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[54] **MOMENTARY SWITCH WITH WIRE SPRING COMPONENTS**

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[51] **Int. Cl.** **H01h 1/06**

[58] **Field of Search**..... 200/DIG. 2, 56 R, 159 R, 200/159 A, 160, 166 B, 166 BA, 244, 246, 276

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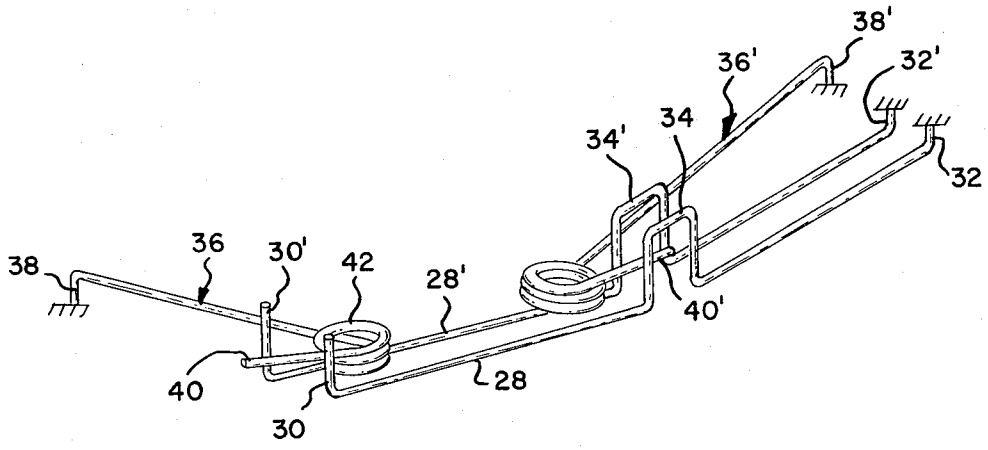
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Assistant Examiner—Gerald P. Tolin
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[57] **ABSTRACT**

A momentary switch of miniature size having a block of dielectric material providing a substrate and a pair of circuit paths defined by uninsulated wires mounted to the block, the ends of the wires forming switch poles, a resilient spring made from a wire mounted on the block, one end of the resilient spring normally engaged on a first switch pole, and a plunger reciprocatingly received in an opening of said block and displaceable into engagement on the spring to urge it forcefully into engagement with the second pole in opposition to the resilient action of said spring to interrupt a first electrical circuit through one of the wires and to complete a second electrical circuit through the second wire.

2 Claims, 3 Drawing Figures



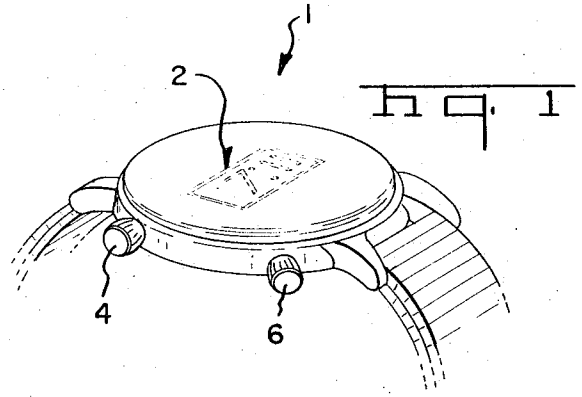
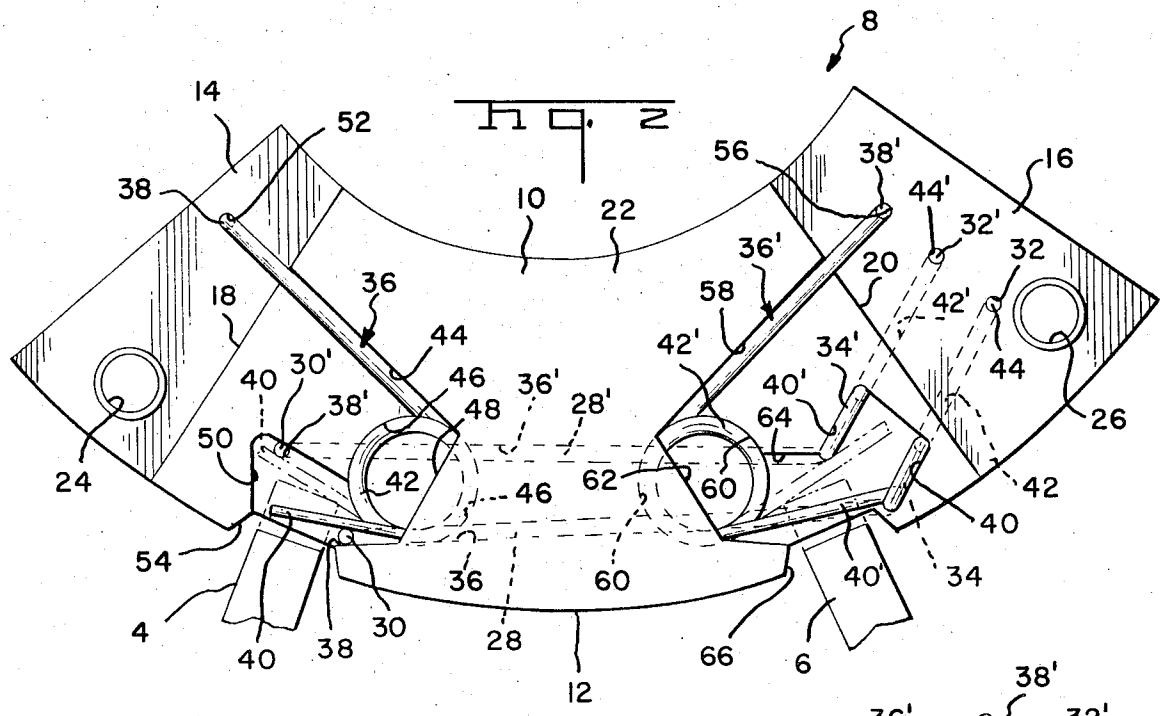

