

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,187,752



Date of Application (No. 383/69) and filing Complete Specification: 2 January, 1969.

Application made in United States of America (No. 699846) on 23 January, 1968.

Complete Specification Published: 15 April, 1970.

Index at Acceptance:—G3 T (A4C, A7D, A1OE2).

International Classification:—G 04 b 27/00.

COMPLETE SPECIFICATION

An Improved Horological Movement

We, THE UNITED STATES TIME CORPORATION, a Corporation organized under the laws of the State of Connecticut, United States of America, of Waterbury, Connecticut, United States of America, 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:—

The present invention relates to a horological movement and more particularly to a mechanism to obtain a friction-slip arrangement in a dial train.

A horological device, such as a watch or a clock, usually includes a power source, a timekeeping device, a dial train and time indicating means, such as rotating hands. The power source is usually a mainspring or an electric battery. The timekeeping device is usually a balance wheel or other type of oscillatory mechanism and escapement. The dial train consists of a series of gears, some of which are small and are called pinions, and others of which are comparatively large and are called wheels.

The time indicating hands are set, i.e., turned to their correct position, by means of a crown which is on the outside of the case. Usually the crown is pulled away from the case and rotated to set the hands. The hands must be set, for example, when starting the movement, when changing time zones or when correcting the time. The crown, in a mainspring driven watch or clock, may also be used to wind up the mainspring.

The crown is attached to a staff which carries a gear. That gear, either directly or by means of intermediate gears, turns the gears of the dial train. It is necessary that some of the gears of the dial train rotate in order that the hands may be set. The

dial train gears to serve two functions, at different times, namely, to turn the time indicating hands during the normal running of the movement and to set the time indicating hands.

The rotation of the crown and the setting of the hands should not damage the oscillator or escapement. During such rotation, if the dial train is kept connected to the index wheel in an electric watch, or to the escape wheel in a mechanical watch, the pins on the lever or other of the delicate mechanisms may be damaged. The dial train is usually disconnected from the index or escape wheel during the setting of the hands by means of a friction-slip mechanism. During normal operation of the movement, the friction connection is sufficient so that power is transferred to the time indicating hands. However, the escapement or index wheel, either directly or indirectly, is kept from turning during the setting of the hands by a click, magnet or some other device. The index or escape wheel is held with sufficient strength during hand-setting so that the friction connection is overcome, i.e., the connection slips, and the dial train is effectively disconnected from the index or escape wheel.

Various mechanisms have been proposed to obtain the friction connection in the dial train. For example, a coil spring may be compressed between the bottom surface of a pinion and a gear wheel. The spring is wound around the same staff upon which the pinion and the wheel are mounted. The pinion is attached to the staff and the wheel is mounted so that it may rotate relative to the staff. The spring provides a friction-fit of the wheel against a flange of the staff so that the wheel normally turns with the staff. That frictional force is overcome when the wheel is held fixed, during the setting

[Price 5s. 0d.]

of the hands, the pinion and staff then being free to rotate. This type of mechanism takes a considerable amount of space and is relatively costly.

- 5 A mechanism utilised in watches, for the purpose of obtaining a friction-slip, consists of a number of protrusions on the inside wall of a tubular cannon pinion. The protrusions may be formed by indentations
10 in the wall of the tubular portion of the cannon pinion. The protrusions rub against the seconds staff, which is within the tube of the cannon pinion. During normal running of the watch, the friction between the
15 centre arbor and the cannon pinion is sufficient so that the rotation of the centre arbor carries the pinion with it. During hand setting, the centre arbor is held fixed and the cannon pinion rotates by overcoming
20 the friction. This type of device is inexpensive. However, it is not accurate as it is difficult to reproduce consistently the exact desired friction due to tolerance variations in the diameter of the arbor and the
25 cannon pinion and the size of the protrusions.

- It is an object of the present invention to provide a mechanism to provide a friction-slip in a horological dial train, which mechanism is relatively inexpensive, may be readily assembled and repaired, and which provides an accurate and constant predetermined amount of friction.

- In accordance with the present invention
35 there is provided a horological movement comprising time indicating means, a time-keeping oscillator, a dial train including a plurality of gears mounted on staffs, means to set the time indicating means, and a
40 friction-slip mechanism to disconnect at least part of the dial train from the oscillator, wherein the friction-slip mechanism comprises a gear integral with or attached to a staff, an arbor fitting at least partly
45 over said staff and having a slot, and a spring positioned at least partly in said slot and urging the arbor and staff to rotate together.

