

Description

Mechanical time piece having hairspring holder
adjusting mechanism

[Technical Field]

The present invention relates to a mechanical time piece having a hairspring holder adjusting mechanism constituted to be capable of adjusting a position of a hairspring holder.

[Background of the Invention]

According to a conventional mechanical time piece, as shown in Fig. 6 and Fig. 7, a movement (machine body) 1100 of a mechanical time piece is provided with a main plate 1102 constituting a base plate of the movement. A winding stem 1110 is rotatably integrated to a winding stem guide hole 1102a of the main plate 1102. A dial 1104 (shown in Fig. 7 by an imaginary line) is attached to the movement 1100.

Generally, in both sides of the main plate, a side thereof having the dial is referred to as "back side" of the movement and a side thereof opposed to the side having the dial is referred to as "front side" of the movement. A train wheel integrated to the "front side" of the movement is referred to as "front wheel train" and a train wheel integrated to the "back side" of the movement is referred to as "back train wheel".

The position in the axis line direction of the winding stem 1110 is determined by a switch apparatus including a setting lever 1190, a yoke 1192, a yoke spring 1194 and a setting lever jumper 1196. A winding pinion 1112 is provided rotatably at a guide shaft portion of the winding stem 1110. When the winding stem 1110 is rotated in the state in which the winding stem 1110 is disposed at a first winding stem position (0-stage) which is the position furthest inward along the stem axis, the winding pinion 1112 is rotated via rotation of a clutch wheel. A crown wheel 1114 is rotated by rotation of the winding pinion 1112. A ratchet wheel 1116 is rotated by rotation of the crown wheel 1114. By rotating the ratchet wheel 1116, a mainspring 1122 contained in a barrel complete 1120 is wound up. A center wheel & pinion 1124 is rotated by rotation of the barrel complete 1120. An escape wheel & pinion 1130 is rotated via rotation of a fourth wheel & pinion 1128, a third wheel & pinion 1126 and the center wheel & pinion 1124. The barrel complete 1120, the center wheel & pinion 1124, the third wheel & pinion 1126 and the fourth wheel & pinion 1128 constitute a front wheel train.

An escapement & speed control apparatus for controlling rotation of the front wheel train includes a balance with hairspring 1140, the escape wheel & pinion 1130 and a pallet fork 1142. The balance with hairspring 1140 includes a balance stem 1140a, a balance wheel 1140b and a hairspring 1140c. Based

on rotation of the center wheel & pinion 1124, a cannon pinion 1150 is simultaneously rotated. A minute hand 1152 attached to the cannon pinion 1150 displays "minute". The cannon pinion 1150 is provided with a slip mechanism relative to the center pinion & wheel 1124. Based on rotation of the cannon pinion 1150, via rotation of a minute wheel (not illustrated), an hour wheel 1154 is rotated. An hour hand 1156 attached to the hour wheel 1154 displays "hour".

The barrel complete 1120 is supported rotatably by the main plate 1102 and a barrel bridge 1160. The center wheel & pinion 1124, the third wheel & pinion 1126, the fourth wheel & pinion 1128 and the escape wheel & pinion 1130 are supported rotatably by the main plate 1102 and a train wheel bridge 1162. The pallet fork 1142 is supported rotatably by the main plate 1102 and a pallet bridge 1164. The balance with hairspring 1140 is supported rotatably by the main plate 1102 and a balance bridge 1166.

The hairspring 1140c is a leaf spring in a helical (spiral) shape having a plural turn number. The inner end portion of the hairspring 1140c is fixed to an inner hairspring holder 1140d fixed to the balance stem 1140a. A stud support 1170 is rotatably attached to the balance bridge 1166. The rotational center of the stud support 1170 is the same as the rotational center of the balance with hairspring 1140.

As shown in Fig. 6 through Fig. 9, a hairspring holder

1172 is fixedly screwed to the stud support 1170 by a hairspring holder screw 1174. The outer end portion of the hairspring 1140c is fixed to the hairspring holder 1172. In a state in which the hairspring holder screw 1174 is loosened, the hairspring holder 1172 can be moved in a direction in parallel with the axis line of the balance with hairspring 1140.