1
2
4
6

Fig. 1


8
14
52
38
10
22
56
38'
16
44'
32'
36'
20
32
36
18
58
42'
44
42'
34'
40
30'
46
36'
28'
40'
38'
48
64
26
50
24
42
46
62
60
42
40
54
36
60
40'
34
4
40
38
30
28
66
6
12

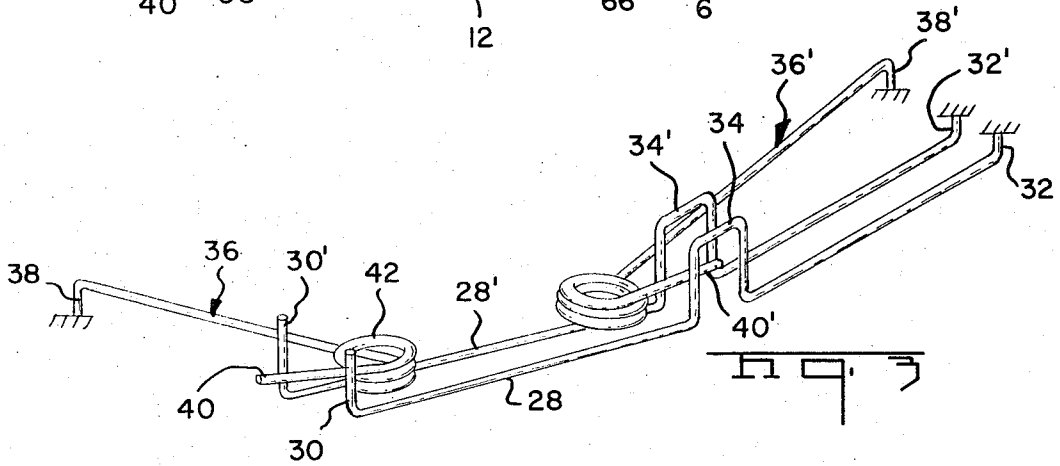

38'
36'
32'
34'
34
32
38
36
30'
42
28'
40'
40
28
30

Fig. 3

MOMENTARY SWITCH WITH WIRE SPRING COMPONENTS

The present invention relates generally to a miniature switch adaptable for use in an electronic watch or time keeping device having an electronically driven watch movement. In such a timepiece, the output from a quartz crystal or other type high frequency oscillator is supplied to a frequency divider or a pre-set counter which is driven by the oscillator output. The frequency divider also may be replaced by an analogue counter. The output from the frequency divider or counter is then supplied to a decoder network driver or a motor driver. The motor driver is utilized to drive the mechanical hands display of a watch. The decoder network driver functions as a readout driver system for a solid state digital display in the form of either light emitting diodes or nematic liquid crystals. Accordingly, the watch movement is advanced by the counter or frequency divider, which in turn is driven by the oscillator which has a relatively accurate and constant high frequency output. Also in such a timepiece there is a need to rapidly advance the movement to provide an adjustment for error in time-keeping or otherwise to set the time indicated by the watch in synchronization with the instantaneous time. This is accomplished by a switch which uncouples the motor driver or read out driver out of the normal output from the frequency divider or counter and couples the driver into a second output of the frequency divider or counter. This second output is always of greater frequency than the first output and rapidly advances the timepiece display until it reads in synchronization with the correct time. At this point, the motor driver or readout driver is switched back to the first output of the frequency divider or counter, again advancing the display in synchronization with the corresponding advancement in correct time. The present invention is therefore directed to a switch of miniature size adaptable for use within the relatively small confines of an electronic watch case to provide for adjustment or synchronization of the watch display with the correct time.