- The movement is particularly adapted for use in an electric battery powered wrist watch wherein preferably the friction mechanism provides a frictional connection between the friction pinion staff and an arbor attached to the third wheel. The spring used
55 is preferably about U-shaped, i.e., a harp spring. One arm of the spring bears against the friction pinion staff. The other arm of the spring acts against an arbor on the third wheel, normally urging the third wheel arbor and the friction pinion staff to rotate
60 together.

- Other features and advantages of the present invention will be apparent from the following detailed description given by way of example of a preferred embodiment of

the invention, reference being had to the accompanying drawings, in which:—

Figure 1 is a side cross-sectional view of a portion of a watch movement; and

Figure 2 is a sectional view taken along
70 lines A-A of Figure 1.

The description which follows is directed to a wrist watch which is powered by an electric battery. The battery supplies current to a coil mounted on a balance wheel.
75 The coil interacts with one or more magnets fixed on the frame of the watch. The current is supplied intermittently, either by means of contacts or an electronic circuit. The movement of the balance either directly
80 or indirectly through a lever, is transmitted to an index wheel. The index wheel is connected, usually by means of a pinion, with a seconds wheel, i.e., a fourth wheel. The fourth wheel is fixed on a fourth wheel staff
85 which carries the seconds hand on its end. A pinion is connected to, or is integral with, the fourth wheel staff. That pinion, called the fourth pinion, meshes with the third wheel. Figure 1 shows the third wheel and
90 its immediate mechanism.

In the embodiment described herein, the friction device is used in the environment of the third wheel of an electric battery powered watch. However, the friction device of the present invention may also be used on other wheels of electric powered watches of various types or in connection with mechanical, electrical or otherwise
95 powered watches, clocks and other horological instruments.

In Figure 1, the main (front) frame plate of the watch movement has a cavity 2 at the bottom of which there is a hole 3. A train bridge 4 is kept separated from the frame plate 1 by pillars or other means (not shown).
105

One end of the fourth wheel (seconds) staff 5 rotates in a hole 6 in the train bridge 4. A pinion 7a and a fourth wheel (seconds wheel) 7b are fixed on the fourth wheel staff 5. The fourth wheel staff 5 rotates within a tube 8 fixed within a hole in the frame plate 1. A minute tube 9 rotates about tube 8. The centre wheel 10 is attached to the tube 9. A seconds hand (not shown) is connected to the fourth wheel staff 5 and a minutes hand (not shown) is connected to the tube 9. The movement further comprises an hour hand (also not illustrated) in a conventional arrangement.
115

The centre wheel 10 meshes with a friction pinion 11. One portion of the staff 12 of the friction pinion 11 rotates within the hole 3 of the frame plate 1. The staff 12 is integral with, or attached to, the pinion. The staff 12 consists of an enlarged portion 13 on one side of the frame plate, a smaller circular portion 14 which rotates within hole 3, an elongated cylindrical portion 15
125 130

slightly smaller in diameter than the portion 14 and defining in conjunction therewith a flange 20, a tapered portion 16 the bottom of the taper being integral with the portion 15, and a top portion 17 having a bevelled edge and a flat top 17a. The cylindrical portion 15, tapered portion 16 and top portion 17 of staff 12 are substantially covered by a third wheel arbor 18. The third wheel arbor 18 has a bottom shoulder 19 which rests on the flange 20 of pinion staff 12. The wall of the centre hole 21 of arbor 18 is rotatable, with a clearance, about the cylindrical portion 15 of staff 12. A centre portion 22 of arbor 18 which has a centre slot 33 fits over the tapered portion 16 of the staff. A top inverted bowl-like portion 23 of the arbor fits over the top portion 17 of the staff. A cylindrical shaft 24 protrudes from portion 23 of the arbor 18 and rotates in a hole 25 of the train bridge 4.

The arbor 18 has a slot 31 in its centre portion 22. The base of slot 31, as seen in Figure 2, is chordal and the slot is sufficiently deep so that the tapered portion of staff 12 is exposed.

A harp spring 32, in the general form of a U, has a straight arm portion 26 which is positioned in the slot 31. The spring 32 also includes a U-shaped centre portion 27, a straight arm portion 28, a short portion 29 angled inward to portion 28, and a short portion 30 angled outward to portion 29. The outer surface of centre portion 22 of the arbor fits in the angle formed by portions 28 and 29 of the spring 32.

The spring 32 urges the wall of the hole 33 in the centre portion 22 toward the tapered portion 16 of the staff. The pressure of the spring 32 against the tapered portion 16 urges the staff 12 into the third wheel arbor 18. The staff 12 is thus prevented by the spring 32 from falling out (away from frame 1). The third wheel 34 is fixed on the top portion 23 of the third wheel arbor. The third wheel 34 meshes with the fourth wheel pinion 7a.

