

[54] **ELECTROMAGNETIC BUZZER FOR A WATCH WITH TONGUE ADJUSTMENT MEANS**

3,462,943 8/1969 Spadini et al. .... 58/57.5

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[57] **ABSTRACT**

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[58] Field of Search..... **58/38, 57.5**

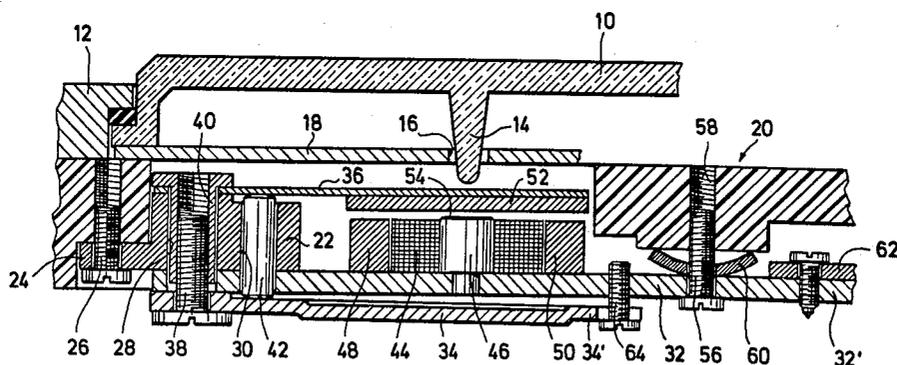
A buzzer for a watch has an electromagnet system attached to a support arm, one end of which can be fixed in the watch and the other, free end of which can be adjusted relative to a membrane with a first adjusting element which is in a contacting relationship with the watch. The buzzer has a tongue, clamped tightly on one side, which can be excited to oscillate by the electromagnet system and which strikes against the membrane either directly or indirectly. The location of the tongue relative to the electromagnet system is adjustable by means of a second adjusting element acting on it in the vicinity of the tightly clamped end of the tongue.

