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(54) IMPROVEMENTS IN OR RELATING TO ELECTRONIC TIMEPIECES

(71) We, KABUSHIKI KAISHA SEIKOSHA, a Japanese company, of 6-21, 2-chome, Kyobashi, 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:-

This invention relates to electronic timepieces and more particularly to electronic timepieces providing a digital display of time. Though not exclusively limited to its application thereto, the invention is most advantageously applicable to and is primarily intended for quartz crystal electronic wrist watches with digital time displays.

Time adjustment is usually effected in conventional digital display electronic timepieces by push button systems which fall into one or other of two types. In one type of system the content of a time counter is increased by 1 each time a push button is pushed. In the other type of system the content of a time counter is increased fairly rapidly at a predetermined rate so long as a button is being pushed. The former type of system has the defect of being troublesome and tedious to operate: for example, it may be necessary to push the button as many as 59 times (advancing the seconds display by 59) in order to correct the minutes digit display. The latter system has the defect that the push button must be held down for anything up to 59 seconds in order to correct the minutes display, assuming that the predetermined rate of advance of count contents is 1 per second. If, in order to avoid this defect, a higher predetermined rate of advance is adopted there is the defect that the user is liable to over-correct, i.e. to hold down the button too long.

The present invention seeks to provide in an electronic timepiece improved and simple time correcting which avoids the defects of the two conventional time correcting types of arrangement above broadly described and enables easy, speedy, and accurate time correction to be effected by enabling the rate of correction to be high, when a high rate of correction is appropriate and lower when a lower rate is appropriate,

i.e. when the displayed time is nearing the correct time. As will be seen later the invention enables the switches necessary for time correction to be simplified as compared with those known systems in which selection switches are used to select different time unit displays to be selected for correction. Other advantages achievable by the invention will be appreciated from the embodiments thereof to be described later herein.

According to this invention there is provided an electronic timepiece wherein time correction is effected by time adjusting pulses which are produced from pulse generation means which receives pulses produced in response to the operation of a manually controllable pulse-producing switching device and produces in response to pulses derived from said device time adjusting pulses the periodicity and numbers of which are predetermined in dependence on the speed of operation of said device over at least a range of said speed of operation.

The time adjusting pulses may be applied to a counter normally counting time to change the count content thereof.

The counter may be an up/down counter and the time adjusting pulses may be arranged to change the count content thereof up if the switching device is operated in one predetermined manner or down if said device is operated in another predetermined manner. Said switching device may be a rotary switch having switch contacts which are opened and closed when the switch is rotated, and in such a case the counter may be arranged to count up when the rotary switch is rotated in one direction and down when said switch is rotated in the other. However the switching device may be an automatic-return push switch having contacts which are opened and closed when said switch is operated.

If desired means may be provided for preventing time correction if the switching device is operated at more than a predetermined speed.

The invention is illustrated in and further explained in connection with the accompanying drawings in which:-

Figure 1 is a circuit diagram of one embodiment

ment of the present invention;

Figure 2 is a side view of one form of switch construction for a pulse generating switch used in Figure 1;

5 Figure 3 is a wave form chart explanatory of the operation of the circuit in Figure 1;

Figure 4 is a circuit diagram of another embodiment of the invention;

10 Figure 5 is a wave form chart explanatory of the operation of the circuit in Figure 4; and

Figure 6 is a circuit diagram of a third embodiment of the invention.

