

PATENT SPECIFICATION

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(54) ELECTROMAGNETIC BUZZER FOR A WATCH

(71) We, TIMEX CORPORATION, a Corporation organised under the Laws of the State of Delaware, United States of America of Waterbury 20, Connecticut, United States of America, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to an electromagnetic buzzer for a watch.

An electromagnetic buzzer for a wrist-watch is described in United States Patent Specification No. 3,462,943. In this buzzer, a tongue oscillates at right angles to, and strikes, a pin formed on the watch crystal and extending through the dial of the watch, whereby the watch crystal is excited at its natural frequency. The watch crystal acts as a membrane or diaphragm and, when so excited, vibrates to give an audible alarm. The buzzer has a block which is mounted to a movement plate and to which the fixed ends of a support arm and the tongue are attached. Since it is necessary to adjust the buzzer, and especially its tongue, relative to the pin formed to the watch crystal, an adjustable yoke, attached in the watch, extends over the support arm in the area of the block and is in a contacting relationship with the support arm by means of a blade. Tightening the yoke causes the support arm to press against the pin, which, however, necessitates also moving the block toward the pin. Located in a tapped hole in the block at right angles to the plane of the tongue is an adjusting screw, whose one conical end is in a contacting relationship with the tongue in the vicinity of the clamping point and whose other end extends through a hole in the support arm in order to be rotated. This adjusting screw permits the tongue to be adjusted relative to a pole surface of an

electromagnet of the electromagnet system facing it, which is also necessary.

The known design has various disadvantages: The tongue cannot be adjusted relative to the electromagnet system prior to installation of the buzzer in the watch, since the location of the tongue relative to the electromagnet system is altered during the adjustment of the buzzer relative to the pin on the watch crystal, which is necessary after installation. As a result of tightening the yoke which extends over the support arm in the area of the block, the location of the block also changes, and with it the location of the adjusting screw; however, the change in location of the electromagnet system is greater than that of the tongue, so that the gap between an armature fixed to the tongue and the electromagnet system is altered.

A further disadvantage is that, as a result of the contacting relationship of the adjusting screw in the direct vicinity of the firmly clamped end of the tongue, a very slight rotation of the adjusting screw results in large alteration of the gap between tongue and electromagnet system. Finally, during operation the tip of the adjusting screw, which is in a contacting relationship with the tongue, is permanently deformed, whereby the gap between tongue and electromagnet system is also altered during the course of time. Since, finally the above-mentioned yoke is also in a contacting relationship in the vicinity of the fixed end of the support arm, relatively minor changes in position of the yoke result in a relatively great change of position of the buzzer in the vicinity of the pin which is formed on the watch crystal, as this is naturally arranged at some distance from the fixed ends of the tongue and the support arm. For this reason, the contact pressure between the blade of the yoke and the support arm is relatively large, so that

plastic deformations also occur here during operation.

It is an object of the invention to provide an electromagnetic buzzer for a watch, which can be more easily adjusted than the above described known design, and in which the adjusted condition can be maintained during operation.

According to the invention there is provided an electromagnetic buzzer for a watch, for operation in association with a membrane having associated projecting pin means, the buzzer comprising an electromagnet system, a support arm carrying the electromagnet system, one end of which support arm is arranged to be supported on the watch and the other end of which is movable relative to said pin means, first adjusting means acting on said movable end of the support arm for positioning said support arm relative to said pin means, a tongue clamped at one end relative to the support arm and arranged to be excited to oscillate by the electromagnet system and strike said pin means, and second adjusting means for positioning the tongue relative to the electromagnet system, said second adjusting means acting through motion reduction means which acts upon the tongue near its clamped end.

The buzzer is accordingly designed in such a manner that the first adjusting means adjusts the electromagnet system including the support arm as a whole (and this adjusts the buzzer relative to the membrane), and in that the second adjusting means acts on the tongue through motion reduction means and adjusts the tongue relative to the electromagnet system. Because of these features, it is much easier to adjust the buzzer according to the invention precisely, since both the adjustment of the first as well as of the second adjusting means are simplified. Also eliminated is the problem of plastic deformation in the area of the second adjusting means which deformation occurs during operation as a result of the high contact pressure between the bridge of the known design and the support arm.