[56] **References Cited**

**UNITED STATES PATENTS**

2,786,326 3/1957 Junghans et al. .... 58/57.5

**15 Claims, 4 Drawing Figures**



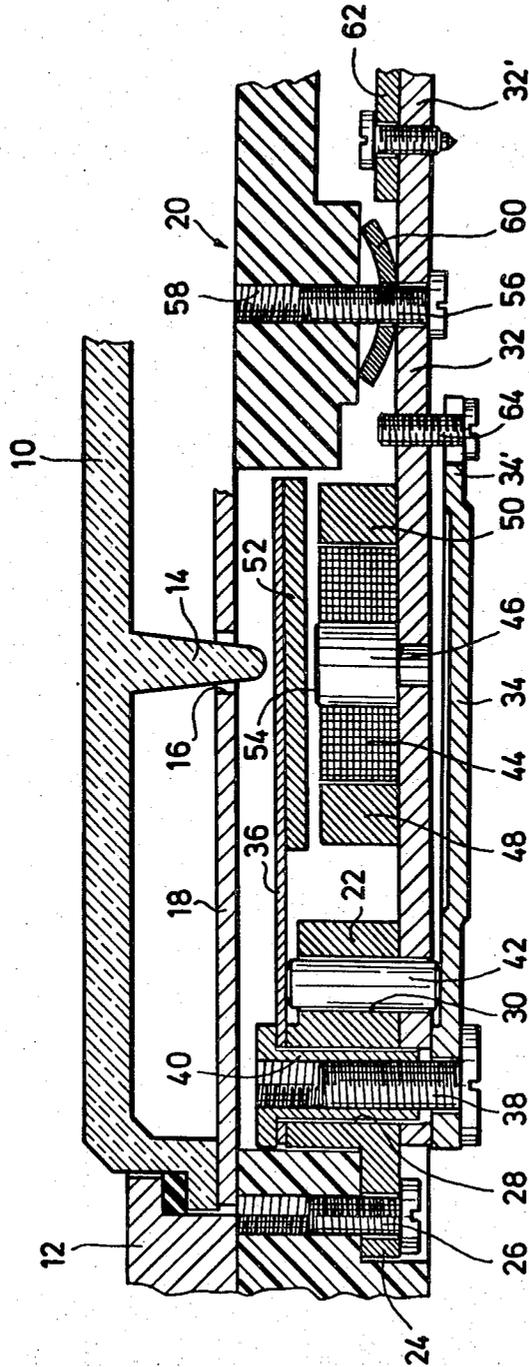


Fig. 1

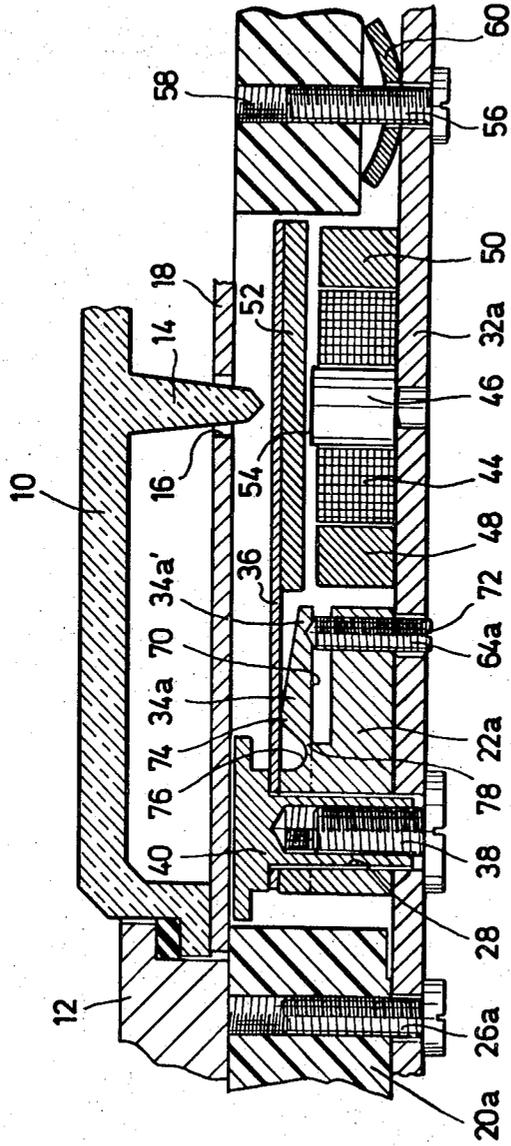


Fig. 2

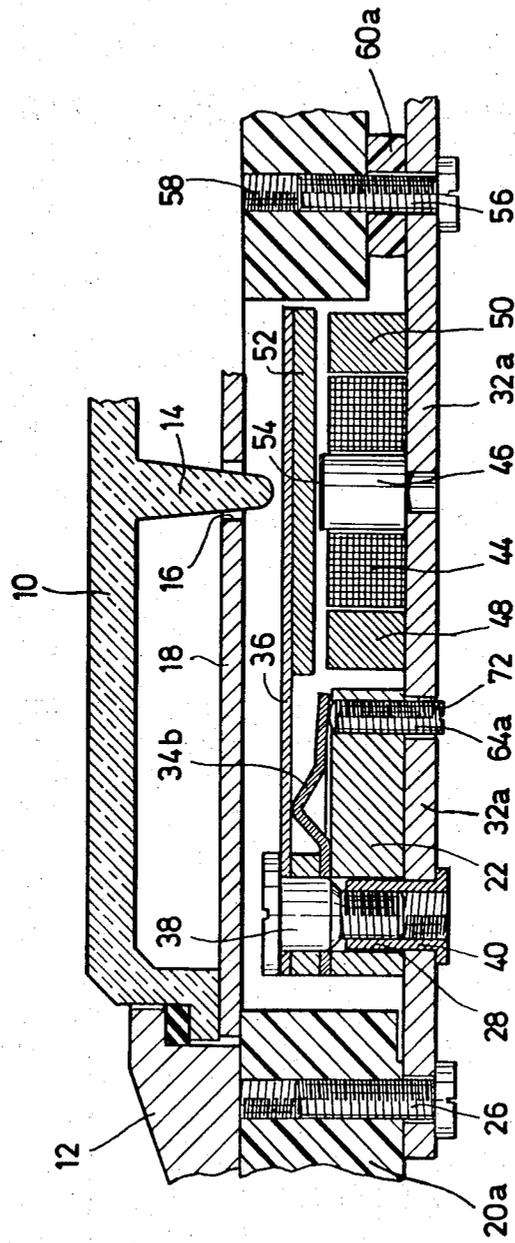


Fig. 3

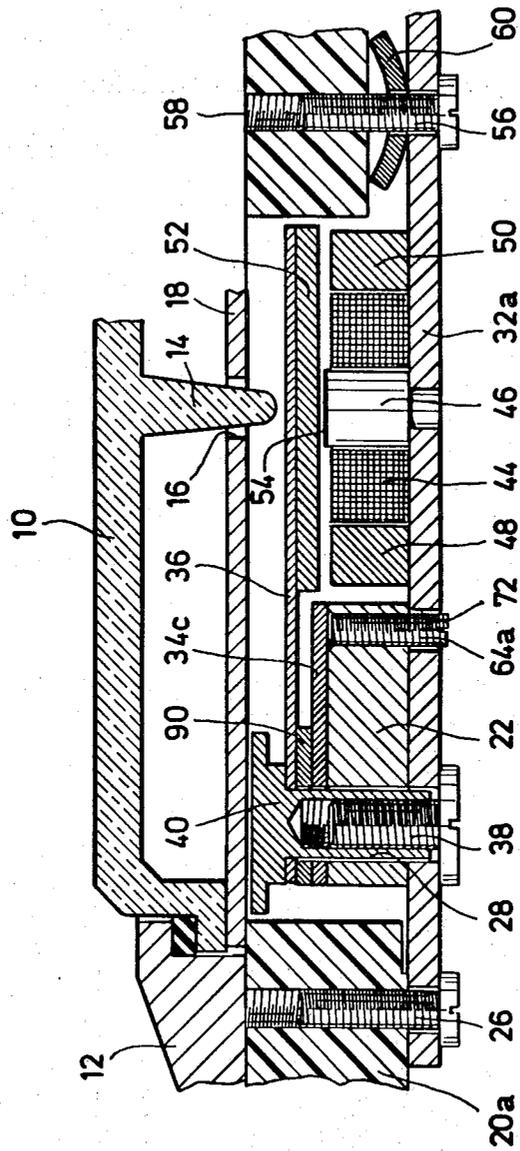


Fig. 4

## ELECTROMAGNETIC BUZZER FOR A WATCH WITH TONGUE ADJUSTMENT MEANS

### BACKGROUND OF THE INVENTION

The present invention relates to an improved electro- 5  
magnetic buzzer for a watch, having a membrane, espe-  
cially in the form of the watch crystal. More particu-  
larly it relates to an improved adjustment system for the  
buzzer.

An electromagnetic buzzer of the type mentioned at 10  
the outset for a wristwatch is already known from U.S.  
Pat. No. 3,462,943 issued Aug. 26, 1969. In this  
buzzer, the tongue oscillates at right angles to, and  
strikes, a pin formed to the watch crystal and extending  
through the dial of the watch, whereby the watch crystal 15  
is to be excited in its natural frequency. Between  
support arm and tongue, the buzzer has a block which  
is mounted to a movement plate and to which the fixed  
ends of the support arm and the tongue are attached.  
Since it is necessary to adjust the buzzer, and especially 20  
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 sup- 25  
port arm to press against the pin, which however neces-  
sitates 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 30  
the vicinity of the clamping point and whose other end  
extends through a hole in the support arm in order to  
permit it to be rotated. This adjusting screw permits the  
tongue to be adjusted relative to a pole surface of a  
electromagnet of the electromagnet system facing it, 35  
which is also necessary.

The known design has various disadvantages: The  
tongue cannot be adjusted relative to the electromag-  
net 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 tight-  
ening 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 40  
system is greater than that of the tongue, so that the gap  
between an anchor sheet fixed to the tongue and the  
electromagnet system is altered.