In operation, during normal running of the watch, the oscillator indexes the index wheel. The index wheel has a pinion which meshes with the fourth wheel 7b. The power is transmitted in the following order: oscillator (balance wheel); index wheel and index wheel pinion; fourth wheel 7b and fourth wheel pinion 7a; third wheel 34 and pinion 11; centre wheel 10 with its minute tube 9; change wheel consisting of a wheel and a pinion; and an hour wheel with its tube. The complete layout of the wheels may be seen in Patent Specification No. 1,041,951, particularly Figure 2.

To set the hour and minute hands, the crown (not shown) is pulled out, which stops the oscillation of the balance wheel.

The crown is then rotated. The change gears are turned by the shaft connected to the crown which is also connected to those gears. The centre wheel 10 and pinion 11 rotate with the turning of the crown. The index wheel is prevented from rotating by a magnet or a click mechanism. Due to the friction clutch arrangement described above, the third wheel 34, pinion 7a, seconds wheel 7b, index pinion and index wheel do not rotate during the setting of the hands. The third wheel 34 is held still, during the setting of the hands, by the magnet or click mechanism which holds the index wheel at that time. The disconnection of the rotation of the crown from the index wheel prevents damage to the indexing mechanism.

In the process of assembling the watch movement the third wheel 34 is attached to the top portion 23 of the third wheel arbor 18. The harp spring 32 is positioned on the centre portion 22 of the third wheel arbor 18. The third wheel 34, the third wheel arbor 18, and the harp spring 32 form a sub-assembly. This sub-assembly is preferably placed on the front frame 1, although it may alternatively be assembled to the train bridge 4. The train bridge 4 is then assembled in position, spaced away from the front frame 1 for example by pillars and screws or other spacing means as already mentioned. The shaft 24 is positioned within the hole 25 of the train bridge 4 during assembly of the train bridge to the movement. At this point in the assembly process, after the frame and train bridge are assembled, the sub-assembly, consisting of the third wheel 34, the third wheel arbor 18 and the harp spring 32, is in its position between the front frame plate 1 and the train bridge 4. The arbor is held substantially upright and aligned in position because of the support of the cylindrical wall of cavity 2 on the cylindrical external wall of the lower portion of the third wheel arbor 18. The sub-assembly is positioned so that the centre hole 21 of the third wheel arbor 18 is substantially aligned with the hole 3 of cavity 2 within frame plate 1.

The friction pinion 11 may now be assembled in the movement. This is accomplished by inserting the top portion 17 of the friction pinion staff 12 through hole 3 in frame plate 1 and hole 21 in the third wheel arbor 18. When the friction pinion 11 is inserted, the bevelled edge of its top portion 17 spreads the harp spring 32 and permits the passage of the top portion 17.

As an alternative assembly procedure, first the friction pinion 11 may be inserted through its hole 3 in frame plate 1. The third wheel arbor sub-assembly may then be snapped in place over the friction pinion. the train bridge would then be assembled

in place over the third wheel pinion.

The structure of the components of the movement of the present invention provides advantages in the assembly operation. The

- 5 bevelled edge on the top portion 17 of the friction staff 12 forces the spring 32 open — without the necessity of manually opening the spring. The cavity 2 of the frame plate 1 provides a means for temporarily
10 holding the third wheel arbor substantially properly aligned. The taper of the tapered portion 16 of the friction pinion staff co-operates with the inward force of the harp spring 32 to provide a draw movement
15 which holds the friction pinion staff within the third wheel arbor. The construction of the third wheel arbor and the friction pinion, in separate pieces, enables them to be assembled through a relatively small hole
20 3 having a relatively low bearing friction. If, alternatively to the structure of the present invention, the third wheel arbor and friction pinion were constructed in one unitary piece, the hole in the front frame plate 1
25 would have to be sufficiently large for the insertion of the friction pinion 11. Such a large hole would require a larger shaft and have increased bearing friction. The two-piece construction of the friction pinion and
30 the third wheel arbor enables the friction pinion to be removed and replaced without removal of the third wheel arbor sub-assembly (the third wheel arbor, the third wheel and the harp spring).

35 **WHAT WE CLAIM IS:—**

1. A horological movement comprising time indicating means, a timekeeping oscillator, a dial train including a plurality of
40 gears mounted on staffs, means to set the time indicating means, and a friction-slip mechanism to disconnect at least part of the dial train from the oscillator, wherein the friction-slip mechanism comprises a gear integral with or attached to a staff, an
45 arbor fitting at least partly over said staff and having a slot, and a spring positioned at least partly in said slot and urging the arbor and staff to rotate together.