A regulator 1168 is attached rotatably to the balance bridge 1166. A hairspring bridge 1168a and a hairspring rod 1168b are attached to the regulator 1168. A portion of the hairspring 1140c proximate to the outer end portion is disposed between the hairspring bridge 1168a and the hairspring rod 1168b.

However, according to the conventional mechanical time piece, the hairspring holder can be moved only in a direction in parallel with the axis line of the balance with hairspring. Therefore, in fabricating a highly accurate mechanical time piece, it has been difficult to effectively carry out an operation of aligning the rotational center of the balance with hairspring and the center of the hairspring (the so-called operation of "centering of rotation of hairspring"). That is, according to the operation of centering of rotation of the hairspring, there is needed an operation of adjusting the original shape of the hairspring by using hairspring tweezers.

The operation of adjusting the original shape of the hairspring is a very difficult operation even in the case in which an operator having a highly skilled technique carries

out the operation. Therefore, there poses a problem in which fabrication of a highly accurate mechanical time piece requires an operator having a highly skilled technique and a long period of time.

It is an object of the invention to provide a mechanical time piece having a hairspring holder adjusting mechanism constituted such that the position of a hairspring holder relative to a rotational center of a balance with hairspring can be adjusted simply and firmly.

It is another object of the invention to provide a highly accurate mechanical time piece capable of easily carrying out adjustment of the original shape of a hairspring and facilitating fabrication thereof.

[Disclosure of the Invention]

According to the invention, there is provided a mechanical time piece characterized in that in a mechanical time piece having a mainspring constituting a power source of the mechanical time piece, a front wheel train rotated by the rotational force from rewinding the mainspring and an escapement & speed control apparatus for controlling rotation of the front wheel train in which the escapement & speed control apparatus is constituted to include a balance with hairspring alternately repeating right rotation and left rotation, an escape wheel & pinion rotated based on the rotation of the front wheel train

and a pallet fork for controlling rotation of the escape wheel & pinion based on an operation of the balance with hairspring, the mechanical time piece comprising a stud holder provided rotatably to a central axis line of a balance with hairspring, a hairspring holder attached to the stud holder to be movable orthogonal to the central axis line of the balance with hairspring, and a hairspring an inner end portion of which is fixed to the balance with hairspring and an outer end portion of which is fixed to the hairspring holder in the mechanical time piece having the mainspring constituting the power source of the mechanical time piece, the front wheel train rotated by the rotational force of rewinding the mainspring and the escapement & speed control apparatus for controlling the rotation of the front wheel train in which the escapement & speed control apparatus is constituted to include the balance with hairspring alternately repeating right rotation and left rotation, the escape wheel & pinion rotated based on the rotation of the front wheel train and the pallet fork for controlling the rotation of the escape wheel & pinion based on the operation of the balance with hairspring.

According to the mechanical time piece of the invention, it is preferable that an eccentric pin is rotatably attached to the stud holder, the eccentric pin includes an eccentric hole and the hairspring holder is integrated to the eccentric hole.

Further, according to the mechanical time piece of the invention, it is preferable that the mechanical time piece further comprises a hairspring holder setscrew for fixing the hairspring holder to the stud holder, wherein the eccentric pin includes a lateral hole formed in a shape of a long hole which is elongated at the opening such that the length thereof orthogonal to the central axis line is long and the length thereof the same direction as the central axis line is short, and the front end of the hairspring holder setscrew penetrates the lateral hole of the eccentric pin and fixes the hairspring holder by pressing on it.

Further, according to the mechanical time piece of the invention, it is preferable that the hairspring holder is rotatably integrated to the eccentric pin.

By constituting the mechanical time piece in this way, adjustment of an original shape of the hairspring holder can easily be carried out.

Further, according to the mechanical time piece of the invention, the eccentric pin is rotatably attached to the stud holder and accordingly, fabrication of the mechanical time piece and adjustment of the hairspring are facilitated.

