July 1, 1969 HIROSHI IWASAWA ETAL 3,452,539

STOP AND START MECHANISM FOR TIMEPIECE MOVEMENT

Filed Dec. 27, 1967 Sheet 1 of 3

FIG. 1

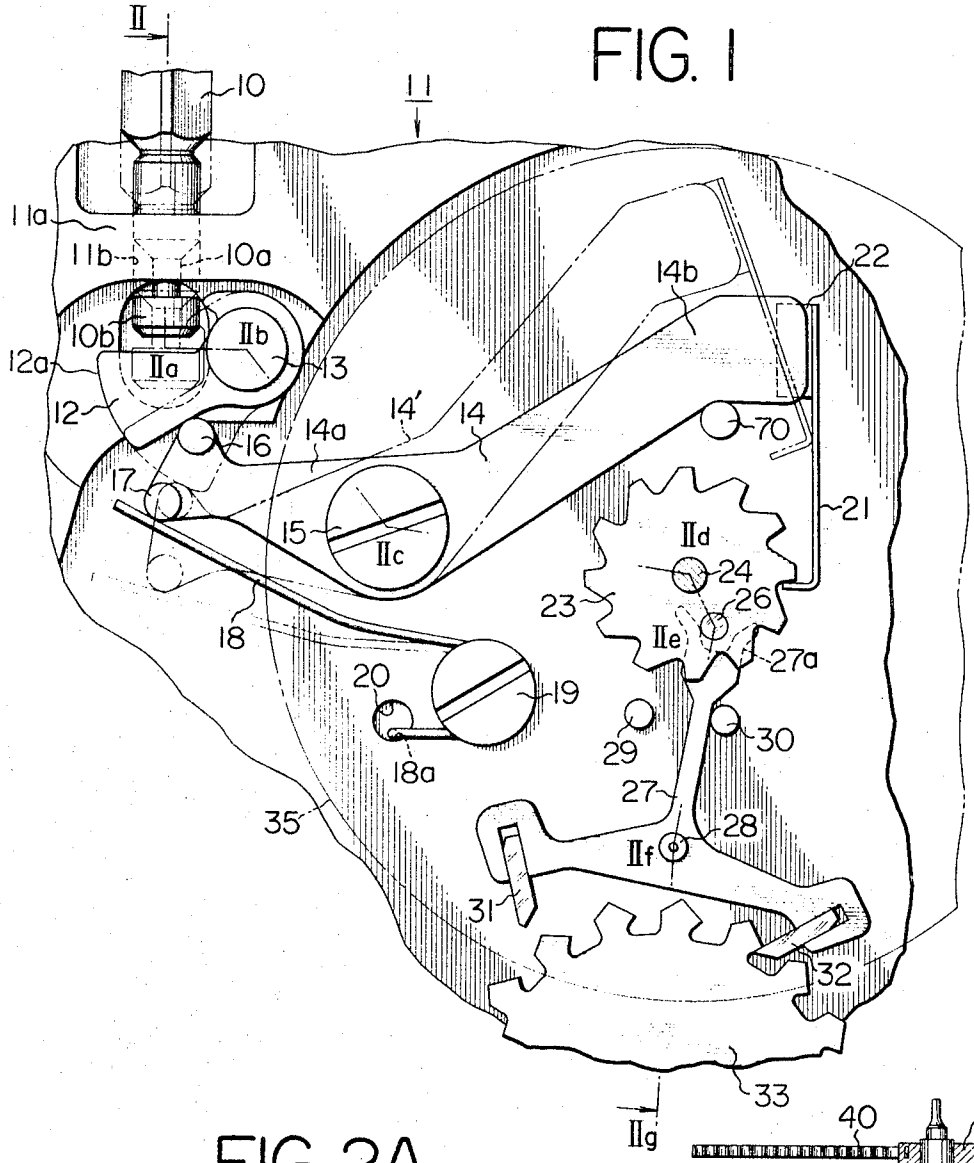
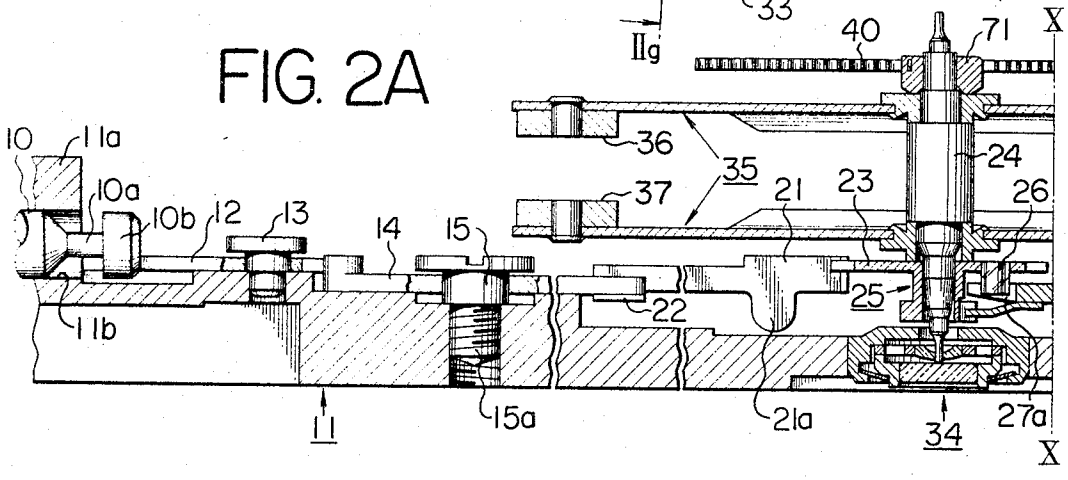