Referring to Figure 1, this represents a wrist watch or other timepiece comprising a time standard quartz crystal oscillator 1 output of which is fed to a frequency divider 2 which divides the oscillator frequency down to a frequency suitable for use for time-counting, e.g. a frequency of 1 Hz, which is passed on to one input of an AND gate 16. A predetermined frequency (e.g. 512 Hz) which is higher than the time counting frequency appears at the intermediate output terminal 2a of the divider. 3 is an up/down counter which receives the time counting pulses (e.g. at 1 Hz) from the divider 2 and effects the time counting e.g. counts seconds, minutes and hours. The count contents of the counter 3 are converted by a decoder-driver 4 into signals suitable for operating a digital time display device 5 and which are fed thereto. The oscillator 1, divider 2, up/down counter 3, decoder-driver 4 and display device 5 may be as known per se and need no further description here. There is a counter 6 which counts pulses from the terminal 2a of the divider 2 and produces pulses at terminals 6a, 6b whenever pre-set counts are reached. There is also a counter 7 which counts pulses from terminal 2a and produces pulses at terminals 7a, 7b and 7c whenever pre-set counts are reached.

The blocks referenced 8 to 14 inclusive are flip-flops; 15 is a differentiating circuit; 16 to 30 inclusive are gate circuits; 31 is an inverter 32 to 35 inclusive are resistors; and 36, 37 and 38 are contact bounce effect eliminators, which may be as known per se and are designed to eliminate electrical noise generated by the opening and closing of mechanical contacts.

50 They may be composed of registers or of logic circuits consisting of flip-flops and serving the same purpose. +E is the positive terminal of the power supply source (not shown). 39, 40 and 41 are switches incorporated in a switch construction which may be as shown in Figure 2.

Referring to Figure 2, a knob 45 is secured on one end of an electrically conductive shaft 44 which has formed thereon "click" grooves 42 and 43, and which carries a short cylindrical rotary drum 46. The drum can be rotated by rotating the knob 45 and moved endwise by pulling out or pushing in said knob 45. The "click" grooves co-operate with any suitable spring means (not shown) so as to impart to the shaft 44 definite positions longitudinally,

when the knob 45 is pushed in or pulled out. Electrodes 48 shaped as shown and extending parallel to the drum axis (the shaft 44) are formed on the cylindrical surface 47 of the drum 46. Each of the electrodes has an electrically conductive portion 49 which is formed integrally therewith and which electrically connects it to the shaft 44. The said shaft 44 is connected to the power supply source (see Figure 1) via a contact strip 50 and terminal P₁.

51 and 52 are contact strips of predetermined different lengths so that their free ends or tips 51a, 52a are differently positioned to a considerable and predetermined extent with respect to the circle of revolution of the drum 46. The tip 51a and the electrodes 48 co-operate to form the switch 40 (Figure 1); and the tip 52a and electrodes 48 co-operate to form the switch 41 (Figure 1). The contact strips 51, 52 are respectively grounded via terminals P₂, P₃ and resistors 34, 35 (Figure 1). The fixed ends of the contact strips 50, 51 and 52 are secured to a pillar 54 standing up from a support member 53. The fixed end of a contact strip 55 is secured to the end of a pillar 57 standing up from a support member 56. The free end of strip 55 has a contact 55a which co-operates with a contact 58a carried by a pillar 58 standing up from the support member 56. If the knob 45 and shaft 44 are moved leftward as viewed in the drawing, contact 55a closes on to contact 58a. These two contacts are the contacts of the switch 39 of Figure 1. Contact strip 55 is connected to the power supply source terminal +E via terminal P₄ and contact 58a is grounded via a terminal P₅ and resistor 33 (Figure 1). The terminals P₁ to P₅ are shown in both Figures 1 and 2.

When the knob 45 of Figure 2 is pushed in the switch 39 is open. This opens the AND gate 16 by the output of the inverter 31 (Figure 1) and also holds the up/down counter 3 in the up-counting condition via the OR gate 18. The clock input CL of the counter 3 receives the 1 Hz output from the divider 2 via the AND gate 16 and the OR gate 17 (which is also open), the said counter counts time in the ordinary way and the display device 5 displays the time counted.