It is therefore an object of the present invention to provide a switch of miniature size capable for use within an electronic watch case.

Another object of the present invention is to provide a switch of miniature size which utilizes a minimum number of component parts and is adaptable for use within the case of an electronic timepiece.

Another object of the present invention is to provide a momentary switch that has a preferred and normal position completing a circuit between a counter or frequency divider and the motor driver or decoder network driver of an electronic watch, with a second position of the switch connecting the motor driver or decoder network driver to a second and higher frequency output of the counter or frequency divider in order to rapidly advance the timepiece display and synchronize it with the instantaneous correct time.

Other objects and many attendant advantages of the present invention will become apparent upon perusal of the following detailed description taken in conjunction with the accompanying drawings, wherein:

FIG. **1** is an enlarged schematic of an electronic watch illustrating the display of which is in the form of a solid state digital display;

FIG. **2** is an enlarged plan view of a switch according to the present invention, illustrating in detail the component parts thereof; and

FIG. **3** is an enlarged perspective which schematically illustrates the electrical component parts of the switch embodiment illustrated in FIG. **2.**

With more particular reference to the drawings, there is illustrated generally in FIG. **1** at **1** an electronic timepiece wherein the time keeping display of which, generally illustrated at **2,** is in the form of a solid state digital display. In such a watch, the digital display **2** is advanced by a decoder network driver in turn driven by either an analogue or digital frequency divider or fixed rate counter. In turn, the frequency divider or counter is driven by a high frequency oscillator such as a quartz crystal, or tuning fork. The circuitry for advancing the display **2** is well known in the prior art and the details thereof are therefore omitted. In another form, the digital display **2** may be replaced by the well-known arcuately displaceable mechanical hands, in which case a vibrating or stepping motor is utilized to advance the hands in place of the decoder network utilized to advance the digital display **2.**

In an electronically driven watch, the frequency divider or counter is driven at a controlled rate determined by the constant frequency output of the oscillator or by the fixed rate of the counter itself. This insures that the hands or digital display is advanced in synchronization with the correct time. To adjust the time display so as to indicate the correct time, there is generally provided a second output from the frequency divider or counter which rapidly advances the display **2** or mechanical hands display until it reads the correct instantaneous time. The present invention relates to a switch which selectively couples the driver for the display to either of the outputs of the frequency divider or counter. As shown in FIG. **1,** a pair of stems or plungers **4** and **6** are illustrated on the watch case of the watch **1.** When the stem **4** is depressed inwardly toward the watch case, it will actuate the switch according to the present invention so as to connect the hour display with the rapid frequency output from the frequency divider or counter so as to rapidly advance the hour display until synchronization with the instantaneous correct time. In similar fashion, when the stem **6** is depressed inwardly toward the watch case, the switch is actuated to correct the minute display with the rapid frequency output so as to rapidly advance the minute display until synchronization with the correct time.

With reference to FIGS. **2** and **3,** the details of the switch according to the present invention will become readily apparent. The switch is illustrated generally at **8** and comprises a block **10** of dielectric material having convex arcuate periphery **12** for registration against the arcuate confines of the watch case of the timepiece **1.** In plan view, the block **10** has an appearance like that of a segment of a circle and the outer end portions **14** and **16** are of reduced thickness. The end portions **14** and **16** are immediately adjacent to respective stepped portions **18** and **20** which define the end portions of a relatively thick central portion **22** of the segment. Each of the end portions **14** and **16** are provided with respective apertures **24** and **26** therethrough for receiving fasteners which mount the block **10** within the watch case of the watch **1.**

The block **10** provides a dielectric substrate for a pair of electrical paths which are formed by metal wires.

More particularly, as shown in FIGS. 2 and 3, a first uninsulated metal wire is illustrated at 28. As shown the wire is provided with a circular cross-section, although any cross-section wire may be utilized. The wire 28 has a first end portion 30 bent at a protruding angle, with the opposite end portion 32 of the wire also bent outwardly at a protruding angle. The medial portion of the wire 28 is formed with a protruding bight portion 34, which is of inverted U-shape configuration.