FIG. 2A



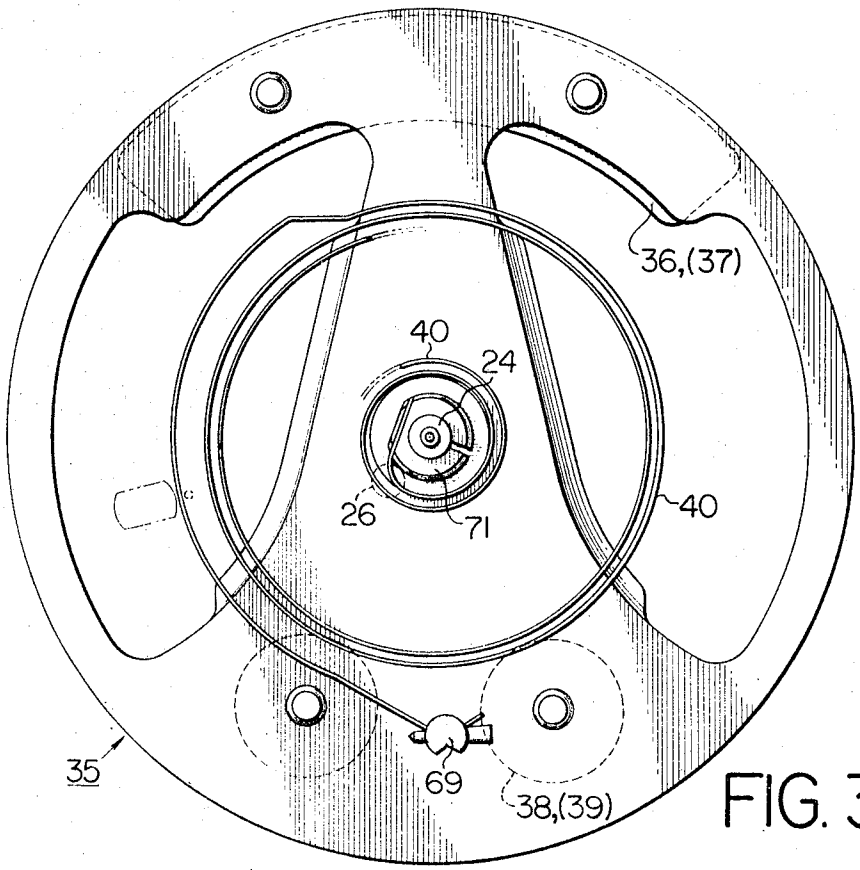

36,(37)
40
24
26
71
40
35
69
38,(39)