It is simplest if the reduction means comprise a lever, one end of which is fixed relative to the support arm in the area of the fixed end of the tongue and which is arranged so that the second adjusting means is in a contacting relationship with its other end and so that an intermediate portion of the lever is in an operative connection with the tongue between the ends of the tongue.

There are several possibilities for avoiding the gap between tongue and electromagnet system being influenced by adjustment of the first adjusting means; embodiments of the invention proposed

herein utilize a characteristic of the above-mentioned known design, as they both provide a block clamped between support arm and tongue.

In the first embodiment, the lever (which forms part of the reduction means) is located on the side of the support arm facing away from the electromagnet system, while the second adjusting means is in a contacting relationship with the support arm between the first adjusting means and the electromagnet system; in addition, a pin, extending through the support arm, is slidably located in the block substantially at right angles to the tongue; one end of this pin is in a contacting relationship with the lever and the other end with the tongue. Since the second adjusting means connects the free end of the lever with the support arm, adjustment of the entire buzzer with the aid of the first adjusting means does not alter the gap between tongue and electromagnet system. Since, on the other hand, alteration of the setting of the second adjusting means is transmitted to the tongue by means of the slidable pin, alteration of the setting of the gap between tongue and electromagnet system does not result in alteration of the location of the support arm.

With this embodiment of the invention, it is advisable to design the ends of the pin spherically, as this reduces the contact pressure between the pin and the lever as well as between the pin and the tongue, and prevents plastic deformations during operation.

The design of the first embodiment also permits the block to be employed as the base element of the buzzer, and the buzzer to be attached by it to the watch.

In other embodiments the lever (forming the reduction means) is arranged between tongue and block, and the second adjusting means is in a contacting relationship with the block. If the block is viewed as being rigid, which is permissible within the scope of the invention, it can clearly be seen that an alteration of the setting of the second adjusting means i.e. to change the location of the tongue relative to the electromagnet system, will not result in a change in the location of the support arm. If the fixed end of the support arm is now attached to the watch and the block is further attached to the support arm, an adjustment of the first adjusting means will cause the support arm as a whole, including block and tongue, to move relative to the membrane so that, in the same manner as with the above discussed first embodiment, it is possible to install the buzzer, pre-adjusted relative to the gap between tongue and electromagnet system, in the watch as a sub-assembly whereby it needs

then only be adjusted relative to the membrane with the aid of the first adjusting means.

In these other embodiments it is practical to provide a line-shaped contact area between lever and tongue in order to avoid excessively high contact pressures in this manner and plastic deformations during operation.

It is advisable to cover the pole of an electromagnet of the electromagnet system facing the tongue with a plastics film to avoid adhesion of the tongue to this pole.

Finally, it is advantageous to arrange an elastic element especially in the form of an elastic block or a spring washer, between the free end of the support arm and the watch (e.g. a plate), and to design the first adjusting means as a screw extending through the support arm and the elastic element.

The above and further features and advantages of the invention will appear from the following description of four preferred embodiments of the buzzer according to the invention, given with reference to the accompanying drawings in which:—

Figure 1 is a transverse cross-section through a first embodiment of a buzzer according to the invention mounted in a wristwatch, and

Figures 2, 3 and 4 are respectively corresponding cross-sections through three other, largely similar embodiments.

Figure 1 shows a portion of a watch crystal 10, mounted in a support 12 and having a pin 14 formed on its inside, said pin 14 extending through a hole 16 in a dial 18. Watch crystal 10 is most practically of plastics. Moreover, of the watch only a plate, designated 20 as a whole, is shown, to which the buzzer according to the invention is attached.

This plate carries a mounting block 22 with a mounting flange 24, which serves to fix the mounting block to plate 20 by means of a screw 26. The mounting block has two holes 28 and 30; the former serves to fix one end of a support arm 32 and a lever 34 to one side of mounting block 22 as well as a tongue 36 to the other side by means of a screw 38 and a threaded sleeve 40. Slidably arranged in the second hole 30 is a pin 42, whose ends are in a contacting relationship with lever 34 on one side and tongue 36 on the other. Also fixed to support arm 32 is an electromagnet system, consisting of an electromagnet comprising one or two coils 44 and a core 46 as well as two permanent magnets 48 and 50. This electromagnet system further includes an armature plate 52, which is fixed on tongue 36. The end surface of core 46 facing the armature plate, which forms one pole of electromagnet 44, 46 is

lined with a plastics film 54 in order to prevent the armature plate, and thus tongue 36, from adhering to the electromagnet.