The operation of time correction will now be explained. Assume that the Q outputs of the flip-flops 12 and 13 are initially "1". When the knob 45 of Figure 2 is pulled out the tips 51a, 52a of both contact strips 51, 52 can co-operate with the electrodes 48. The output level of the inverter 31 is reversed, the AND gate 16 is closed and one input of the OR gate 18 is held at "0". In order to advance the content of the up/down counter 3, the knob 45 is rotated in the direction indicated by the arrow A. This first brings the tip 51a into contact with an electrode 48 and, a little later, brings the tip 52a into contact with an electrode 48. Consequently, pulses having wave forms A and

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B as shown in Figure 3 respectively appear at the outputs of the eliminators 37 and 38 in Figure 1. Hence, the Q output of the flip-flop 8 becomes "1" and the up/down counter 3 is kept at "up" by the output of the OR gate 18.

The wave forms A and B are also supplied to the data input terminals D of the flip-flops 8 and 9 respectively. To the clock input CL of flip-flop 9 is supplied the pulses (of 512 Hz, for example) from the terminal 2a of the divider 2 and a wave form as shown at C of Figure 3 appears at the Q output of the flip-flop 9. Pulses having wave forms as shown at D and E of Figure 3 are respectively generated at the Q outputs of the flip-flops 10 and 11. These pulses combine to produce a wave form F from the AND gate 20 and this is fed to the differentiating circuit 15 which sets the flip-flop 14 the Q output of which opens the AND gate 23 and the output from the terminal 2a of the divider 2 produces a pulse k_1 as shown by line K in Figure 3 which is applied to the counter 7 and also (via leads marked a and OR gate 17) to the up/down counter 3. The content of the counter 3 is thus advanced by one. The counter 7 is so designed that when it counts one, a pulse is generated from its terminal 7a.

The output of the AND gate 28 is retained at "1" since the Q output of the flip-flops 12, 13 are at "1" initially. Accordingly the pulse at the terminal 7a of the counter 7 re-sets the flip-flop 14 via the AND gate 24 and the OR gate 27, the AND gate 23 closes, and the counter 7 is reset.

Thus, as soon as the knob 45 is rotated, a time-adjusting pulse is generated and advances the content of the up/down counter 3 by one.

Meanwhile a pulse having the wave form shown at G in Figure 3 is produced from the AND gate 21 at a time near the ends of the pulses of the wave forms D and E generated respectively at the outputs of the flip-flops 10 and 11. These pulses at G reset the counter 6 and also the flip-flops 12 and 13. At the end of the pulse at the Q output of the flip-flop 11 the output of the AND gate 22 reverses to "1" as indicated by the wave form at H in Figure 3 and the AND gate 19 is opened. Accordingly, the output at 2a is applied to the counter 6 via said AND gate 19. The counter 6 thus counts during the period between the end of the abovementioned pulse from the Q output of the flip-flop 11 and the appearance of the next pulse from the same Q output, that is during the period from cut-off of contact between the tip 51a and one electrode 48 and the subsequent contact of said tip 51a with the next electrode 48 shown in Figure 2. In effect, therefore, the speed of revolution of the knob 45 in Figure 2 is detected.

To quote a practical example, in a particular case of an embodiment as shown in Figures 1 and 2, the counter 6 is so set that when it counts for about 0.25 to 0.5 seconds, pulses are generated from the terminals 6a and 6b respec-

tively. When contact between the tip 51a and an electrode 48 is cut off and established once after an output pulse of the wave form shown at I in Figure 3 is generated from the terminal 6a of the counter 6 and before an output pulse of the wave form shown at J is generated from the terminal 6b, that is, during the period from 0.25 to 0.5 seconds, a pulse of the wave form shown at F in Figure 3 is generated from the gate 20 while the output of the gate 29 keeps the gate 25 open. The resulting pulse fed through the OR gate 27 sets the flip-flop 14 and its Q output opens the gate 23 so that the output from the divider terminal 2a is applied to the up/down counter 3 and to the counter 7.