FIG. 3

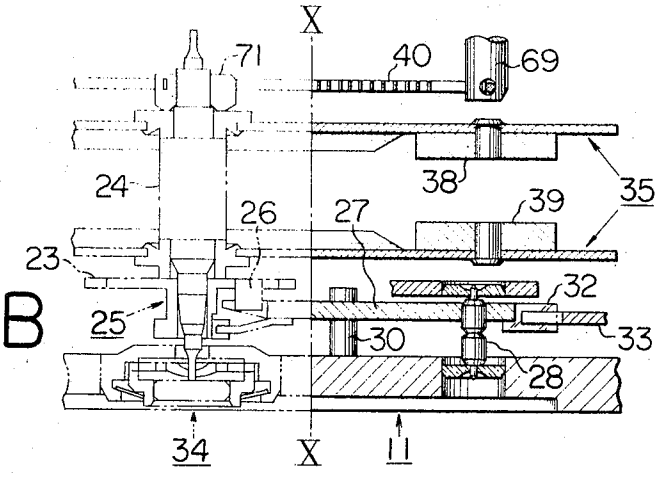

X
71
40
69
38
35
24
26
27
39
23
32
25
30
33
28
34
X
11

FIG. 2B

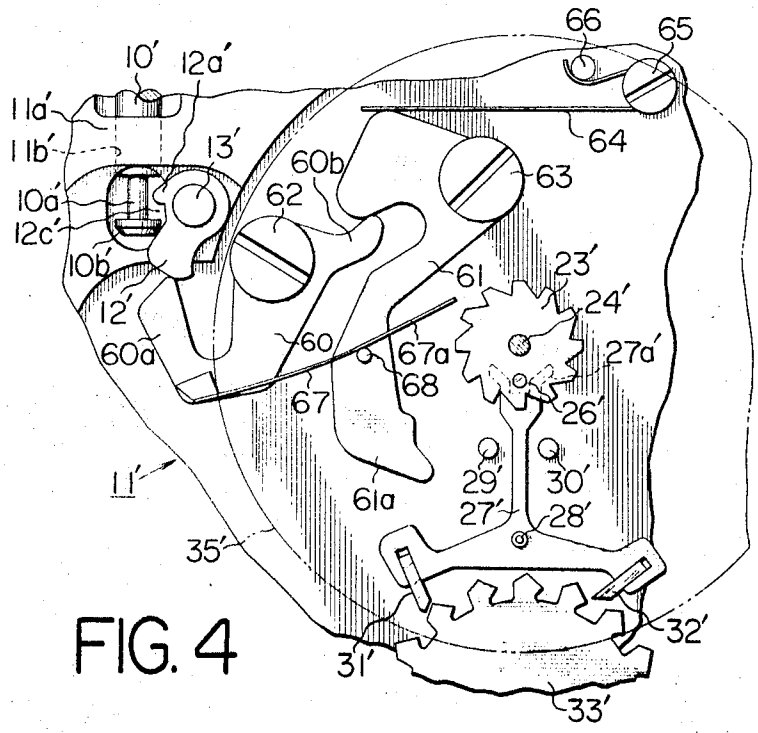

66
65
10'
12a'
11a'
11b'
13'
60b
64
63
10a'
62
12c'
10b'
61
23'
24'
12'
60a
60
67a
27a'
67
68
26'
11'
29'
30'
61a
27'
28'
35'
32'
31'
33'