The other, movable end 32' of support arm 32 can be adjusted relative to the watch, in the illustrated case relative to plate 20, with the aid of a system adjusting screw 56, which engages a tapped hole 58 in plate 20. Also located between support arm 32 and plate 20 is a spring washer 60, serving as a return spring for the support arm.

The movable end 32' of support arm 32 also carries a printed circuit board 62 which bears an oscillator circuit serving to excite electromagnet 44, 46 at the natural frequency of tongue 36, which is also the natural frequency or a whole-number multiple of the natural frequency of watch crystal 10.

The free end 34' of lever 34 can be adjusted relative to support arm 32 by means of a tongue adjusting screw 64.

The entire buzzer can be pre-adjusted prior to installation in the wristwatch, with respect to the gap between armature plate 52 and one pole of electromagnet 44, 46. This adjustment is made with the aid of tongue adjusting screw 64. As a result of the arrangement of pin 42, the displacement of the free end 34' of lever 34 is transferred to tongue 36 greatly reduced, so that the tongue can easily be adjusted very precisely relative to the electromagnet with the aid of tongue adjusting screw 64.

After the buzzer has been installed in the watch, the entire buzzer is adjusted relative to pin 14 of the watch crystal with the aid of system adjusting screw 56 in such a manner that tongue 36 strikes the pin sufficiently. Because of the fact that tongue adjusting screw 64 is screwed into the support arm 32 adjustment of the entire system with the aid of adjusting screw 56 does not result in any alteration of the previously set gap between armature plate 52 and electromagnet 44, 46; another factor in this is that since the tongue adjustment is transmitted from lever 34 to tongue 36 by means of pin 42, which is slidably arranged in the support arm and in mounting block 22, in the illustrated design tightening system adjusting screw 56 also results in a slight displacement of mounting of mounting block 22. However, this has no effect on the adjustment of the tongue relative to the electromagnet, because with tongue adjusting screw 64 in a certain position pin 42 maintains the clearance between tongue 36 and support arm 32, and thus between the tongue and the electromagnet system constant.

While in the embodiment of the invention shown in Figure 1 the mounting block 22 is fixedly attached in the watch, the embodiments shown in Figures 2 to 4 have a mounting block 22a or 22b which is attached to a support arm 32a and can move with it. Since the embodiments according to Figures 2 to 4 are similar to one another and coincide largely with the embodiment according to Figure 1, only the differing parts are described below; individual parts not mentioned in regard to Figures 2 to 4 are provided with the same reference numbers as the corresponding parts in Figure 1; the differing parts also have the same reference numbers, however, with suffix letters a, b etc.

Instead of being mounted by means of a mounting flange of the mounting block, the entire buzzers of the embodiments according to Figures 2 to 4 are attached to plate 20a by attaching support arm 32a thereto by means of a screw 26a. In the Figure 2 embodiment the mounting block 22a has a slot 70, thus forming a lever 34a which replaces the lever 34 in Figure 1. Its free end 34a' is subject to the effect of a tongue adjusting screw 64a which is threaded into a tapped hole in block 22a and extends through a clearance hole 72 in support arm 32a so that the end of the screw is accessible for adjustment. The adjustment movement of this adjusting screw is again transmitted reduced to tongue 36 by lever 34a, through a rib 74 which provides a line-contact relationship between lever 34a and tongue 36. According to Figure 2, to the left of the rib 74 the mounting block 22a has a notch 76, which results in a hinge 78 at the root of lever 34a, around which the lever can be swivelled with the aid of tongue adjusting screw 64a.

As indicated by the dash-dotted line in Figure 2, lever 34a could also be a separate member and not part of mounting block 22a.

As a result of the fact that in this embodiment the mounting block moves with support arm 32a, adjustment of system adjusting screw 56 again does not result in alteration of the gap between armature plate 52 and electromagnet 44, 46, so that tongue 36 can be adjusted relative to the electromagnet system with the aid of adjusting screw 64a prior to the installation of the buzzer in the watch.

The embodiment shown in Figure 3 differs significantly from that according to Figure 2 only in that lever 34b is designed as a separate member in the form of a stamped strip of sheet metal and in that the return spring for support arm 32a is in the form of a resilient block 60a.