[Brief Description of the Drawings]

Fig. 1 is a plane view showing an outline shape of a front side of a movement of a mechanical time piece according

to the invention. (in Fig. 1, portions of parts are omitted and bridge members are indicated by imaginary lines).

Fig. 2 is an outline partial sectional view of the movement of the mechanical time piece according to the invention (in Fig. 2, portions of parts are omitted).

Fig. 3 is an enlarged partial plane view of a stud support of the mechanical time piece according to the invention.

Fig. 4 is an enlarged partial sectional view of the stud support of the mechanical time piece according to the invention.

Fig. 5 is an enlarged perspective view of an eccentric pin of the mechanical time piece according to the invention.

Fig. 6 is a plane view showing an outline shape of a front side of a movement according to a conventional mechanical time piece (in Fig. 6, portions of parts are omitted and bridge members are indicated by imaginary lines).

Fig. 7 is an outline partial sectional view of the movement of the conventional mechanical time piece (in Fig. 7, portions of parts are omitted).

Fig. 8 is an enlarged partial plane view of a stud support of the conventional mechanical time piece.

Fig. 9 is an enlarged partial sectional view of the stud support of the conventional mechanical time piece.

[Best Mode for Carrying Out the Invention]

An explanation will be given of embodiments of a

mechanical time piece according to the invention in reference to the drawings as follows.

In reference to Fig. 1 and Fig. 2, according to an embodiment of a mechanical time piece of the invention, a movement (machine body) 1300 of the mechanical time piece is provided with a main plate 1302 constituting a base plate of the movement. A winding stem 1310 is rotatably integrated to a winding stem guide hole 1302a of the main plate 1302. A dial 1304 (shown in Fig. 2 by an imaginary line) is attached to the movement 1300.

The winding stem 1310 is provided with a square portion and a guide shaft portion. A clutch wheel (not illustrated) is integrated to the square portion of the winding stem 1310. The clutch wheel is provided with a rotational axis line the same as a rotational axis line of the winding stem 1310. That is, the clutch wheel is provided with a square hole and is provided to rotate based on rotation of the winding stem 1310 by fitting the square portion of the winding stem 1310 to the square hole. The clutch wheel is provided with teeth A and teeth B. The teeth A are provided at the end portion of the clutch wheel proximate to the center of the movement. The tooth B are provided at the end portion of the clutch wheel proximate to an outer side of the movement.

The movement 1300 is provided with a switch apparatus for determining the position of the winding stem 1310 in the

axis line direction. The switch apparatus includes a setting lever 1390, a yoke 1392, a yoke spring 1394 and a setting lever jumper 1396. Based on rotation of the setting lever, the position in the rotational axis line of the winding stem 1310 is determined. Based on rotation of the yoke, the position in the rotational axis line direction of the clutch wheel is determined. Based on rotation of the setting lever, the yoke is positioned to two positions in the rotational direction.

A winding pinion 1312 is provided rotatably at the guide shaft portion of the winding stem 1310. When the winding stem 1310 is rotated in a state in which the winding stem 1310 is disposed at a first winding stem position (0-stage) most proximate to the center of the movement along the rotational axis line, the winding pinion 1312 is constituted to rotate via rotation of the clutch wheel. A crown wheel 1314 is constituted to rotate by rotation of the winding pinion 1312. A ratchet wheel 1316 is constituted to rotate by rotation of the crown wheel 1314.

The movement 1300 is provided with a mainspring 1322 contained in a barrel complete 1320 as its power source. The mainspring 1322 is made of an elastic material having spring performance such as iron. By rotating the ratchet wheel 1316, the mainspring 1322 is constituted to be capable of being wound up.