FIG. 4

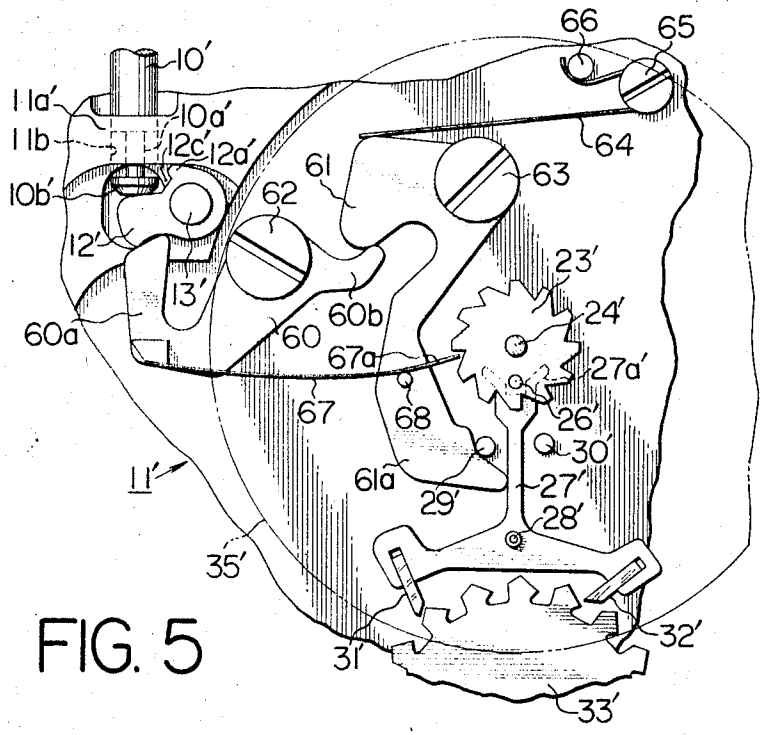

66
65
10'
11a'
10a'
11b
12c'
12a'
64
61
63
10b'
62
23'
12'
24'
13'
60b
60a
60
67a
27a'
67
68
26'
30'
11'
61a
29'
27'
28'
35'
32'
31'
33'

FIG. 5

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STOP AND START MECHANISM FOR TIMEPIECE MOVEMENT

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Int. Cl. G04f 7/04
U.S. Cl. 58—79 5 Claims

ABSTRACT OF THE DISCLOSURE

A stem-controlled stop and start mechanism for a timepiece movement, wherein a wing lever is provided between the enlarged inner end of the winding stem and the main stop lever, for making the latter substantially insensitive to unintentional minor movement of the stem.

This invention relates to a stop and start mechanism for the movements of timepieces, said mechanism being fitted with a longitudinally slidable control member, preferably embodied into a conventional winding stem. This kind of known stop and start mechanism for timepiece having at least a stationary plate, a winding stem having an enlarged inner and actuating end and being mounted slidably in its longitudinal direction on said plate, comprises a first lever pivotably mounted on said plate and an oscillatory balance wheel mounted on said plate, said wheel being operatively connected with a time-indicating gear train through a second or anchor lever and an escape wheel, said first lever being adapted for cooperation with said enlarged stem end, and an elongated spring means mounted on said first lever adapted for engagement with and disengagement from said balance wheel depending upon the longitudinal positioning of said stem for locking and releasing the balance wheel.

In such conventional mechanism, when a drawing manual effort is exerted to a certain predetermined degree upon the stem, the regular balance wheel of the timepiece movement is positively prevented from its regular oscillating movement, and the locked balance wheel is released again with the drawn-out stem being pushed in into its regular non-operating position operatively disengaged from the balance wheel.

In the course of this manual control operation, motion is considerably enlargingly transmitted from the lever mechanism onto the balance wheel, for the purpose of locking or releasing the latter, as the case may be.

If there should be a certain inaccuracy in the workmanship of the stem or its related parts, an accidental operating error at the side of the stem or an occasional and accidental longitudinal movement of the latter as may be frequently encountered when the timepiece is being carried along personally for daily use, the erroneous movement of the stem could be so enlargedly transmitted onto the balance wheel that the latter would be locked against its oscillatory movement.

