

PATENT SPECIFICATION

(11) 1 501 575

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- (21) Application No. 33454/76
- (22) Filed 11 Aug. 1976
- (31) Convention Application No. 649115
- (32) Filed 14 Jan. 1976 in
- (33) United States of America (US)
- (44) Complete Specification published 15 Feb. 1978
- (51) INT CL² H01H 25/06
- (52) Index at acceptance

HIN 441 442 44Y 451 45X 616 630 649 664 701 704 735 74X
G3T QB



(54) DUAL FUNCTION PUSH AND ROTATE SWITCH FOR SOLID STATE WATCHES

(71) We, TIMEX CORPORATION, a Corporation organized under the Laws of the State of Delaware, United States of America of Waterbury, Connecticut 06720, 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 dual function push and rotate switch assembly suitable for solid state watches.

In the use of electronic watches, particularly multifunction digital watches, it is usually necessary to have switches which enable the user of the watch to select the desired display function, or to set the information being displayed, or to illuminate the display or to shut down or disconnect the power supply, i.e. the battery, from the watch circuitry. The prior art has suggested the use of rotary switch arrangements and push switches to actuate functions in a digital watch for example a four position rotary detent action switch which permits adjustment of the displayed information, and push switches to control separate watch functions such as to illuminate the display.

Accordingly, an object of this invention is to provide an improved dual function switch assembly suitable for a solid state watch.

Another object of this invention is to provide an improved combined detent and pusher spring arrangement for a solid state watch.

A further object of this invention is to provide an improved single stem dual function push and rotate switch arrangement for a solid state watch.

A further object of this invention is to provide a multi-position stem detent and pusher arrangement and an internal switch arrangement.

According to one aspect of the invention there is provided a dual function rotate and

push switch assembly for a solid state watch, the assembly comprising a shaft having an electric contact in the form of an eccentric tab at one end thereof, a detent retainer section, and an end portion for actuation of the switch; a plurality of switch blades mounted for selective engagement with the eccentric tab; and spring means engaging the detent retainer section of the shaft for permitting longitudinal and detented rotational movement of the shaft to enable engagement of the eccentric tab with a selected switch blade or blades upon longitudinal and/or rotational movement of the shaft.

According to a further aspect of the invention there is provided a dual function rotate and push switch assembly for a solid state watch which comprises a shaft having an eccentric tab at the end thereof which in use is inside the watch case, an intermediate section having a detent retainer section, and an end portion projecting outwardly from the case; a first switch blade mounted for selective engagement with the eccentric tab with the shaft being in a first detent position and pushed-in longitudinally; a second switch blade mounted for selective engagement with the eccentric tab with the shaft being rotated to a second detent position; and spring means engaging the detent retainer section for permitting detented rotational movement and for engaging the shaft to urge the shaft into a longitudinal position to disengage the eccentric tab from the first switch blade, said shaft being pushed-in longitudinally against the bias of the spring means to a longitudinal position to engage the eccentric tab with the first switch blade, said spring means returning said shaft to the disengaged longitudinal position upon release of the shaft.

According to a still further aspect of the invention there is provided a dual function rotate and push switch assembly for a solid state watch, the assembly comprising a shaft having an electric contact in the form

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of an eccentric tab at the end thereof which in use is inside the watch case, an intermediate section having a detent
 5 retainer section, and an end portion projecting outwardly from the case; a first switch blade mounted for selective engagement with the eccentric tab with the shaft being in a first detent position and pushed-in longitudinally; a second switch
 10 blade mounted for selective engagement with the eccentric tab with the shaft being in a second detent position and pushed-in longitudinally; and spring means engaging the detent retainer section for permitting
 15 detented rotational movement and for engaging the shaft to urge the shaft into a longitudinal position to disengage the eccentric tab from each of the first and second switch blades, said shaft being
 20 pushed-in longitudinally against the bias of the spring means to a longitudinal position to engage the eccentric tab with either the first or second switch blades, said spring means returning
 25 said shaft to the disengaged longitudinal position upon release of the shaft.