A further disadvantage is that, as a result of the con-  
tacting 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 al-  
teration of the gap between tongue and electromagnet  
system. Finally, during operation the tip of the adjust-  
ing screw, which is in a contacting relationship with the  
tongue, is permanently deformed, whereby the gap be-  
tween tongue and electromagnet system is also altered  
during the course of time. Since, finally the above men- 55  
tioned 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 rela-  
tively great change of position of the buzzer in the  
vicinity of the pin which is formed to the watch crystal,  
as this is naturally arranged at some distance from the  
fixed ends of the tongue and the support arm. For this 60  
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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.

### SUMMARY OF THE INVENTION

It was the object of the invention to improve an elec-  
tromagnetic buzzer of the type mentioned at the outset  
in such a manner that it can be more easily adjusted  
than the above described known design and that the ad-  
justed condition can be maintained during operation.  
For this purpose, according to the invention it is pro-  
posed that the buzzer be designed in such a manner  
that the first adjusting element (for adjusting the buzzer  
relative to the membrane) is in a contacting relation- 15  
ship with a movable end of the support arm on the op-  
posite side of the electromagnet system from the fixed  
end of the support arm, and in that the second adjust-  
ing element (for adjusting the tongue relative to the elec-  
tromagnet system) acts on the tongue through reduc-  
tion means. Because of these features, it is much easier  
to adjust the buzzer according to the invention pre-  
cisely, since both the adjustment of the first as well as  
of the second adjusting elements are reduced. Also  
eliminated is the problem of plastic deformation in the  
area of the second adjusting element, which occurs 25  
during operation as a result of the high contact pressure  
between the bridge of the known design and the sup-  
port arm.