The counter 7 is so set that when it counts 4, a pulse is generated from its terminal 7b. Accordingly, when 4 pulses are applied to counter 7 via the gate 23, a pulse appears at the terminal 7b of counter 7 and resets the flip-flop 14 via the gates 25 and 27. Thus, the content of the up/down counter 3 is advanced by 4. If the knob is rotated in this manner and at such a speed that the contact between the tip 51a and an electrode 48 is cut off and re-established once during the period from 0.25 to 0.5 seconds, the content of the up/down counter 3 is advanced by 4 due to cut-off and contact action between 51a and 48.

If the speed of revolution of the knob 45 is slower so that one cut-off and contact between the tip 51a and an electrode 48 occupy more than 0.5 seconds, a pulse is produced from the gate 20 while the Q outputs of both flip-flops 12 and 13 are at "1" and one time-adjusting pulse is applied to the up/down counter 3 in the same way as mentioned above. In other words, when the speed of revolution of the knob 45 is made less, the number of time-adjusting pulses is decreased and along therewith, the speed of advance of the up/down counter 3 is also made less.

On the other hand, if the speed of revolution of the knob 45 is increased so that one cut-off and contact between the tip 51a and an electrode 48 occur in less than 0.25 seconds, a pulse is produced from the gate 20 before a pulse appears at the terminal 6a of the counter 6, that is to say, while the Q outputs of both flip-flops 12 and 13 are "0". The counter 7 counts the output pulses from terminal 2a of the divider 2 and is so set that when it counts eight pulses, it produces a pulse from its terminal 7c. In this case, therefore, the up/down counter 3 is caused to advance by 8.

In order to reduce the content of the up/down counter 3, the knob 45 may be rotated in the direction opposite to that indicated by the arrow A. If this is done the operation is as follows. The tip 52a first contacts an electrode 48 and a little later the tip 51a contacts an electrode 48. The Q output of the flip-flop 8 is reversed to "0" due to the pulses from the eliminators 37 and 38. Accordingly, the up/down counter 3 is changed over to the "down"

mode. The subsequent operations are as described over except that the counter 3 counts down.

As will now be appreciated, the speed of revolution of the knob 45 is in effect detected by utilising the time between the cut-off of contact of a tip 51a and an electrode 48 and subsequent contact of said tip 51a with the electrode 48. However, the speed of revolution may also be detected by utilising the contact time between the tip 51a and an electrode 48. Figure 4 illustrates an example of an embodiment in which this is done. In Figure 4 references 59, 60 and 61 designate AND gates. Like references designate like parts in Figures 1 and 4.

Referring to Figure 4, when the knob 45 (Figure 2) is rotated in the direction indicated by the arrow A, pulses having the wave forms A and B shown in Figure 5 are generated respectively from the eliminators 37 and 38, and pulses having the wave forms C, D and E of Figure 5 are generated respectively from the flip-flops 9, 10 and 11 due to the pulses from 38. Pulses having the wave forms F, G and H are produced from the gates 59, 60 and 61. The pulse of wave form H of Figure 5 produced at the output of gate 60 resets the counter 6 and the flip-flops 12 and 13, and the pulse of wave form G of Figure 5 produced at the output of gate 61 opens the gate 19.

The counter 6 counts the pulses from the divider terminal 2a, that is, the time corresponding to the contact time between the tip 51a and an electrode 48 (Figure 2). When a pulse of the wave form F of Figure 5 is produced from the gate 59 after the Q output of flip-flop circuit 12 is reversed to "1" (see wave form I of Figure 5) by the pulse from terminal 6a of the counter 6 and before a pulse is produced from terminal 6b of the counter 6, four time-adjusting pulses (for example) of the wave form J of Figure 5 are produced from the gate 23, thereby advancing the up/down counter 3 by four.

As will be seen, if the speed of revolution of the knob 45 is made slower, one contact between the tip 51a and an electrode 48 produces one time-adjusting pulse and advances the content of the up/down counter 3 by one in the same way as in the embodiment of Figure 1.