A preferred form of the dual function push and rotate device and switch assembly of the invention comprises a crown portion
 30 on the outside of the watch case with a shaft portion having an intermediate detent retainer section in the portion immediately inside the case and an eccentric tab at the internal end thereof. The crown is locked in
 35 one of a plurality of rotational tactile positions by the co-operating action of the spring and the detent retainer section of the shaft. The shaft is also capable of longitudinal motion against an outward bias
 40 provided by the spring when the crown is pushed in. The spring also includes outwardly extending portions which are biased against the case or bezel so that a high simultaneous contact pressure is
 45 provided between the stem and spring and case.

The eccentric tab on the end of the shaft is designed to engage with one or more of a plurality of switch blades either separately
 50 or jointly. For example, one of the switch blades is positioned to be engaged by the eccentric tab with each depression of the crown and the other switch blade is positioned to be separately engaged by the
 55 eccentric tab when the crown is rotated to a predetermined detent position. Both switch blades are engaged when the crown is pushed-in while in this predetermined detent position.

The above and other features and advantages of this invention may be seen more clearly from the following description taken in conjunction with the
 60 accompanying drawings wherein:—

65 Figure 1 is a side view of a first

embodiment of the dual function push and rotate switch assembly of the invention, and also shows co-operating portions of a watch;

Figure 2 is a similar view of a second embodiment of the invention; and

Figure 3 is a similar view of another embodiment of the invention.

Referring to Figure 1 of the drawings, there is shown part of the case 17 of a solid state watch to which is fitted the push and rotate switch assembly. A watch stem assembly 10 has an eccentric tab 11 at one end, a main shaft portion 12, an
 75 intermediate detent retainer section 13 of lesser diameter than the shaft portion 12 and provided with flat portions 14 and 15, and another end portion having a watch crown 16 affixed thereto outside the case 17.

Switch blades 19 and 20 which comprise, 85 for example, thin beryllium copper stampings, are riveted or soldered perpendicular to each other to a solid state substrate (not shown). The switch blades are connected to an integrated circuit chip (not shown) through printed circuit leads. The connection of the switch blades to the integrated circuit is not pertinent to the present invention, and reference may be made to United States Patent Specification No. 3,874,162 for further details thereof. 95

The switch blade 19 which is engaged by the tab 11 when the stem assembly 10 is depressed is the "light" switch blade and is coupled to the circuits and a power supply (not shown) to energize a light source (not shown) to illuminate the watch face. Switch blade 20 is the "setting" switch blade and is coupled to logic circuits (not shown) to provide the capability of selectively 105 advancing or updating the information being displayed, for example, the minutes or hours.

The stem assembly 10 also permits detent holding of the stem in a rotational position for engaging one or the other of the switch blades 19 and 20 when depressed, as further described below, and provides electrical contact to ground the stem to the case. The detent action is effected through the flat portions 14, 15 of the shaft. The flat portions 14, 15 engage a single stamped spring 21 to provide a two position rotary tactile detent action. The detent action is similar to that described in United States Patent Specification No. 3,874,162 except that in the present embodiment a two position detent action is used. However, it should be recognised that the present invention, if desired, is suited for a multi- 125 position detent switch assembly having more than two detent positions.

In Figure 1 the spring 21 comprises a pair of spaced arms of substantially U-shape extending from a base secured to the watch. 130

The arms of the spring 21 are spring biased into engagement with the flat portions 14, 15. Moreover, as can be noted from the drawings, the spring 21 is preformed at a point 22 so as to exert not only a high simultaneous radial contact pressure between the stem portion and the arms but also a compressible outward spring pressure or bias on the stem by engagement with a shoulder provided on the stem by the end of the main shaft portion 12.