It is simplest if the reduction means are comprising  
a lever, one end of which is fixed relative to the sup-  
porting arm in the area of the fixed end of the tongue,  
whereby the second adjusting element is in a contacting  
relationship with its other end and is in an operative  
connection with the tongue between its ends. 30

There are several possibilities for avoiding the gap  
between tongue and electromagnet system being influ-  
enced by adjustment of the first adjusting system; two  
embodiments proposed in accordance with the inven-  
tion utilize a characteristic of the above mentioned,  
known design, as they both provide a firmly clamped  
block arranged between support arm and tongue on the  
opposite side of the electromagnet system from the free  
end of the support arm. 35

In the first embodiment, the lever (which forms the  
reduction means) is located on the side of the support  
arm facing away from the electromagnet system, while  
the second adjusting element is in a contacting relation-  
ship with the supporting arm between the first adjusting  
element and the electromagnet system; in addition, a  
pin, extending through the support arm, is slidably lo-  
cated in the block roughly 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 element connects the free end of the  
lever with the support arm at a point which is located  
between the first adjusting element and the fixed end  
of the support arm, adjustment of the entire buzzer  
with the aid of the first adjusting element does not alter  
the gap between tongue and electromagnet system. 45  
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Since, on the other hand, alteration of the second ad-  
justing element is not transmitted to the tongue by  
means of the support arm and the block as a result of  
the slidable pin, alteration of the setting of the gap be-  
tween 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 variant also permits the block to be employed as the base element of the buzzer, and the watch to be attached to it, whereby it supports the support arm and the tongue.

In the second variant of the design according to the invention, in which the two adjusting possibilities are disconnected, the lever (forming the reduction means) is arranged between tongue and block, and the second adjusting element 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 element, i.e., 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 element will cause the support arm to move relative to the membrane as a whole, including block and tongue, so that, in the same manner as with the above discussed first variant, 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 must then only be adjusted relative to the membrane with the aid of the first adjusting element.

In the second variant, it is practical to provide a line-shaped contacting relationship 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 plastic film to avoid, especially, 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 element as a screw extending through the support arm and the elastic element.

#### DRAWING

Further characteristics and details of the invention can be seen from the enclosed claims and/or the drawings and the following description of four embodiments of the buzzer according to the invention, in which

FIG. 1 shows a cross section through a first embodiment of a buzzer according to the invention, made at right angles to the dial of a wristwatch; and

FIGS. 2 to 4 show corresponding cross sections through three other, largely similar embodiments.

#### DESCRIPTION

FIG. 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 plastic. 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 has 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 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 anchor plate, which forms one pole of electromagnet 44, 46, is lined with a plastic film 54 in order to prevent the anchor plate, and thus tongue 36, from adhering to the electromagnet.

The movable end 32' of support arm 32 can be adjusted relative to the clock, 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 20 also carries an indicated printed circuit board 62, which bears the oscillator circuit. This serves to excite electromagnet 44, 46 with 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 both the gap between anchor 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 support arm 32 between the electromagnet system and the point of contact of system adjusting screw 56, 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 the tongue adjustment is transmitted from lever 34 to tongue 36 by means of pin 42, which slidably arranged in the support arm and in mounting block 22, since 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, since with tongue adjusting screw 64 in a certain position pin 42 maintains the constant clearance between tongue 36 and support arm 32, and thus between the tongue and the electromagnet system.

While in the embodiment of the design according to the invention shown in FIG. 1 mounting block 22 is fixedly attached in the watch, the embodiments shown

in FIGS. 2-4 have a mounting block 22a and 22b which is attached to a support arm 32a and can move with it. Since the embodiments according to FIGS. 2-4 are similar to one another and coincide largely with the embodiment according to FIG. 1, only the differing parts shall be described below; individual parts not mentioned on the basis of FIGS. 2-4 are provided with the same reference numbers as the corresponding parts in FIG. 1; the differing parts also have the same reference numbers, however with the letters a, b . . . .

