

PATENT SPECIFICATION

(11)

1 341 597

1 341 597

- (21) Application No. 17915/71 (22) Filed 28 May 1971
 (31) Convention Application No. 56 291 (32) Filed 9 June 1970 in
 (33) Japan (JA)
 (44) Complete Specification published 28 Dec. 1973
 (51) International Classification G04B 13/02
 G04C 5/00
 (52) Index at acceptance
 G3T A5B1 A7D



(54) TIMEPIECE MECHANISM

(71) We, KABUSHIKI KAISHA SUWA SEIKOSHA, a Japanese corporation of 3-4, 4-chome, Ginza, 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:—

10 This invention concerns a timepiece mechanism e.g. for an electrically actuated watch.

According to the present invention, there is provided a timepiece mechanism comprising a ratchet or index wheel which is mounted on a shaft spaced portions of which are rotatably mounted in a bridge and in a plate, and a resilient member which is mounted on the bridge or plate and which subjects the ratchet or index wheel to an axially directed force.

The invention is particularly applicable to an electrically actuated watch or other timepiece. Thus in contrast to a conventional mechanical watch, in which drive is imparted to an escape wheel and a regulator through a gear train from a power source such as a spring, the spring being run down by the regular oscillation of a regulator, and the regular rotation of the gear train being utilised as the time indication, in the case of an electric watch, an index wheel and a regulator serve to drive the gear train so that torque is not transmitted to the gear train except when the index wheel is operating. Thus, in the case of a mechanical watch, due to the torque given by the power source, the escape wheel gives the required rotational power to a pallet fork so that the escape wheel and pallet fork must keep a predetermined geometrical relationship at all times. Such an arrangement, however, cannot be provided in an electric watch, in which it is necessary to provide a construction which effects separate operation of the

[Price 25p]

index wheel and the pallet fork. The mechanism of the present invention permits this to be done.

The resilient member may engage an end portion of the shaft. Alternatively the resilient member may engage a pinion which is mounted on said shaft.

The spaced portions of the shaft are preferably mounted in jewels carried by the bridge and plate.

The resilient member may be U-shaped and may have limbs which respectively engage the said shaft and a second shaft so as to impart axial forces thereto, the second shaft carrying a gear forming part of a gear train of said mechanism.

The invention also comprises a timepiece, e.g. an electrically actuated watch, provided with a mechanism as set forth above.

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

Figures 1, 3 and 5 are plan views of known timepiece escapements.

Figures 2, 4 and 6 are cross-sectional views of the escapements respectively shown in Figures 1, 3 and 5.

Figures 7 and 8 are cross-sectional views of two different embodiments of a timepiece mechanism according to the present invention and

Figure 9 is a plan view of another embodiment of a timepiece mechanism according to the present invention.

In the known construction shown in Figures 1 and 2, a ratchet or index wheel 1, which is fixed co-axially to a friction disc 2, is mounted on a shaft 3 spaced portions of which are rotatably mounted in a plate 4 and bridge 5. A resilient member 6, one end of which is fixed to the plate 4 or bridge 5, is urged against the friction disc 2 so as to impart radially directed forces to the latter and so as to generate frictional torque. By reason of this frictional torque, the posi-

tion of the ratchet or index wheel is controlled.

In a construction as shown in Figures 1 and 2, after the wheel 1 has been inserted between the plate 4 and the bridge 5 it is necessary to assemble the resilient member 6. Since the resilient member 6 is completely concealed beneath the bridge 5, the resilient member must be assembled or adjusted through a peep hole 12, or through a gap between the plate 4 and the bridge 5. Assembly is therefore very difficult, it is difficult to modify the position or shape of the resilient member 6, the frictional torque is not constant, and the adjustment takes considerable time.

Moreover, the electrical circuit for the timepiece occupies considerable space, so that the space for the necessary gear train is reduced and it is very difficult to provide a resilient member whose lateral pressure does not impede the engagement between the wheel 1 and a pallet fork (not shown) and between the wheel 1 and a gear train (not shown).

If the position of the wheel is determined by magnetic attraction, the frequency of a balance wheel (not shown) is equal to that of the advancing step of a seconds hand (not shown). In this case, the wheel is driven by half a pitch for each two cycles in the frequency of the balance wheel, and the loading on the wheel 1 and the regulator (not shown) as a driving source is decreased while the precision of the watch is improved.

Thus in the case of the conventional arrangement illustrated in Figures 3 and 4, a ratchet or index wheel 1, and a wheel 7 which has more teeth than the wheel 1, are fixed co-axially on a shaft 3. Two magnets 8, which are fixed to the plate 4, are disposed beneath the edge of the teeth of the wheel 7 and attract the said teeth due to magnetic force, so as to control the position of the wheel 1.