In the operation of the device shown in Figure 1, the wearer of the watch pushes in or depresses the crown 16 by applying pressure thereto or rotates the crown 16 to one of the tactile detent positions provided. The crown 16 protrudes from the case 17 so that the wearer of the wristwatch may have access to it and to permit longitudinal movement of the shaft. The crown 16 is depressed against the bias of the spring 21 which returns the stem 10 to its protruding position upon release of the crown. During this motion of the stem, the eccentric tab 11 longitudinally engages a light switch blade 19 causing illumination of the display. The two flat portions 14, 15 in co-operation with the spring 21 allow for a two position detent of the eccentric tab 11. A first detent position effects orientation of the eccentric tab 11 so that it does not engage this switch blade 20 when the crown is depressed. In this manner, the single function of illuminating the display is effected. If the crown is rotated, for example, 180° to the second detent position and depressed, the tab 11 longitudinally engages the setting switch blade 20 causing update of the displayed information.

Main shaft portion 12 is inserted into a housing 24 which passes through the wall of the case 17. A gasket 23 is accommodated in an annular groove in the shaft 12 and is compressed between the shaft and the housing. During the motion of the stem 10, the gasket 23 applies pressure against the internal wall of the housing 24. The gasket 23, by applying pressure between the annular groove 18 and the internal wall of the housing 24 prevents dust and moisture from entering the interior of the watch case.

The second embodiment of the invention shown in Figure 2 is similar to the embodiment of the invention shown in Figure 1 in that when the crown 25 is in a first detent position as shown and is depressed, the eccentric tab 27 is in a position to longitudinally engage a first switch blade 28, for example for causing distinction of separate display indicia such as the date to be displayed. However, this embodiment differs in that upon rotation of the crown 29 to a second detent position without depression the eccentric tab 27

rotatably engages a second switch blade 30. If the stem 25 is also depressed when the eccentric tab 27 is in the detent position for contacting switch blade 30, the eccentric tab 27 will also contact or engage switch blade 28. The switch blade 30 is biased to permit longitudinal sliding motion of the eccentric tab 27 and to maintain contact therewith during this motion of the eccentric tab.

The switch assembly shown in Figure 3 is similar to those shown in Figures 1 and 2 with the exception that the switch blades 35 and 40 are positioned to function differently with respect to the eccentric tab and that the housing which co-operates with the gasket is eliminated. In this embodiment the gasket or sealing element co-operates with the interior wall of the case 41. The switch blade 40 is precisely positioned such that with each depression of the stem 32 in the detent position illustrated in full lines, the eccentric tab 33 engages the blade 40 and does not engage the blade 35, as illustrated by the dashed lines 31, 34 and 42. Switch blade 35 is separately engaged by the eccentric tab 33 upon rotation of the stem 32 to the second detent position, and depression of the stem 32 in this detent position, as illustrated by the dashed line 36. The switch blade 35 is biased to permit longitudinal sliding motion of the eccentric tab 33 and to maintain contact therewith during this motion of the eccentric tab. This feature is illustrated by the line 37. Both the eccentric tab 33 and switch blade 35 are contoured as at 38 and 39 so as to permit ease of motion and proper engagement of the eccentric tab 33 with the switch blade 35.

There have thus been disclosed switch assemblies which combine the capabilities and advantages of both the push and rotate type switches, enable control of a number of functions either separately or simultaneously, are adapted for ease of use by the user of the watch and involve a minimum of associated parts.

WHAT WE CLAIM IS:—

1. A dual function rotate and push switch assembly for a solid state watch, the assembly comprising a shaft having an electric contact in the form of an eccentric tab at one end thereof, a detent retainer section, and an end portion for actuation of the switch; a plurality of switch blades mounted for selective engagement with the eccentric tab; and spring means engaging the detent retainer section of the shaft for permitting longitudinal and detented rotational movement of the shaft to enable engagement of the eccentric tab with a selected switch blade or blades upon longitudinal and/or rotational movement of the shaft.



The arms of the spring 21 are spring biased into engagement with the flat portions 14, 15. Moreover, as can be noted from the drawings, the spring 21 is preformed at a point 22 so as to exert not only a high simultaneous radial contact pressure between the stem portion and the arms but also a compressible outward spring pressure or bias on the stem by engagement with a shoulder provided on the stem by the end of the main shaft portion 12.