Instead of being mounted by means of a mounting flange of the mounting block, the entire buzzers of the embodiments according to FIGS. 2-4 are attached to plate 20a with support arm 32a by means of a screw 26a. Mounting block 22a has a slot 70, thus forming a lever 34a which replaces the lever 34 in FIG. 1. Its free end 34a' is subject to the effect of a tongue adjusting screw 64a, which extends through a hole 72 in support arm 32a. The adjustment movement of this adjusting screw is again transmitted reduced to tongue 36 by lever 34a, thanks to a rib 74 which provides a line-shaped contacting relationship between lever 34a and tongue 36. According to FIG. 2, to the left of the rib mounting block 22a has a notch 76, which results in a constriction 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 FIG. 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 anchor plate 52 and electromagnet 44, 46, so that tongue 36 can be adjusted relative to the electromagnet system with the aid of adjustment screw 64a prior to the installation of the buzzer in the watch.

The embodiment shown in FIG. 3 differs from that according to FIG. 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 FIG. 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 also being clamped between it and tongue 36. If lever 34c is adjusted with the aid of tongue adjusting screw 64a sheetmetal strip 90 transmits and reduces the adjustment path of adjusting screw 64a.

Thus, it is common to all embodiments that

1. the adjustment paths of the adjusting screws are reduced;
2. pre-adjustment of the buzzer relative to the 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 according to FIG. 2, the conical end of tongue adjusting screw 64a engages a correspondingly shaped recess in lever 34a, and in the embodiments according to FIGS. 3 and 4, tongue adjusting screw 64a has a spherical end.

We claim:

1. In an electromagnetic buzzer for a watch, said buzzer of the type having a membrane with associated projecting pin means, an electromagnet system, a support arm carrying the electromagnet system, one end of which support arm is fixed to the watch and the other movable end of which can be adjusted relative to said pin means, and a tongue clamped on one end and arranged to be excited to oscillate by the electromagnet system and strike said pin means, the improvement comprising:

first adjusting means on said movable end of the support arm opposite the electromagnet system for positioning said support arm relative to said pin means,

second adjusting means acting near the clamped end of the tongue for positioning the tongue relative to the electromagnet system, said second adjusting means acting through reduction means.

2. The buzzer set forth in claim 1, wherein one pole of an electromagnet of said electromagnet system facing the tongue is covered with plastic film.

3. The buzzer set forth in claim 1, wherein an elastic element, especially in the form of an elastic block or a spring washer, is arranged between the movable end of the support arm and the watch, and in that the first adjusting element is a screw extending through the support arm and said elastic element.

4. The buzzer set forth in claim 1, wherein said reduction means comprises a lever, one end of which is fixed relative to the supporting arm in the area of the fixed end of the tongue and arranged so that the second adjusting means is in a contacting relationship with its other end and is in an operative connection with the tongue between the ends of the tongue.

5. The buzzer set forth in claim 4 further having a fixedly clamped block arranged between support arm and tongue on the opposite side of the electromagnet system from the movable end of the support arm, characterized in that the lever is located on the side of the support arm facing away from the electromagnet system, in that the second adjusting element is in a contacting relationship with the support arm between the first adjusting element and the electromagnet system, and including a pin slidably located in said block which extends at roughly right angles to said tongue and extends through the support arm, with one end of the pin in a contacting relationship with the lever and the other end with the tongue.

6. The buzzer set forth in claim 5, wherein the ends of said pin are spherical.

7. The buzzer set forth in claim 5, characterized in that said block is attached to the watch and supports the support arm and the tongue.

8. The buzzer set forth in claim 4, having a firmly clamped block arranged between support arm and tongue on the side of the electromagnet system facing away from the movable end of the support arm,

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wherein said lever is arranged between said tongue and said block and in that said second adjusting element is in a contacting relationship with said block.

9. The buzzer set forth in claim 8, wherein the fixed end of the support arm is attached to the watch and that the block is attached to the support arm.

10. The buzzer set forth in claim 8, wherein said lever is in a contacting relationship with the tongue along a line.

11. The buzzer set forth in claim 8, wherein said block defines a slot forming the lever.

12. The buzzer set forth in claim 8, wherein the lever is a section firmly clamped between block and tongue.

13. The buzzer set forth in claim 8, wherein the lever is a flat strip of sheet metal which is clamped between block and tongue together with a shorter strip of sheet metal located between it and the tongue.

14. The buzzer set forth in claim 8, wherein said second adjusting element is a screw for which said block has a thread, and in that the screw is accessible through a hole in the support arm or engages therethrough.

15. The buzzer set forth in claim 14, wherein said screw is in a contacting relationship with the lever via a spherical end.

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