The simplest embodiment of a lever

forming a reduction for tongue adjusting screw 64a is shown by Figure 4. In this embodiment, lever 34c simply has the shape of a plane strip of sheet metal, with another simple, but shorter, strip of sheet metal 90 being clamped between it and tongue 36. If lever 34c is adjusted with the aid of tongue adjusting screw 64a sheet-metal strip 90 transmits and reduces the adjustment displacement of adjusting screw 64a.

Thus, it is common to all embodiments that:

1. the adjustment displacements of the adjusting screws are reduced;
2. pre-adjustment of the buzzer relative as regards clearance between tongue 36 and electromagnet 44, 46 is possible, since adjustment of the entire system relative to pin 14 with the aid of the system adjusting screw does not result in alteration of the gap between tongue and electromagnet;
3. the precise adjustment of the buzzer itself and adjustment relative to pin 14 is not altered during operation.

This last advantage results from the fact that the entire system is not adjusted with the aid of a blade, but with the aid of system adjusting screw 56, and that the elements serving to adjust tongue 36 relative to electromagnet 44, 46 are less subject to plastic deformation during operation. In the first embodiment, pin 42 has spherical ends for this purpose; in the second embodiment of Figure 2, the tongue adjusting screw 64a has a conical end which engages a correspondingly shaped recess in lever 34a, and in the embodiments of Figures 3 and 4, tongue adjusting screw 64a has a spherical end.

WHAT WE CLAIM IS:—

1. An electromagnetic buzzer for a watch, for operation in association with a membrane having associated projecting pin means, the buzzer comprising an electromagnet system, a support arm carrying the electromagnet system, one end of which support arm is arranged to be supported on the watch and the other end of which is movable relative to said pin means, first adjusting means acting on said movable end of the support arm for positioning said support arm relative to said pin means, a tongue clamped at one end relative to the support arm and arranged to be excited to oscillate by the electromagnet system and strike said pin means, and second adjusting means for positioning the tongue relative to the electromagnet system, said second adjusting means acting through motion reduction means which acts upon the tongue near its clamped end.

2. A buzzer according to Claim 1,

While in the embodiment of the invention shown in Figure 1 the mounting block 22 is fixedly attached in the watch, the embodiments shown in Figures 2 to 4 have a mounting block 22a or 22b which is attached to a support arm 32a and can move with it. Since the embodiments according to Figures 2 to 4 are similar to one another and coincide largely with the embodiment according to Figure 1, only the differing parts are described below; individual parts not mentioned in regard to Figures 2 to 4 are provided with the same reference numbers as the corresponding parts in Figure 1; the differing parts also have the same reference numbers, however, with suffix letters a, b etc.

Instead of being mounted by means of a mounting flange of the mounting block, the entire buzzers of the embodiments according to Figures 2 to 4 are attached to plate 20a by attaching support arm 32a thereto by means of a screw 26a. In the Figure 2 embodiment the mounting block 22a has a slot 70, thus forming a lever 34a which replaces the lever 34 in Figure 1. Its free end 34a' is subject to the effect of a tongue adjusting screw 64a which is threaded into a tapped hole in block 22a and extends through a clearance hole 72 in support arm 32a so that the end of the screw is accessible for adjustment. The adjustment movement of this adjusting screw is again transmitted reduced to tongue 36 by lever 34a, through a rib 74 which provides a line-contact relationship between lever 34a and tongue 36. According to Figure 2, to the left of the rib 74 the mounting block 22a has a notch 76, which results in a hinge 78 at the root of lever 34a, around which the lever can be swivelled with the aid of tongue adjusting screw 64a.

As indicated by the dash-dotted line in Figure 2, lever 34a could also be a separate member and not part of mounting block 22a.

As a result of the fact that in this embodiment the mounting block moves with support arm 32a, adjustment of system adjusting screw 56 again does not result in alteration of the gap between armature plate 52 and electromagnet 44, 46, so that tongue 36 can be adjusted relative to the electromagnet system with the aid of adjusting screw 64a prior to the installation of the buzzer in the watch.

The embodiment shown in Figure 3 differs significantly from that according to Figure 2 only in that lever 34b is designed as a separate member in the form of a stamped strip of sheet metal and in that the return spring for support arm 32a is in the form of a resilient block 60a.