The wire 28 is mounted on the block 10 in the following manner. The block thickened portion is provided with a groove 36 on the undersurface thereof which communicates with a generally vertical aperture 38. The wire 28 is received within the groove 36 with the end 30 protruding through the aperture 38 which thereby anchors the end portion 30 within the block 10. The block thickened portion 22 is further provided with a vertical aperture 40 communicating with the groove 36 on the block undersurface. The channel 40 receives therein the bight portion 34 thereby anchoring the medial portion of the wire 28 within the block 10. The block is further provided with another channel 42 in the undersurface thereof which communicates with the aperture 40 and with a generally vertical aperture 44 in the portion 16 of the block which receives the end portion 32 of the wire 28 therein. The end 32 is thereby anchored within the end portion 16 of the block within the aperture 44.

In similar fashion, a second spring 28' of the same configuration as the spring 28 is likewise mounted to the block 10 in a similar fashion and in spaced relationship from the first spring 28. Thus like parts having like numbers except for primed designations will be described. The spring 28' resides within a groove 36' provided in the undersurface of the thickened portion 22 of the block 10, with the end portion 30' of the spring 28' anchored in a vertical aperture 38' in the block communicating with the groove 36'. The bight portion 34' of the spring 28' is received within the vertical aperture 40' of the thickened portion 22 of the block 10. The spring 28' further resides within a groove 42' provided on the undersurface of the block 10 with the end portion 32' of the spring 28' being anchored within the vertical surface 44' provided in the end portion 16 of the block 10.

With more particular reference to FIGS. 2 and 3, there is illustrated generally at 36 a first wire spring of conducting metal having a first end portion 38 bent outwardly from the medial portion of the spring 36 and with the medial portion of the spring further being provided with a plurality of helical coils 42 adjacent to an end portion 40 of the spring 36. The spring 36 is generally of resilient metal and is mounted on the block 10 in the following manner. The obverse surface of the block 10 is provided with a groove 44 therein which communicates with a generally arcuate recess 46 provided in the obverse surface of the block. The arcuate recess 46 is partially overlied by a lip 48 molded integrally with the thickened portion 10 of the block. The arcuate recess 46 opens into and communicates with a generally trapezoidal recess 50 which intercepts the vertical apertures 38 and 38'. The wire 36 has the helical coils 42 thereof received within the recess 46 with the lip portion 48 providing a pocket retaining the coil springs in position within the recess 46. The end portion 40 of the spring is received within the trapezoidal recess 50 and is normally engaged against the end portion 30 of the spring 28 which is exposed within the recess 50. The spring further is disposed within the groove 44 of the block 10 and has the end portion 38 of the spring in registration within a vertical aperture 52 provided in the end portion 14 of the block 10. The recess 50 communicates with a generally flared notch 54 in the convex periphery 12 of the block 10 which receives the end of the stem 4 of the watch 1.

In similar fashion, a second spring 36' of similar construction to the spring 36 is illustrated with like parts having the same number designations as the spring 36 but with prime designations. Accordingly, the spring 36' has a protruding end portion 38' received in a vertical aperture 56 provided in the end portion 16 of the block 10, with the spring being disposed within a groove 58 provided in the top surface of the thickened portion 22 of the block 10. A medial portion 42' is provided with a plurality of helical coils received within an arcuate recess 60 in the obverse surface of the thickened portion 22 of the block 10 which communicates with the groove 58. The recess 60 is partially covered by a lip portion 62 provided integral with the thickened portion 22 of the block 10 to form a pocket for receiving and retaining the coils 42' in mounted position on the block. The arcuate recess 60 communicates with a generally elbow-shaped recess 64 in the obverse surface of the block which exposes the bight portions 34 and 34' therein. The end portion 40' of the spring 36' protrudes into the elbow-shaped recess 64 and normally engages against the bight portion 34. The recess 64 further communicates with a flared notch portion 66 provided in the arcuate periphery 12 of the block 10, the recess 66 receiving therein the end of the stem 6 of the watch 1.