In the conventional arrangement shown in Figures 5 and 6, the ratchet or index wheel 1 is itself made of a strongly magnetic material and is provided with a plurality of angularly spaced apart elongated apertures 13 whose number is twice that of the teeth of the wheel 1. As before, the wheel 1 is mounted on a shaft 3 which is itself rotatably mounted in the plate 4 and bridge 5. A magnet 8, which is fixed to the plate 4, is disposed beneath the wheel 1, and magnetically attracts an adjacent unapertured part of the latter. Thus the wheel 1 is urged into a predetermined position at any time.

However, the use of a strongly magnetic material in forming the wheel 7 or the wheel 1 makes these wheels liable to be affected by an external magnetic field and by a magnet (not shown) for driving an oscillator of the watch. This is liable to upset the proper

functioning of the wheel and regulator. Moreover, a heat treatment is necessary for improving the magnetic characteristics of the wheel 1 or the wheel 7, while manufacture and assembly is difficult. Since a special part such as a magnet and a strongly magnetic material is employed, the number of parts is larger than necessary and the cost is considerable. Moreover, if all parts of the watch do not accurately exercise a controlling action at the predetermined positions of the ratchet or index wheel, the engagement of the ratchet or index wheel and pallet fork can be impaired and the watch can even stop. It is therefore necessary that the relationship between a magnet and the ratchet or index wheel and errors in the positioning of and shape of the wheels should be reduced to the minimum and this is expensive and time consuming.

In the embodiment of the present invention shown in Figure 7, a timepiece mechanism comprises a ratchet or index wheel 1 which is mounted on a shaft 3 spaced portions of which are rotatably mounted in jewels 10, 9 which are respectively carried by a bridge 5 and a plate 4. A resilient member, constituted by a holding spring 6, is fixed by a screw 14 to the bridge 5 and engages the upper end portion of the shaft 3. Thus, the shaft 3 and hence the wheel 1 is subjected to an axially directed force which acts in a downward direction. Accordingly, a brake torque is generated by friction between the jewel 9 and the lower part of the shaft 3, and this controls the position of the wheel 1.

In Figure 8 there is shown an arrangement which is similar to that of Figure 7, except that the holding spring 6 is secured by a screw 15 to the plate 4, and engages beneath a pinion 16 which is mounted on the shaft 3. In this case, the holding spring 6 subjects the shaft 3 and hence the wheel 1 to an upwardly directed axial force so that brake torque is generated by friction between the jewel 10 and the upper part of the shaft 3.

The jewels 9 and 10 are formed of low frictional stable material. Moreover, point contact may be made between holding spring 6 and the shaft 3, while contact between the jewels 9, 10 and the shaft 3 may be kept to a minimum. Accordingly, if the spring force of the holding spring 6 is increased, there is little increase in the brake torque, and a substantially stable brake torque is thus obtained.

In the arrangement shown in Figure 9, the holding spring 6 is U-shaped and has limbs 17, 18 which respectively engage the shaft 3 (not shown in Figure 9) and a second shaft (not shown) so as to impart axial forces to both these shafts, the said second shaft carrying a gear 19 which forms part of a

gear train 20 of the mechanism.

In the case of the constructions shown in Figures 7 to 9, the holding spring 6 can be assembled during or after the time that the wheel 1 is mounted between the plate 4 and the bridge 5. Assembly is therefore very simple. Moreover, it is unnecessary in the constructions shown in Figures 7 to 9 to adjust the shape or the position of the holding spring through a gap between the plate 4 and bridge 5 or through a peep-hole. Adjustment is thus easier, the spring force of the holding spring is more stable, and a stable brake torque on the ratchet or index wheel is obtainable.

Moreover, since the holding spring may be placed above or below the gear train, the space is less restricted, the shape of the spring is substantially stable, and the spring force exerted will not vary greatly with any variation in the exact position of the spring. Furthermore, since the control force is axially directed along the shaft 3, the engagement between the ratchet or index wheel and the pallet fork on the one hand, and between the ratchet or index wheel and the gear train on the other hand, is not impaired.

In the case of the prior art in order to avoid external magnetic effects, or magnetic effects upon other parts of the watch, a magnetic shield may be used, while the structure may be such as to increase the magnetic forces. However, the use of special materials and special treatments increases the cost. Such arrangements are unnecessary in the case of the present invention.

The present invention enables the frequency of the balance wheel to be made equal to that of the advancing step of the seconds hand, and the watch may be made of high precision, whilst the said predetermined positions of the ratchet or index wheel may be exactly determined.