2. A horological movement as claimed in Claim 1 wherein said staff includes a tapered portion against which the spring bears.

3. A horological movement as claimed in Claim 1 or Claim 2, wherein said arbor includes a staff portion protruding from its
55 top.

4. A horological movement as claimed in Claim 3, wherein the movement is a watch movement having a frame and a train bridge, and said arbor rotates in the
60 train bridge and the staff rotates in the frame.

5. A horological movement as claimed in any one of the preceding claims, wherein the movement is a watch movement and
65 the gear is a pinion meshing with the centre wheel.

6. A horological movement as claimed in any one of the preceding claims, wherein said staff has a shoulder portion against
70 which the lower edge of the arbor rotatably bears.

7. A horological movement as claimed in any one of the preceding claims, wherein the movement is a watch movement and the
75 arbor is attached to the third wheel which meshes with the fourth wheel pinion.

8. A horological movement as claimed in any one of the preceding claims, wherein the spring is a harp-shaped spring.
80

9. A horological movement substantially as hereinbefore described with reference to the accompanying drawings.

10. A watch incorporating the movement as claimed in any one of the preceding
85 claims.

11. The methods of assembling the movement as claimed in any one of Claims 1 to 10 and substantially as hereinbefore described with reference to the accompanying
90 drawings.

STEVENS, HEWLETT & PERKINS,
Chartered Patent Agents,
5, Quality Court,
Chancery Lane,
London, W.C.2.

in place over the third wheel pinion.

The structure of the components of the movement of the present invention provides advantages in the assembly operation. The bevelled edge on the top portion 17 of the friction staff 12 forces the spring 32 open — without the necessity of manually opening the spring. The cavity 2 of the frame plate 1 provides a means for temporarily holding the third wheel arbor substantially properly aligned. The taper of the tapered portion 16 of the friction pinion staff co-operates with the inward force of the harp spring 32 to provide a draw movement which holds the friction pinion staff within the third wheel arbor. The construction of the third wheel arbor and the friction pinion, in separate pieces, enables them to be assembled through a relatively small hole 3 having a relatively low bearing friction. If, alternatively to the structure of the present invention, the third wheel arbor and friction pinion were constructed in one unitary piece, the hole in the front frame plate 1 would have to be sufficiently large for the insertion of the friction pinion 11. Such a large hole would require a larger shaft and have increased bearing friction. The two-piece construction of the friction pinion and the third wheel arbor enables the friction pinion to be removed and replaced without removal of the third wheel arbor sub-assembly (the third wheel arbor, the third wheel and the harp spring).

WHAT WE CLAIM IS:—

1. A horological movement comprising time indicating means, a timekeeping oscillator, a dial train including a plurality of gears mounted on staffs, means to set the time indicating means, and a friction-slip mechanism to disconnect at least part of the dial train from the oscillator, wherein the friction-slip mechanism comprises a gear integral with or attached to a staff, an arbor fitting at least partly over said staff and having a slot, and a spring positioned at least partly in said slot and urging the arbor and staff to rotate together.

2. A horological movement as claimed in Claim 1 wherein said staff includes a tapered portion against which the spring bears.

3. A horological movement as claimed in Claim 1 or Claim 2, wherein said arbor includes a staff portion protruding from its top.

4. A horological movement as claimed in Claim 3, wherein the movement is a watch movement having a frame and a train bridge, and said arbor rotates in the train bridge and the staff rotates in the frame.

5. A horological movement as claimed in any one of the preceding claims, wherein the movement is a watch movement and the gear is a pinion meshing with the centre wheel.

6. A horological movement as claimed in any one of the preceding claims, wherein said staff has a shoulder portion against which the lower edge of the arbor rotatably bears.

7. A horological movement as claimed in any one of the preceding claims, wherein the movement is a watch movement and the arbor is attached to the third wheel which meshes with the fourth wheel pinion.

8. A horological movement as claimed in any one of the preceding claims, wherein the spring is a harp-shaped spring.

9. A horological movement substantially as hereinbefore described with reference to the accompanying drawings.

10. A watch incorporating the movement as claimed in any one of the preceding claims.

11. The methods of assembling the movement as claimed in any one of Claims 1 to 10 and substantially as hereinbefore described with reference to the accompanying drawings.

STEVENS, HEWLETT & PERKINS,
Chartered Patent Agents,
5, Quality Court,
Chancery Lane,
London, W.C.2.



* C L M S *