The main object of the invention is to provide a stop and start mechanism for the timepiece movement, capable of obviating the aforementioned drawback inherent in the conventional stop and start mechanism of the kind above referred to.

Another object is to provide a stop and start mechanism of the above kind, capable of stopping the balance wheel movement in an accurate and reliable manner.

Still another object is to provide a stop and start mechanism of the above kind, capable of providing a large starting torque when starting.

These and further objects, features and advantages of the invention will become more clear when read the following detailed description of the invention by reference to the accompanying drawings illustrative of two preferred embodiments of the invention shown only for illustrative purpose and thus not in any limiting sense of the invention.

Starting from the said known mechanism, the stop and start mechanism according to this invention in its broadest aspect comprises characterizingly a wing lever positioned in close proximity to said enlarged stem end and between the latter and said first lever for establishing motion transmitting relationship therebetween, said wing lever having an actuating surface extending within a certain central angle about its pivotal center, said surface being substantially of an arc having a radius from said center, thereby making said lever insensible to occasional minor unintentional movement of said stem.

In the drawings:

FIG. 1 is a schematic plan view of essential parts of the stop and start mechanism embodying the novel principles of the present invention, wherein the full lines of the stem and its related parts illustrate their balance wheel-locking position and chain-dotted lines show their non-operating or balance wheel-releasing position.

FIGS. 2A and 2B represent in combination a sectional view taken substantially along a section line II–II*a*–II*b*–II*c*–II*d*–II*e*–II*f* shown in FIG. 1, a chain line X—X being a parting line for combining together said two figures into one.

FIG. 3 is a schematic top plan view of the balance wheel employed.

FIG. 4 is a simplified similar view to FIG. 1 illustrative of a somewhat modified second embodiment of the invention wherein the stem is positioned in its non-operating position for keeping the balance wheel in its regularly operating position.

FIG. 5 is a similar view to FIG. 4 wherein, however, the stem has been drawn out to a certain predetermined degree for locking the balance wheel, thereby giving a possibility for making a time-setting or the like manual adjusting operation.

Now referring to the drawings, more specifically FIGS. 1, 2A and 2B, the numeral **10** denotes a modified winding stem which is slidably mounted as conventionally relative to the lower plate **11**, only partially shown, of a timepiece movement, shown again only partially. For this purpose, the lower plate **11** is formed with an elongated land **11***a* provided with a horizontal opening at **11***b* through which the stem **10** passes for its sliding guidance. As most clearly seen from FIG. 2A, the inner end of the stem **10** is formed with a reduced part at **10***a*, the innermost extremity thereof being formed into an enlargement, preferably shaped into substantially a circular disc **10***b* as shown.

A wing-shaped lever **12** is provided at a close proximity to the stem enlargement **10***b* and pivotably mounted on a shaft **13** which is studded in the lower plate **11**. A bell crank lever **14** is pivotably mounted on a further shaft **15** having a reduced and threaded part **15***a* which is threadedly studded in the lower plate **11**. Double arms of the lever **14** are shown at **14***a* and **14***b*, of which the first one is formed with a pair of integral projections **16** and **17**, preferably in the form of short round pins provided on the corners at extremity of said lever arm **14***a*.

As shown, the wing lever **12** is positioned between the enlarged stem end **10***b* and the lever arm **14***a* for establishing a motion-transmitting relationship therebetween. Said wing lever **12** has an actuating surface **12***a* extending within a certain central angle, preferably in the order of 30 degrees as an example, said surface being substantially of an arc having a constant radius from the center

of the pivot shaft 13. If there should arise a certain amount of occasional and unintentional longitudinally upward movement of the stem from its regular position shown in chain-dotted lines in FIG. 1, causing the wing lever 12 to rotate about 10 degrees, for instance, in the clockwise direction, the balance wheel will remain locked in place. Therefore, in this occasional case, practically no influence is invited in the position of the projection 16 and thus that of the bell crank lever 14 which is therefore insensible to occasional minor and unintentional movement of said stem 10.