A center wheel & pinion 1324 is constituted to rotate

by rotation of the barrel complete 1320. A third wheel & pinion 1326 is constituted to rotate based on rotation of the center wheel & pinion 1324. A fourth wheel & pinion 1328 is constituted to rotate based on rotation of the third wheel & pinion 1326. An escape wheel & pinion 1330 is constituted to rotate based on rotation of the fourth wheel & pinion 1328. The barrel complete 1320, the center wheel & pinion 1324, the third wheel & pinion 1326 and the fourth wheel & pinion 1328 constitute the front wheel train.

The movement 1300 is provided with an escapement & speed control apparatus for controlling rotation of the front wheel train. The escapement & speed control apparatus includes a balance with hairspring 1340 repeating right rotation and left rotation at a constant period, the escape wheel & pinion 1330 rotating based on rotation of the front wheel train and a pallet fork 1342 for controlling rotation of the escape wheel & pinion 1330 based on operation of the balance with hairspring 1340.

The balance with hairspring 1340 includes a balance stem 1340a, a balance wheel 1340b and a hairspring 1340c. The hairspring 1340c is made of an elastic metallic material having spring performance such as "elinbar".

Based on rotation of the center wheel & pinion 1324, a cannon pinion 1350 is simultaneously rotated. A minute hand 1352 attached to the cannon pinion 1350 is constituted to display "minute". The cannon pinion 1350 is provided with a slip

mechanism having a predetermined slip torque relative to the center wheel & pinion 1324.

Based on rotation of the cannon pinion 1350, a minute wheel (not illustrated) is rotated. Based on rotation of the minute wheel, an hour wheel 1354 is rotated. An hour hand 1356 attached to the hour wheel 1354 is constituted to display "hour".

The barrel complete 1320 is supported rotatably by the main plate 1302 and a barrel bridge 1360. The center wheel & pinion 1324, the third wheel & pinion 1326, the fourth wheel & pinion 1328 and the escape wheel & pinion 1330 are supported rotatably by the main plate 1302 and a wheel train bridge 1362. The pallet fork 1342 is supported rotatably by the main plate 1302 and a pallet bridge 1364.

The balance with hairspring 1340 is supported rotatably by the main plate 1302 and a balance bridge 1366. That is, an upper mortise 1340a1 of the balance stem 1340a is supported rotatably by a balance upper bearing 1366a fixed to the balance bridge 1366. The balance upper bearing 1366a includes a balance upper hole jewel and a balance upper cap jewel. The balance upper hole jewel and the balance upper cap jewel are made of an insulating material such as ruby.

A lower mortise 1340a2 of the balance stem 1340a is supported rotatably by a balance lower bearing 1302b fixed to the main plate 1302. The balance lower bearing 1302b includes a balance lower hole jewel and a balance lower cap jewel. The

balance lower hole jewel and the balance lower cap jewel are made of an insulating material such as ruby.

The hairspring 1340c is a leaf spring in a helical (spiral) shape having a plural turn number. The end portion of the hairspring 1340c toward the center is fixed to an inner hairspring holder 1340d fixed to the balance stem 1340a. A stud holder 1310 is rotatably attached to the balance bridge 1366. The rotational center of the stud holder 1310 is the same as the rotational center of the balance with hairspring 1340.

Next, an explanation will be given of a detailed structure of the stud holder 1310 of the mechanical time piece according to the invention.

As shown in Fig. 1 through Fig. 4, an eccentric pin 1316 is rotatably attached to the stud holder 1310.

In reference to Fig. 5, the eccentric pin 1316 includes a fitting cylindrical portion 1316a, an eccentric hole 1316b, and an outer peripheral cylindrical portion 1316c provided with slit portions 1316d and a lateral hole 1316e. The central axis line of the fitting cylindrical portion 1316a of the eccentric pin 1316 is eccentric to the central axis line of the eccentric hole 1316b of the eccentric pin 1316. The central axis line of the fitting cylindrical portion 1316a of the eccentric pin 1316 is the same as the central axis line of the outer peripheral cylindrical portion 1316c of the eccentric pin 1316.