If the speed of revolution of the knob 45 is so increased that contact between the tip 51a and an electrode 48 is cut off before a pulse is produced from the counter 6, one contact between the tip 51a and an electrode 48 produces eight time-adjusting pulses and advances the content of the up/down counter 3 by eight in the same way as in the embodiment of Figure 1.

Thus the number of time-adjusting pulses supplied to the up/down counter 3 is changed in steps in dependence on the speed of revolution of the knob 45. When the amount of time adjustment of the counter 3 is large, therefore, the knob 45 is first rapidly rotated and then more slowly rotated as the correct time adjust-

ment is approached. Thus easy speedy and accurate time adjustment is made possible.

In the embodiments so far described the speed of revolution of the knob 45 is detected in three separate stages so as to vary stepwise the number of pulses (one, four or eight) generated in response to a pulse produced by manual operation of the manually operated switch. However, the invention is not limited to this and the number of stages of detection may be increased or decreased as desired by appropriately increasing or decreasing the number of flip-flops (such as 12 and 13) and the number of gates (24 to 26 and 28 to 30) in order appropriately to select the counter output of the counter 7 and thus set the number of time-adjusting pulses at each stage to the number desired. It is also possible to select, at desired values, the number of time-adjusting pulses produced in response to manual operation of the switch (Figure 2) by suitably selecting the frequency supplied from the divider terminal 2a to the counters (such as 6 and 7) and suitably selecting the counting capacity of the counter 6.

Figure 6 shows a modification in which time adjustment is prevented if the knob 45 (Figure 2) is rotated at too high a speed and the way in which this is achieved will now be described.

Referring now to Figure 6, the counter 62 shown therein has substantially the same function as the counter 6 in Figures 1 and 4 except that it has a terminal 6c connected to a counter stage preceding that to which its terminal 6a is connected. In Figure 6, 63 is a flip-flop and 64 is an AND gate. Like reference numerals are used in Figure 6 to identify those parts which are also in and correspond with parts in Figures 1 and 4. In Figure 6, when a "1" output is produced from the gate 20, the Q output of the flip-flop 63 is "0". Accordingly, the gate 64 is kept open so that it does not pass the above-mentioned Q output and the reset condition of the flip-flop 14 does not change. Consequently, no pulse is applied to the up/down counter 3 and time-adjustment is not performed.

The reason why provision is made for preventing time adjustment if the knob 45 is rotated at too high a speed is as follows. With a very high speed of knob rotation, the phases of the two pulse trains generated by the opening and closing of the switches 40 and 41 approach one another and the phases of the pulse trains produced from the eliminators 37 and 38 tend to cause reversion due to interference produced by incorrect switch action, such as contact bounce, the effects of which, at high speed, are not eliminated by the eliminators. In other words, even though time adjustment is made while the up/down counter 3 is set to "up", the said counter 3 may change over to "down" during operation. It is in order to prevent this from occurring that provision is made, in Figure 6, to cut out the time-adjusting pulse when the knob 45 is rotated at too high a speed.

The embodiment of Figure 6 is something of a refinement which, in many cases, will not be necessary and when it is considered that the probability of incorrect action due to too high a speed of knob rotation is negligible the circuits of Figures 1 and 4 may be used.

In the embodiments so far described and illustrated the counter 3 is an up/down counter. However, this is not essential and a simple up-counter can be used instead. Obviously, if this is done no change-over between up to down counting is necessary and the manually operated switch (Figure 2) may be modified so that it constitutes a single rather than (as shown in Figure 2) a double pulse system.

Again, in the embodiments so far described and illustrated, pulses are generated by contact and cut-off of contact between electrodes on a rotary switch member and the tips of contact strips co-operating therewith. However, this is not an essential feature of the invention and the pulses could be generated by repeated operations of an automatic-return type of push switch. If this is done, however, it will be necessary to use an up-counter for time-adjustment, or to provide a separate additional manual switch to select between up and down counting. If an automatic-return type of switch instead of the switch of Figure 2 is used in the embodiment of Figure 1, the number of time-adjusting pulses is varied in accordance with the intervals at which the switch is pushed and, if such a switch is used in the embodiment of Figure 4, the number of time-adjusting pulses is varied in accordance with the push period of the push switch.