The first projection 16 is kept in pressure contact with the pivotable contact with the pivotable wing lever 12, when the stem is positioned at its regular position, while the second projection 17 is kept in resilient contact with the free end of wire spring 19, thus the lever 14 being always urged to swivel around its mounting shaft 15 in the clockwise direction whne seen in FIG. 1. It should be noted that the left-hand end part of FIG. 2A, corresponding to the sectional details along the section line part IIa–IIc, has been shown as seen from the opposite side from that specified in FIG. 1.

Urging force is therefore transmitted from the wire spring 18 through the bell crank lever 14 to the wing lever 12 which is thus normally kept in pressure contact with the stem enlargement 10b. In FIG. 1, however, both are shown as they are kept in separation from each other in their full line position, with the stem being drawn out. This has been caused by contact of the lever 14 with stop pin 70.

The opposite or base end of the wire spring 18 is positioned substantially stationary by means of a positioning screw 19. For further assuring this positioning, the opposite extremity 18a of wire spring 18 is turned transversely and received in a positioning opening 20 bored through the lower plate 11. An elongated hook made of suitable spring material is fixedly attached through a fixture plate 22 to the free end of the lever arm 14b relying upon any conventional conventional fixing technique such as fusing, welding, riveting or the like. With the stem 10 positioned in its drawn-out position, the hook 21 is kept in meshing engagement with a sprocket wheel 23 which is in turn mounted fixedly on a conventional balance wheel wheel shaft 24. In the present embodiment, the sprocket wheel 23 is made into a modification of the conventional roller, generally denoted at 25, which construction is clearly seen at the right-hand end of FIG. 2A. The spring hook 21 is provided with a depending tab at 21a which serves in cooperation with the related part of the lower plate 11 for the mechanical damping of the hook so as to prevent any unintentional disengagement thereof from sprocket wheel 23 to be otherwise caused by occasional and excessive vibration. The roller 25 is fitted as conventionally with an impulse pin 26 which is adapted for cooperation with the forked end at 27a of a conventional anchor lever 27 which is pivotable about a pallet staff 28. There is a pair of banking pins 29 and 30 which are studded in the lower plate 11 at the both sides of the lever 27 for limiting the range of oscillating movement of the latter. The lever 27 is arranged as conventionally to cooperate through inlet and outlet pallet stones 31 and 32 rigidly mounted thereon with an escape wheel 33 rotatably mounted on the plate 11, although the mounting details have been omitted from the drawing for simplicity.

Balance wheel, generally shown at 35, is rigidly mounted on the shaft 24 which is rotatably supported in a pair of upper and lower bearing jewel assemblies of which only the lower one is shown at 34 in detail. Since the timepiece shown in embodied into an electronic watch the balance wheel 35 carries thereon fixedly permanent magnets 36–37 which are arranged to cooperate electromagnetically with a corresponding number of stationary coils, although not shown. These coils are those adapted for sensing and driving purpose for the balance

wheel assembly, as commonly known to those skilled in the art. Balance weight masses 38–39 are also mounted on the balance wheel for better and accurate oscillatory movement. The numeral 40 represents a conventional balance spring attached, on the one hand, to a conventional collet 71 mounted on the balance wheel shaft 24, and to a conventional stud 69, on the other hand.

With the winding stem 10 kept in its regular or pushed-in position as shown in chain-dotted lines in FIG. 1, the lever 14 and the hook 21 are positioned again in their chain-dotted position, thus the sprocket wheel 23 being subjected to no braking action and the regular gear train, not shown, operating in the regular way under the influence of the oscillating balance wheel 35, anchor lever 27 and the steppingly driven escape wheel 33 so far as the balance wheel is kept in motion.