In operation, the spring 28 provides a first circuit path with the end portion 32 thereof providing an electrical terminal for connection to the first output of the counter or frequency divider of the electronic watch circuit. The bight portion 34 provides a first switch pole engaged by the end portion 40' of the spring 42'. The other end portion 38' of the spring 42' provides an electrical terminal for connection to the motor driver or decoder driver which advances the watch display hands or digital display 2. The end portion 30 of the wire 28 provides another switch pole normally engaged by the end portion 40 of the spring 36. The other end of the spring 36 provides an electrical terminal for connection to the motor driver or decoder driver for the hour hand or hour portion of the display. To rapidly advance the minute hand or minute portion of the display 2, the plunger 6 is displaced into engagement against the end portion 40' of the spring portion 36' displacing it to its phantom outline position shown in FIG. 2 into engagement against the bight portion 34' of the spring 28'. The spring 28' provides a second circuit path with the end portion 32' of the spring connected to the second, higher frequency output of the counter or frequency divider of the watch electronic circuitry. The bight portion 34' provides a switch pole against which the end portion 40' engages to complete an electrical circuit from the electrical terminal 32' to the electrical terminal 38', thereby rapidly advancing the minute portion of the watch display until it synchronizes with the actual time. Upon that occurrance, the stem 6 is released to allow the end portion 40' of the spring 36' to be resiliently biased by the helical coils 42' thereof back into engagement with the bight portion 34 of the

first wire **28** and thereby connect the display with the first, normal output from the counter or frequency divider which advances the minute portion of the display in synchronization with correct time.

In similar fashion when it is desired to rapidly advance the hour portion of the watch display, the stem **4** is depressed into engagement with the end portion **40** of the spring **36** disengaging it from the electrical terminal **30** and biasing it into engagement with the electrical terminal **30'**, thereby disengaging the electrical terminal **38** from the first output of the frequency divider or counter and connecting it with the second higher frequency output thereof to rapidly advance the hour portion of the watch display until it synchronizes with the correct time. At that time the stem or plunger **4** is released allowing the end portion **40** of the spring **36** to be resiliently biased by the helical coils **42** back into engagement with the terminal **30,** again connecting the hour portion of the display with the first normal output of the counter or frequency divider which advances the hour portion of the display in synchronization with correct time. Accordingly, the end portions **30** and **30'** of the wires **28** and **28'** provide a first pair of switch poles and the bight portions **34** and **34'** of the wires **28** and **28'** provide a second pair of switch poles which are engaged by the spring end portions **40** and **40'**, respectively. The spring end portion **40** is continuously resiliently biased by the coils **42** to engage against the terminal or switch pole **30.** Accordingly the plunger or stem **4** when depressed in engagement against the spring end portion **40** must overcome the resilient action of the coils **42.** To maintain the end portion **40** in engagement with the electrical terminal **30'**, it is necessary to maintain pressure on the stem **4** forcing it in engagement against the end portion **40.** When the stem **40** is released, the end portion **40** will be automatically biased by the coils **42** back into engagement with the terminal **30.** Accordingly the switch operates as a momentary switch.

In similar fashion, the resilient coils **42'** continuously bias the end portion **40'** of the spring **36'** into engagement with the bight portion **34** to establish the desired electrical circuit. When the stem **6** is depressed into engagement against the end portion **40'** biasing it against the resilient action of the coils **42'**, continuous pressure must be maintained on the stem **6** to maintain the end portions **40'** of the spring in engagement with the bight portion **34'** to complete a second electrical circuit. Upon release of pressure from the stem **6,** the resilient coils **42'** will automatically bias the end portion **40'** back into engagement with the bight portion **34.** Such action also comprises a momentary switch.

Although a preferred embodiment of the present invention is described in detail, other embodiments and modifications thereof are intended to be covered by the spirit and scope of the appended claims, wherein:

What is claimed is:

1. A switch, comprising:

a dielectric base having a pair of pockets,

a pair of wires having first ends thereof embedded in said base,

first and second recesses in said base,

second ends of said wires being mounted in mutual spaced relationship within the first recess of said base,

medial portions of said wires having bight portions mounted in mutual spaced relationship within the second recess of said base,

first and second springs having coiled central portions received in the respective pockets,

a first end of each spring protruding from a corresponding pocket and embedded in said base,

a second end of said first spring being received between said second ends of said wires and being capable of resilient deflection into electrical engagement with each of said second ends of said wires,

a second end of said second spring being received between said bight portions and being capable of resilient deflection into electrical engagement with each of said bight portions, and

actuator means received by said base for engaging and resiliently deflecting a corresponding second end of a corresponding spring.

2. The structure as recited in claim **1,** wherein, said base is arcuate to fit within a watch case, and

said actuator means for deflecting said second end of a corresponding spring is a watch stem reciprocatingly received in said base.

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