In the operation of the device shown in Figure 1, the wearer of the watch pushes in or depresses the crown 16 by applying pressure thereto or rotates the crown 16 to one of the tactile detent positions provided. The crown 16 protrudes from the case 17 so that the wearer of the wristwatch may have access to it and to permit longitudinal movement of the shaft. The crown 16 is depressed against the bias of the spring 21 which returns the stem 10 to its protruding position upon release of the crown. During this motion of the stem, the eccentric tab 11 longitudinally engages a light switch blade 19 causing illumination of the display. The two flat portions 14, 15 in co-operation with the spring 21 allow for a two position detent of the eccentric tab 11. A first detent position effects orientation of the eccentric tab 11 so that it does not engage this switch blade 20 when the crown is depressed. In this manner, the single function of illuminating the display is effected. If the crown is rotated, for example, 180° to the second detent position and depressed, the tab 11 longitudinally engages the setting switch blade 20 causing update of the displayed information.

Main shaft portion 12 is inserted into a housing 24 which passes through the wall of the case 17. A gasket 23 is accommodated in an annular groove in the shaft 12 and is compressed between the shaft and the housing. During the motion of the stem 10, the gasket 23 applies pressure against the internal wall of the housing 24. The gasket 23, by applying pressure between the annular groove 18 and the internal wall of the housing 24 prevents dust and moisture from entering the interior of the watch case.

The second embodiment of the invention shown in Figure 2 is similar to the embodiment of the invention shown in Figure 1 in that when the crown 25 is in a first detent position as shown and is depressed, the eccentric tab 27 is in a position to longitudinally engage a first switch blade 28, for example for causing distinction of separate display indicia such as the date to be displayed. However, this embodiment differs in that upon rotation of the crown 29 to a second detent position without depression the eccentric tab 27

rotatably engages a second switch blade 30. If the stem 25 is also depressed when the eccentric tab 27 is in the detent position for contacting switch blade 30, the eccentric tab 27 will also contact or engage switch blade 28. The switch blade 30 is biased to permit longitudinal sliding motion of the eccentric tab 27 and to maintain contact therewith during this motion of the eccentric tab.

The switch assembly shown in Figure 3 is similar to those shown in Figures 1 and 2 with the exception that the switch blades 35 and 40 are positioned to function differently with respect to the eccentric tab and that the housing which co-operates with the gasket is eliminated. In this embodiment the gasket or sealing element co-operates with the interior wall of the case 41. The switch blade 40 is precisely positioned such that with each depression of the stem 32 in the detent position illustrated in full lines, the eccentric tab 33 engages the blade 40 and does not engage the blade 35, as illustrated by the dashed lines 31, 34 and 42. Switch blade 35 is separately engaged by the eccentric tab 33 upon rotation of the stem 32 to the second detent position, and depression of the stem 32 in this detent position, as illustrated by the dashed line 36. The switch blade 35 is biased to permit longitudinal sliding motion of the eccentric tab 33 and to maintain contact therewith during this motion of the eccentric tab. This feature is illustrated by the line 37. Both the eccentric tab 33 and switch blade 35 are contoured as at 38 and 39 so as to permit ease of motion and proper engagement of the eccentric tab 33 with the switch blade 35.

There have thus been disclosed switch assemblies which combine the capabilities and advantages of both the push and rotate type switches, enable control of a number of functions either separately or simultaneously, are adapted for ease of use by the user of the watch and involve a minimum of associated parts.

WHAT WE CLAIM IS:—

1. A dual function rotate and push switch assembly for a solid state watch, the assembly comprising a shaft having an electric contact in the form of an eccentric tab at one end thereof, a detent retainer section, and an end portion for actuation of the switch; a plurality of switch blades mounted for selective engagement with the eccentric tab; and spring means engaging the detent retainer section of the shaft for permitting longitudinal and detented rotational movement of the shaft to enable engagement of the eccentric tab with a selected switch blade or blades upon longitudinal and/or rotational movement of the shaft.