When a timpiece wearer exerts his finger effort onto the stem 10 so as to draw out the latter until it will have been brought into its full line position in FIG. 1, for time setting or the like purpose, the lever 14 will be pivoted a certain angle in the clockwise direction under the influence of the urging force exerted thereon by spring 18. As shown, the spring hook 21 is brought into meshing with one of the tooth spaces on the sprocket wheel 23, thereby the latter being locked in position and positively prevented from any oscillating motion with the balance wheel 35 even if the wheel receives oscillatory driving forces.

When the operator pushes the stem 10 inwards from the full line to the chain-dotted line position, the manipulating finger pressure is exerted from the sliding stem 10 to the wing lever 12 so as to pivot it around the shaft 13 in the counter-clockwise directior in FIG. 1, thereby urging, to bring the bell crank lever 14 into its full line position. In the course of this pivoting movement of the lever 14, the hook 21 providing a springy and sudden kick to the sprocket wheel 23 so as to start the latter with its shaft 24 in the counter-clockwise direction in FIG. 1. For this purpose, the gap shown between the stem enlargement and the wing lever is much valuable to generate a sudden shock, allowing a stronger and quicker starting to take place. Since the balance wheel 35 is fixedly mounted on this shaft 24, the wheel is naturally given a positive starting torque and will be mechanically assisted to initiate and maintain its regular oscillating movement which is transmitted as usual through the escapement mechanism including lever 27 and escape wheel 33 to the timepiece gear train.

In the modified embodiment shown in FIGS. 4 and 5, winding stem 10', lower plate 11', land 11a', wing lever 12', shaft 13', sprocket wheel 23', balance wheel shaft 24', anchor lever 27', pallet staff 28', banking pins 29' and 30', pallet jewels or stones 31' and 32', and escape wheel 33' have respective similar arrangements and functions as those attached with same reference numerals without prime in the foregoing first embodiment shown in FIGS. 1, 2A, 2B and 3. The balance wheel 35' may be completely same as before, and thus, the wheel is shown in FIGS. 4 and 5 only schematically and partially by a chain-dotted circle at 35' for demonstrating its outer peripheral configuration in its plan view. Further detailed description of the above-mentioned parts may be therefore omitted without sacrificing the better understanding of the invention.

In the present embodiment, the lever 14 has been divided into two mutually cooperating levers 61 and 62 which are pivotable about respective pins or pivot shafts 62 and 63 which are studded in the plate 11'. The first lever 60 is a bell crank lever smaller than that denoted 14 in the foregoing embodiment. The lever 60 comprises two long and short arms 50a and 60b, the former arm being kept always in pressure contact with the wing lever 12' as in the foregoing embodiment and for the same purpose as before. The second lever 61 has substantially the shape of a 7 when seen in its plan view, the short arm 60b of the first lever being always kept in pressure con-

tact with the shorter arm of said second lever **61**. A spring **64** is mounted fixedly at its basic end on the plate **11'** by means of a screw stud **65** and a stop pin **66** as shown. The function of this spring **64** is substantially similar to that shown at **18** in the foregoing embodiment, yet urging in the present embodiment the second lever **61** to rotate in the counter-clockwise direction.

A spring **67** has its root portion **67***a* fixedly mounted on the long arm **60***a* of the first lever **60** such as by fusing or welding, and its free end kept in resilient contact with a stop pin **68** fixedly mounted on the second lever **61**.

When the winding stem **10'** is kept in its normal or pushed-in position as shown in FIG. 4, the free end extremity of the spring **67** is kept in separation from the toothed periphery of sprocket wheel **23'**, thus the latter wheel together with the balance wheel being free to perform the regular oscillative motion without being subjected to any braking.

When the wearer exerts his finger pressure upon the stem **10'** so as to draw out the latter from the position shown in FIG. 4 to that in FIG. 5, the stem enlargement **10***b'* acts upon small projection **12***a'* formed on the wing lever **12'** and rotate the wing lever to a certain angle and then will become disengaged from the projection **12***a'*. The wing lever **12** in the foregoing embodiment is also formed with a similar projection **12***a* for the same purpose.