As will now be appreciated the invention achieves its objects by generating, in dependence upon the speed at which a pulse producing manual switch is operated, predetermined different numbers of time adjusting pulses in response to each pulse from the manual switch. Accordingly it is possible to make easy, speedy and accurate time correction by varying the manual operation speed to suit requirements. For making time adjustment from the minutes digit display up to the hours display, for example, adjustment up to the hours digit can be made within an extremely short period by supplying time-adjusting pulses at high speed to the first order digit of minutes. For time-adjustment of the first order digit of minutes, adjustment can be made relatively slowly and accurately without risk of passing through the correct time. It is therefore possible to dispense with the conventional digit-selection switches or change-over switches usually provided in conventional electronic watches to enable speedy time adjustment to be effected. Moreover, because it is possible in carrying out the present invention optionally to set the relation between the manual operation speed of the manually operable switch and the number of the time-adjusting pulses produced in response to each pulse thereof, a mechanical switch of

quite simple construction can be used. If an automatic-return type of push switch is used as the manually operable switch and logic circuits such as counters in combination with gates are used to generate the time-adjusting pulses, it is possible very easily to set the relation between the manual switch operation speed and the speed of time adjustment by suitable selection of the logic circuitry and to make the whole construction extremely compact. The present invention therefore offers considerable advantages as regards making a timepiece of small size - an important matter for wrist watches.

If a switch, such as that of Figure 2, with a small rotary member having a plurality of electrodes and co-operating contact strips is used, time-correction can be effected by an extremely easy turning operation which is very convenient to the user.

Furthermore, if as in the embodiment of Figure 6, the number of time-adjusting pulses is varied in accordance with the speed of switch operation over a predetermined range of manual operation speed, and said pulses are stopped if the said speed exceeds this range, very reliable and error-free time correction is possible.

WHAT WE CLAIM IS:-

1. An electronic timepiece wherein time correction is effected by time adjusting pulses which are produced from pulse generation means which receives pulses produced in response to the operation of a manually controllable pulse-producing switching device and produces in response to pulses derived from said device time adjusting pulses the periodicity and numbers of which are pre-determined in dependence on the speed of operation of said device over at least a range of said speed of operation.
2. A timepiece as claimed in Claim 1 wherein the time adjusting pulses are applied to a counter normally counting time to change the count content thereof.
3. A timepiece as claimed in Claim 1 or 2 wherein the counter is an up/down counter and the time adjusting pulses are arranged to change the count content thereof up if said switching device is operated in one predetermined manner or down if said device is operated in another predetermined manner.
4. A timepiece as claimed in any of the preceding claims wherein the switching device is a rotary switch having switch contacts which are opened and closed when the switch is rotated.
5. A timepiece as claimed in Claims 3 and 4 wherein the counter is arranged to count up when the rotary switch is rotated in one direction and down when said switch is rotated in the other.
6. A timepiece as claimed in Claim 1 or 2 wherein the switching device is an automatic-return push switch having contacts which are opened and closed when said switch is operated.
7. A timepiece as claimed in any of the pre-

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ceding claims and including means for preventing time correction if the switching device is operated at more than a predetermined speed.

8. A timepiece as claimed in any of Claims 1 to 5 or 7, wherein the switching device is a rotary switch substantially as herein described with reference to Figure 2 of the accompanying drawings.

9. A timepiece substantially as herein described with reference to Figures 1 and 3, or

Figures 4 and 5, or Figure 6 of the accompanying drawings.

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In the embodiments so far described and illustrated the counter 3 is an up/down counter. However, this is not essential and a simple up-counter can be used instead. Obviously, if this is done no change-over between up to down counting is necessary and the manually operated switch (Figure 2) may be modified so that it constitutes a single rather than (as shown in Figure 2) a double pulse system.

