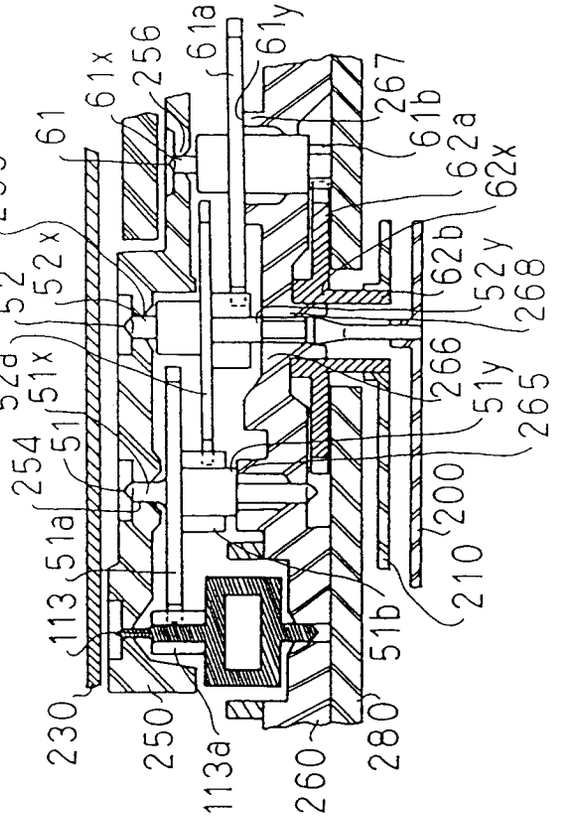

61a
61y
61x
256
267
61
61b
62a
62x
255
52
52x
62b
52y
268
52a
51x
266
51y
254
51
265
51a
200
113
210
51b
230
250
113a
260
280

FIG.16

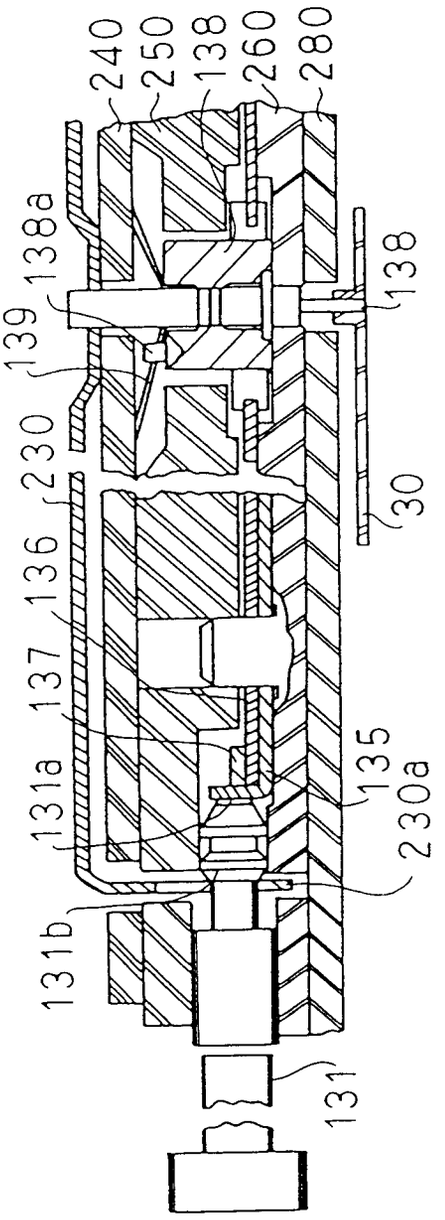
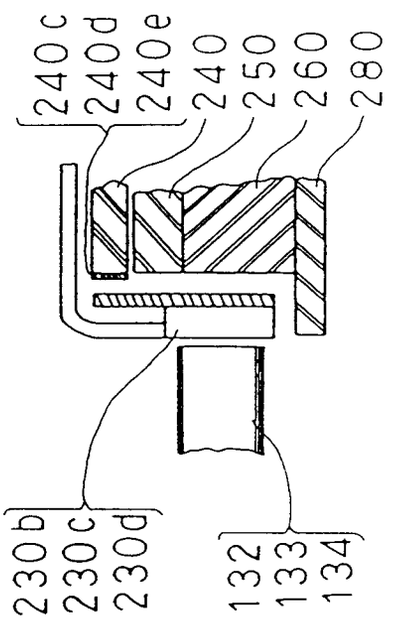

240
250
138
260
280
138a
139
138
230
30
136
137
131a
135
230a
131b
131

FIG.17


240c
240d
240e
240
250
260
280
230b
230c
230d
132
133
134

INTERNATIONAL SEARCH REPORT

International Application No PCT/JP91/00966

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[5] G04C3/14

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	G04C3/14, G04B19/00, G04B33/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

Jitsuyo Shinan Koho 1965 - 1991
Kokai Jitsuyo Shinan Koho 1971 - 1991

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	JP, A, 61-83992 (Citizen Watch Co., Ltd.), April 28, 1986 (28. 04. 86), Fig. 6 (Family: none)	1
Y	JP, A, 58-5687 (Daini Seikosha K.K.), January 13, 1983 (13. 01. 83), Figs. 2, 3 (Family: none)	1-7
Y	JP, A, 58-109879 (Fabrique Torulogiere de Vontine S.A.), June 30, 1983 (30. 06. 83), Figs. 2a, 2b & EP, A, 82,110 & CH, B, 647,636	1-7
Y	JP, A, 1-254890 (Citizen Watch Co., Ltd.), October 11, 1989 (11. 10. 89), Fig. 9 (Family: none)	2, 3
A	JP, A, 60-146175 (Citizen Watch Co., Ltd.), August 1, 1983 (01. 08. 83),	1

* Special categories of cited documents: [10]

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
September 30, 1991 (30. 09. 91)	October 21, 1991 (21. 10. 91)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	