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2. A dual function rotate and push switch assembly as claimed in Claim 1, wherein the plurality of switch blades comprise a pair of spaced apart blades mounted perpendicular to each other. 65
3. A dual function rotate and push switch assembly as claimed in Claim 1 or Claim 2, wherein one of the switch blades is arranged to be engaged by the eccentric tab on rotation of the shaft and to remain in contact with the tab during subsequent longitudinal movement of the shaft. 70
4. A dual function rotate and push switch assembly as claimed in Claim 1, wherein the plurality of switch blades comprise a first switch blade mounted for engagement by the eccentric tab upon longitudinal movement of the shaft in a first detent position, and a second switch blade mounted for engagement by the eccentric tab upon longitudinal movement of the shaft in a second detent position. 75
5. A dual function rotate and push switch assembly as claimed in Claim 1, wherein the plurality of switch blades comprise a first switch blade mounted for engagement by the eccentric tab upon longitudinal movement of the shaft in a first detent position, and a second switch blade mounted for engagement by the eccentric tab upon rotation of the shaft to a second detent position. 80
6. A dual function rotate and push switch assembly as claimed in Claim 1, wherein the plurality of switch blades comprise a first switch blade mounted for engagement by the eccentric tab upon longitudinal movement of the shaft in a first detent position and second switch blade mounted for engagement by the eccentric tab upon rotation of the shaft to a second detent position, the first and second switch blades being also mounted so that the eccentric tab engages both the first and second switch blades when the shaft is moved longitudinally when in the second detent position. 85
7. A dual function rotate and push switch assembly as claimed in any one of the preceding claim, wherein the detent retainer section of the shaft comprises flat portions on the shaft which reduces the diameter of the shaft in this section to provide a shoulder for engagement by the spring member to bias the shaft to permit longitudinal movement thereof regardless of its rotational position. 90
8. A dual function rotate and push switch assembly as claimed in Claim 7, wherein the flat portions co-operate with the spring to provide a two position rotary detent action. 95
9. A dual function rotate and push switch assembly for a solid state watch, the assembly comprising a shaft having an electric contact in the form of an eccentric tab at the end thereof which in use is inside the watch case, an intermediate section having a detent retainer section, and an end portion projecting outwardly from the case; a first switch blade mounted for selective engagement with the eccentric tab with the shaft being in a first detent position and pushed-in longitudinally; a second switch blade mounted for selective engagement with the eccentric tab with the shaft being rotated to a second detent position; and spring means engaging the detent retainer section for permitting detented rotational movement and for engaging the shaft to urge the shaft into a longitudinal position to disengage the eccentric tab from the first switch blade, said shaft being pushed-in longitudinally against the bias of the spring means to a longitudinal position to engage the eccentric tab with the first switch blade, said spring means returning said shaft to the disengaged longitudinal position upon release of the shaft. 100
10. A dual function rotate and push switch assembly for a solid state watch, the assembly comprising a shaft having an electric contact in the form of an eccentric tab at the end thereof which in use is inside the watch case; an intermediate section having a detent retainer section, and an end portion projecting outwardly from the case; a first switch blade mounted for selective engagement with the eccentric tab with the shaft being in a first detent position and pushed-in longitudinally; a second switch blade mounted for selective engagement with the eccentric tab with the shaft being in a second detent position and pushed-in longitudinally; and spring means engaging the detent retainer section for permitting detented rotational movement and for engaging the shaft to urge the shaft into a longitudinal position to disengage the eccentric tab from each of the first and second switch blades, said shaft being pushed-in longitudinally against the bias of the spring means to a longitudinal position to engage the eccentric tab with either the first or second switch blades, said spring means returning said shaft to the disengaged longitudinal position upon release of the shaft. 105
11. A dual function rotate and push switch assembly substantially as hereinbefore described with reference to 110
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any one of the Figures of the accompanying drawings.

12. A solid state watch including the dual function rotate and push switch assembly as claimed in any one of the preceding claims.

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Printed for Her Majesty's Stationery Office, by the Courier Press, Leamington Spa, 1978
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from
which copies may be obtained.