The main wing part of the lever **12** or **12'** and said small projection **12***a* or **12***a'* is so arranged and dimensioned that a shallow recess **12***c* or **12***c'*, respectively, which serves the stem for making it considerably insensitive to any occasional lost motion in the direction from its regular or balanced wheel-released position to its locking one.

Upon disengagement of the projection **12***a'* from the stem enlargement **10***b'*, spring **64** will become more effective to act upon the wing lever **12'** through both pivotable intermediate levers **61** and **60** in succession. In this course, the lever **61** carrying stop pin **68** will pivot around pivot pin **63** in the counter direction in FIGS. 1–2, until the lever is brought into dead stop by contact with banking pin **29'**. At the same time, another one of the lever couple **60–61** to rotate in the clockwise direction, thereby the wire spring **67** acting as a resilient locker, with its free end at **67***a* being kept in engagement with one of tooth spaces around the sprocket **23'**, thus the latter together with the balance wheel, herein not shown, being locked against the oscillatory movement.

When the wearer pushes the stem from its drawn-out position shown in FIG. 5 back into its regular position shown in FIG. 4, the relative motion among stem **10'**, wing lever **12'**, first lever **60**, second lever **61** and wire spring **67** will be carried into effect substantially in the reverse order and the spring **64** is thereby compressed to accumulate resilient energy therein ready for next manipulation of the stem. In this course, the locking spring **67** will turn in effect in the clockwise direction in space and a strong drive force is exerted by the stop **68** upon it. The free end **67***a* of the spring provides thus a strong resilient drive force upon the sprocket wheel **23'** which is thus driven to rotate in the clockwise direction with a heavy starting torque. The balance wheel is thus freed from its locked position and subjected to a strong turning motion for the initiation of its regular oscillatory motion. Motion is therefore transmitted in the conventional way, from the roller, anchor lever and escape wheel to the regular timepiece gear train.

In a modified embodiment from the first embodiment, stop pin **70** can be omitted without affecting considerably adversely the main operation of the inventive mechanism.

What we claim is:

1. In a stop and start mechanism for a timepiece having a stationary plate, a winding stem having an enlarged inner end and being mounted slidably in its longitudinal direction on said plate, and an oscillatory balance wheel mounted on said plate, said wheel being operatively connected with a time-indicating gear train through an anchor lever and an escape wheel, said mechanism comprising a first lever pivotably mounted on said plate, said first lever being adapted for cooperation with said enlarged stem end, and an elongated spring means mounted on said first lever adapted for engagement with and disengagement from said balance wheel depending upon the longitudinal positioning of said stem for locking and releasing the balance wheel, the improvement comprises a wing lever positioned in close proximity to said enlarged stem end and between the latter and said first lever for establishing a motion-transmitting relationship therebetween, said wing lever having an actuating surface extending within a certain central angle about its pivotal center, said surface being substantially of an arc having a constant radius from said center, thereby making said first lever insensible to occasional minor and unintentional movement of said stem.

2. A stop and start mechanism as set forth in claim **1**, characterized by the provision of a projection on said wing lever, thereby forming a recess between said projection and the main wing part of the last mentioned lever, thereby further increasing the insensitiveness of said first lever to occasional and unintentional axial movement of the stem from its regular towards its drawn-out position.

3. A stop and start mechanism as set forth in claim **1**, characterized by that said elongated spring means is a spring hook.

4. A stop and start mechanism as set forth in claim **1**, characterized by that said first lever is split into first and second pivotable lever elements kept in mechanical cooperation with each other, said elongated spring means being mounted on the first lever element and a stop being fixedly mounted on the second lever element, said spring means being always kept in pressure contact with said stop.

5. A stop and start mechanism as set forth in claim **1**, comprising a roller having a large flange and a small flange and being mechanically united into one with said balance wheel, wherein said large flange is shaped into a sprocket wheel so as to cooperate with said spring means.

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