In the case of an electric watch, a holding spring may be used to hold down a second wheel shaft at every advance of a seconds hand in order to prevent the shaking of the seconds hand because of backlash. The construction shown in Figure 9, however, in

which the holding spring is made integral with the spring of the ratchet or index wheel, enables the control operation to be effected by one part.

WHAT WE CLAIM IS:—

1. A timepiece mechanism comprising a ratchet or index wheel which is mounted on a shaft spaced portions of which are rotatably mounted in a bridge and in a plate, and a resilient member which is mounted on the bridge or plate and which subjects the ratchet or index wheel to an axially directed force.

2. A timepiece mechanism as claimed in claim 1 in which the resilient member engages an end portion of the shaft.

3. A timepiece mechanism as claimed in claim 1 in which the resilient member engages a pinion which is mounted on said shaft.

4. A timepiece mechanism as claimed in any preceding claim in which the said spaced portions of the shaft are mounted in jewels carried by the bridge and plate.

5. A timepiece mechanism as claimed in any preceding claim in which the resilient member is U-shaped and has limbs which respectively engage the said shaft and a second shaft so as to impart axial forces thereto, the second shaft carrying a gear forming part of a gear train of said mechanism.

6. A timepiece mechanism substantially as herein described with reference to and as shown in Figures 7 to 9 of the accompanying drawings.

7. A timepiece provided with a mechanism as claimed in any preceding claim.

8. A timepiece as claimed in claim 7 in which the timepiece is an electrically actuated watch.

J. MILLER & CO.,

Agents for the Applicants,

Chartered Patent Agents,

262 High Holborn,
London, WC1V 7EF.

gear train 20 of the mechanism.

In the case of the constructions shown in Figures 7 to 9, the holding spring 6 can be assembled during or after the time that the wheel 1 is mounted between the plate 4 and the bridge 5. Assembly is therefore very simple. Moreover, it is unnecessary in the constructions shown in Figures 7 to 9 to adjust the shape or the position of the holding spring through a gap between the plate 4 and bridge 5 or through a peep-hole. Adjustment is thus easier, the spring force of the holding spring is more stable, and a stable brake torque on the ratchet or index wheel is obtainable.

Moreover, since the holding spring may be placed above or below the gear train, the space is less restricted, the shape of the spring is substantially stable, and the spring force exerted will not vary greatly with any variation in the exact position of the spring. Furthermore, since the control force is axially directed along the shaft 3, the engagement between the ratchet or index wheel and the pallet fork on the one hand, and between the ratchet or index wheel and the gear train on the other hand, is not impaired.

In the case of the prior art in order to avoid external magnetic effects, or magnetic effects upon other parts of the watch, a magnetic shield may be used, while the structure may be such as to increase the magnetic forces. However, the use of special materials and special treatments increases the cost. Such arrangements are unnecessary in the case of the present invention.

The present invention enables the frequency of the balance wheel to be made equal to that of the advancing step of the seconds hand, and the watch may be made of high precision, whilst the said predetermined positions of the ratchet or index wheel may be exactly determined.

In the case of an electric watch, a holding spring may be used to hold down a second wheel shaft at every advance of a seconds hand in order to prevent the shaking of the seconds hand because of backlash. The construction shown in Figure 9, however, in

which the holding spring is made integral with the spring of the ratchet or index wheel, enables the control operation to be effected by one part.

WHAT WE CLAIM IS:—

1. A timepiece mechanism comprising a ratchet or index wheel which is mounted on a shaft spaced portions of which are rotatably mounted in a bridge and in a plate, and a resilient member which is mounted on the bridge or plate and which subjects the ratchet or index wheel to an axially directed force.

2. A timepiece mechanism as claimed in claim 1 in which the resilient member engages an end portion of the shaft.

3. A timepiece mechanism as claimed in claim 1 in which the resilient member engages a pinion which is mounted on said shaft.

4. A timepiece mechanism as claimed in any preceding claim in which the said spaced portions of the shaft are mounted in jewels carried by the bridge and plate.

5. A timepiece mechanism as claimed in any preceding claim in which the resilient member is U-shaped and has limbs which respectively engage the said shaft and a second shaft so as to impart axial forces thereto, the second shaft carrying a gear forming part of a gear train of said mechanism.

6. A timepiece mechanism substantially as herein described with reference to and as shown in Figures 7 to 9 of the accompanying drawings.

7. A timepiece provided with a mechanism as claimed in any preceding claim.

8. A timepiece as claimed in claim 7 in which the timepiece is an electrically actuated watch.

J. MILLER & CO.,

Agents for the Applicants,

Chartered Patent Agents,

262 High Holborn,
London, WC1V 7EF.