The lateral hole 1316e of the eccentric pin 1316 is provided to penetrate a portion of a wall of the fitting cylindrical portion 1316a from an outer periphery of the fitting cylindrical portion 1316a to the eccentric hole 1316b. Inner wall faces of the lateral hole 1316e of the eccentric pin 1316 are constituted to be orthogonal to the central axis line of the fitting cylindrical portion 1316a of the eccentric pin 1316.

The lateral hole 1316e of the eccentric pin 1316 is formed in a shape of a long hole which is elongated at the opening such that the length thereof orthogonal to the central axis line of the fitting cylindrical portion 1316a of the eccentric pin 1316 is long and the length thereof in the same direction as the central axis line of the fitting cylindrical portion 1316a is short. For example, the lateral hole 1316e of the eccentric pin 1316 is formed at an angle of a range of 90 through 180 degree relative to the central axis line of the fitting cylindrical portion 1316a.

Further, as the lateral hole 1316e of the eccentric pin 1316, the fitting cylindrical portion 1316a of the eccentric pin 1316 may be formed with a plurality of round holes to direct to the central axis line.

As shown in Fig. 1 through Fig. 4, a hairspring holder 1312 includes a fitting shaft portion 1312a, a slit portion 1312b and a cut portion 1312c.

The outer periphery of the fitting cylindrical portion

1316a of the eccentric pin 1316 is rotatably integrated into an eccentric pin hole 1310a of the stud holder 1310. The hairspring holder 1312 is rotatably integrated into the eccentric hole 1316b of the eccentric pin 1316.

The hairspring holder cut portion 1312c is provided at an outer peripheral portion of the hairspring holder 1312. Wall faces of the hairspring holder cut portion 1312c are constituted in parallel with the central axis line of the hairspring holder 1312.

A hairspring holder setscrew 1314 is screwed to a screw hole of the stud holder 1310. Fixing of the hairspring holder 1312 to the stud holder 1310 is carried out by screwing the hairspring holder setscrew 1314 to the stud holder 1310 in a state in which the front end of the hairspring holder setscrew 1314 penetrates the lateral hole 1316e of the eccentric pin 1316 and presses the cut portion 1312c of the hairspring holder 1312.

The central axis line of the hairspring holder setscrew 1314 is constituted to be orthogonal to the central axis line of the fitting cylindrical portion 1316a of the eccentric pin 1316 after fixing the hairspring holder 1312. Further, the central axis line of the hairspring holder setscrew 1314 is constituted to be orthogonal to the central axis line of the hairspring holder 1312 after fixing the hairspring holder 1312.

The end portion of the hairspring 1340c toward the

periphery is fixed to a hairspring receiving portion provided at a lower end portion of the hairspring holder 1312.

A regulator 1368 is rotatably attached to the balance bridge 1366. A hairspring bridge 1368a and a hairspring rod 1368b are attached to the regulator 1368. A portion of the hairspring 1340c proximate to its peripheral end is disposed between the hairspring bridge 1368a and the hairspring rod 1368b.

The hairspring 1340c is elongated and contracted in the radius direction of the hairspring 1340c in accordance with the rotational angle the balance with hairspring 1340. For example, in the state shown by Fig. 1, when the balance with hairspring 1340 is rotated in the clockwise direction, the hairspring 1340c is contracted toward the center of the balance with hairspring 1340, and when the balance with hairspring 1340 is rotated in the counterclockwise direction, the hairspring 1340c is expanded away from the center of the balance with hairspring 1340.

Next, an explanation will be given of the operation of adjusting the position of the hairspring holder 1312 in the embodiment of the mechanical time piece according to the invention.

In reference to Fig. 1 through Fig. 4, the hairspring holder setscrew 1314 is loosened and the front end of the hairspring holder setscrew 1314 is separated from the wall faces of the hairspring holder cut portion 1312c. In such a state

in which the hairspring holder setscrew 1314 is loosened, the eccentric pin 1316 can be rotated.