The simplest embodiment of a lever

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Thus, it is common to all embodiments that:

1. the adjustment displacements of the adjusting screws are reduced;
2. pre-adjustment of the buzzer relative as regards clearance between tongue 36 and electromagnet 44, 46 is possible, since adjustment of the entire system relative to pin 14 with the aid of the system adjusting screw does not result in alteration of the gap between tongue and electromagnet;
3. the precise adjustment of the buzzer itself and adjustment relative to pin 14 is not altered during operation.

This last advantage results from the fact that the entire system is not adjusted with the aid of a blade, but with the aid of system adjusting screw 56, and that the elements serving to adjust tongue 36 relative to electromagnet 44, 46 are less subject to plastic deformation during operation. In the first embodiment, pin 42 has spherical ends for this purpose; in the second embodiment of Figure 2, the tongue adjusting screw 64a has a conical end which engages a correspondingly shaped recess in lever 34a, and in the embodiments of Figures 3 and 4, tongue adjusting screw 64a has a spherical end.

WHAT WE CLAIM IS:—

1. An electromagnetic buzzer for a watch, for operation in association with a membrane having associated projecting pin means, the buzzer comprising an electromagnet system, a support arm carrying the electromagnet system, one end of which support arm is arranged to be supported on the watch and the other end of which is movable relative to said pin means, first adjusting means acting on said movable end of the support arm for positioning said support arm relative to said pin means, a tongue clamped at one end relative to the support arm and arranged to be excited to oscillate by the electromagnet system and strike said pin means, and second adjusting means for positioning the tongue relative to the electromagnet system, said second adjusting means acting through motion reduction means which acts upon the tongue near its clamped end.

2. A buzzer according to Claim 1, 130



wherein said reduction means comprises a lever, one end of which is fixed relative to the support arm in the area of the fixed end of the tongue and which is arranged so that the second adjusting means is in a contacting relationship with its other end and so that an intermediate portion of the lever is in an operative connection with the tongue between the ends of the tongue.

- 10 3. A buzzer according to Claim 2 further comprising a block clamped between the support arm and the tongue near the fixed end of the tongue, the lever being located on the side of the support arm facing away from the electromagnet system, and the second adjusting means being in a contacting relationship with the support arm between the first adjusting means and the electromagnet system, the reduction means including a pin slidably located in said block and extending substantially at right angles to said tongue and through the support arm and the block, with one end of the pin in a contacting relationship with the lever and the other end with the tongue.

25 4. A buzzer according to Claim 3, wherein the ends of said pin are spherical.

5. A buzzer according to Claim 3 or Claim 4, wherein said block is arranged to be attached to the watch to support the support arm and the tongue.

6. A buzzer according to Claim 2, comprising a block clamped between the support arm and the tongue near the fixed end of the tongue, and wherein said lever is arranged between said tongue and said block and said second adjusting means is in a contacting relationship with said block and said tongue to adjust the tongue relative to the block.

7. A buzzer according to Claim 6, wherein the fixed end of the support arm is arranged to be attached to the watch and the block is attached to the support arm.

- 45 8. A buzzer according to Claim 6 or Claim 7, wherein said lever is in a contacting relationship with the tongue along a line.

9. A buzzer according to Claim 6, Claim 7 or Claim 8, wherein said second adjusting means is a screw for which said block has a thread, and the screw is accessible through a hole in the support arm.

10. A buzzer according to Claim 9, wherein said screw has a spherical end in contacting relationship with the lever.

11. A buzzer according to Claim 6, wherein said block contains a slot forming the lever.

12. A buzzer according to Claim 6, wherein the lever is a stamped metal strip firmly clamped at one end between block and tongue.

13. A buzzer according to Claim 6, wherein the lever is a flat strip of metal which is clamped between the block and the tongue together with a shorter strip of sheet metal located between it and the tongue.

14. A buzzer according to any one of the preceding claims, wherein one pole of an electromagnet of said electromagnet system facing the tongue is covered with a plastics film.

15. A buzzer according to any one of the preceding claims, wherein an elastic element, in the form of an elastic block or a spring washer, is provided for location between the movable end of the support arm and the watch, and the first adjusting element is a screw extending through the support arm and said elastic element.

16. An electromagnetic buzzer for a watch, substantially as hereinbefore described with reference to any one of the Figures of the accompanying drawings.

17. A watch fitted with the buzzer according to any one of the preceding claims, and having a watch crystal formed with a projecting pin which co-operates with the tongue.

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