Again, in the embodiments so far described and illustrated, pulses are generated by contact and cut-off of contact between electrodes on a rotary switch member and the tips of contact strips co-operating therewith. However, this is not an essential feature of the invention and the pulses could be generated by repeated operations of an automatic-return type of push switch. If this is done, however, it will be necessary to use an up-counter for time-adjustment, or to provide a separate additional manual switch to select between up and down counting. If an automatic-return type of switch instead of the switch of Figure 2 is used in the embodiment of Figure 1, the number of time-adjusting pulses is varied in accordance with the intervals at which the switch is pushed and, if such a switch is used in the embodiment of Figure 4, the number of time-adjusting pulses is varied in accordance with the push period of the push switch.

As will now be appreciated the invention achieves its objects by generating, in dependence upon the speed at which a pulse producing manual switch is operated, predetermined different numbers of time adjusting pulses in response to each pulse from the manual switch. Accordingly it is possible to make easy, speedy and accurate time correction by varying the manual operation speed to suit requirements. For making time adjustment from the minutes digit display up to the hours display, for example, adjustment up to the hours digit can be made within an extremely short period by supplying time-adjusting pulses at high speed to the first order digit of minutes. For time-adjustment of the first order digit of minutes, adjustment can be made relatively slowly and accurately without risk of passing through the correct time. It is therefore possible to dispense with the conventional digit-selection switches or change-over switches usually provided in conventional electronic watches to enable speedy time adjustment to be effected. Moreover, because it is possible in carrying out the present invention optionally to set the relation between the manual operation speed of the manually operable switch and the number of the time-adjusting pulses produced in response to each pulse thereof, a mechanical switch of

quite simple construction can be used. If an automatic-return type of push switch is used as the manually operable switch and logic circuits such as counters in combination with gates are used to generate the time-adjusting pulses, it is possible very easily to set the relation between the manual switch operation speed and the speed of time adjustment by suitable selection of the logic circuitry and to make the whole construction extremely compact. The present invention therefore offers considerable advantages as regards making a timepiece of small size - an important matter for wrist watches.

If a switch, such as that of Figure 2, with a small rotary member having a plurality of electrodes and co-operating contact strips is used, time-correction can be effected by an extremely easy turning operation which is very convenient to the user.

Furthermore, if as in the embodiment of Figure 6, the number of time-adjusting pulses is varied in accordance with the speed of switch operation over a predetermined range of manual operation speed, and said pulses are stopped if the said speed exceeds this range, very reliable and error-free time correction is possible.

WHAT WE CLAIM IS:-

1. An electronic timepiece wherein time correction is effected by time adjusting pulses which are produced from pulse generation means which receives pulses produced in response to the operation of a manually controllable pulse-producing switching device and produces in response to pulses derived from said device time adjusting pulses the periodicity and numbers of which are pre-determined in dependence on the speed of operation of said device over at least a range of said speed of operation.

2. A timepiece as claimed in Claim 1 wherein the time adjusting pulses are applied to a counter normally counting time to change the count content thereof.

3. A timepiece as claimed in Claim 1 or 2 wherein the counter is an up/down counter and the time adjusting pulses are arranged to change the count content thereof up if said switching device is operated in one predetermined manner or down if said device is operated in another predetermined manner.

4. A timepiece as claimed in any of the preceding claims wherein the switching device is a rotary switch having switch contacts which are opened and closed when the switch is rotated.

5. A timepiece as claimed in Claims 3 and 4 wherein the counter is arranged to count up when the rotary switch is rotated in one direction and down when said switch is rotated in the other.

6. A timepiece as claimed in Claim 1 or 2 wherein the switching device is an automatic-return push switch having contacts which are opened and closed when said switch is operated.

7. A timepiece as claimed in any of the pre-

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