Next, a front end of a driver (not illustrated) is inserted into the slit portions 1316d of the eccentric pin 1316 and rotated to thereby rotate the eccentric pin 1316. By rotating the eccentric pin 1316, a position of the hairspring holder 1312 integrated to the eccentric pin 1316 is changed. That is, by rotating the eccentric pin 1316, a position of the eccentric hole 1316b of the eccentric pin 1316 is changed, as a result, a distance between the central axis line of the eccentric hole 1316b of the eccentric pin 1316 and the central axis line of the balance with hairspring 1340 is changed.

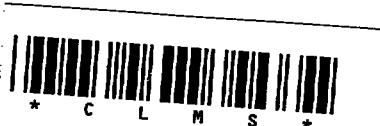
Next, a front end of a driver (not illustrated) is inserted into the slit portion 1312b of the hairspring holder 1312 and the driver is rotated to thereby rotate the hairspring holder 1312. Thereby, the position and the direction of the outer end portion of the hairspring 1340c can be adjusted highly accurately.

Next, the hairspring holder setscrew 1314 is screwed to the stud holder 1310 by bringing the front end portion of the hairspring holder setscrew 1314 into a state in which the front end portion penetrates the lateral hole 1316e of the eccentric pin 1316 and presses the cut portion 1312c of the hairspring holder 1312. Thereby, the position of the outer end portion of the hairspring 1340c is determined.

As has been explained above, according to the invention, in the mechanical time piece, there is constructed the constitution having the stud holder provided rotatably to the central axis line of the balance with hairspring (1340), the hairspring holder attached to the stud holder to be movable in the direction orthogonal to the central axis line of the balance with hairspring and the hairspring the center-facing end of which is fixed to the balance with hairspring and the periphery-facing end of which is fixed to the hairspring holder and accordingly, the position of the hairspring holder relative to the rotational center of the balance with hairspring can be adjusted simply and firmly and adjustment of the original shape of the hairspring can easily be carried out. Therefore, fabrication of the mechanical time piece of the invention is facilitated.

[Industrial Applicability]

The mechanical time piece of the invention is suitable for realizing a highly accurate mechanical time piece constituted to be able to firmly adjust a position of a hairspring holder.



Claim(s)

1. A mechanical time piece characterized in that in a mechanical time piece having a mainspring constituting a power source of the mechanical time piece, a front wheel train rotated by a rotational force of rewinding the mainspring and an escapement & speed control apparatus for controlling rotation of the front wheel train in which the escapement & speed control apparatus is constituted to include a balance with hairspring alternately repeating right rotation and left rotation, an escape wheel & pinion rotated based on the rotation of the front wheel train and a pallet fork for controlling rotation of the escape wheel & pinion based on the operation of the balance with hairspring, said mechanical time piece comprising:

a stud holder (1310) provided rotatably to a central axis line of a balance with hairspring (1340);

a hairspring holder (1312) attached to the stud holder (1310) to be movable in a direction orthogonal to the central axis line of the balance with hairspring (1340); and

a hairspring (1340c) the portion toward the center of which is fixed to the balance with hairspring (1340) and the portion toward the periphery of which is fixed to the hairspring holder (1312).

2. The mechanical time piece according to Claim 1, characterized in that an eccentric pin (1316) is rotatably



attached to the stud holder (1310), the eccentric pin (1316) includes an eccentric hole (1316b) and the hairspring holder (1312) is integrated to the eccentric hole (1316b).

3. The mechanical time piece according to Claim 2, characterized in further comprising:

a hairspring holder setscrew (1314) for fixing the hairspring holder (1312) to the stud holder (1310);

wherein the eccentric pin (1316) includes a lateral hole (1316e) formed in a shape which is elongated at the opening such that the length thereof in a direction orthogonal to the central axis line is long and the length thereof in the same direction as the central axis line is short; and

wherein a front end of the hairspring holder setscrew (1314) penetrates the lateral hole (1316e) of the eccentric pin (1316) and fixes the hairspring holder in a state of pressing the hairspring holder (1312).

4. The mechanical time piece according to Claim 3, characterized in that the hairspring holder (1312) is rotatably integrated to the eccentric pin (1316).