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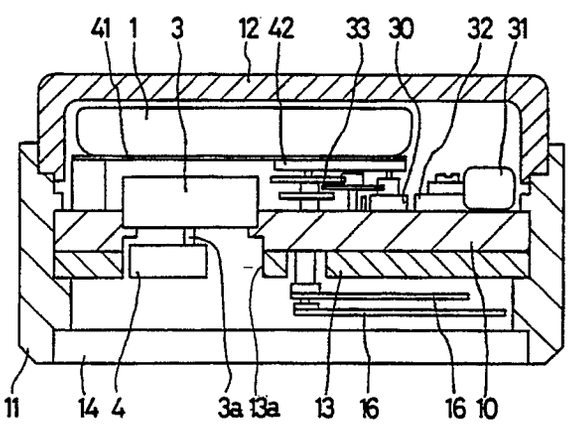
(54) Time keeping device with vibrational alarm.

(57) A vibrating alarm timekeeping device comprising a casing (11,12,14) having a rear cover portion (12); a motor (3) which is mounted within the casing (11,12,14), the motor (3) having a motor shaft (3a) which carries an eccentric weight (4) which is arranged to be driven by the motor (3) at a preset alarm time so as to impart vibrations to the casing (11,12,14); and motor control means (2,29) for effecting operation of the motor (3) at the said preset alarm time, characterised in that the motor shaft (3a) is substantially perpendicular to the rear cover portion (12), the motor shaft (3a) extending from the motor (3) on the side of the latter remote from the rear cover portion (12).

FIG. 1



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"A VIBRATING ALARM TIMEKEEPING DEVICE"

The present invention relates to a vibrating alarm timekeeping device, such, for example, as a vibrating alarm watch and a vibrating timer.

A vibrating alarm timekeeping device is known in which an eccentric weight is attached to a shaft of a motor which is rotated at a preset alarm time to inform a person wearing the watch of the arrival of the preset time.

In the known vibrating alarm watch, the motor is arranged on a base plate facing the rear cover of the watch so that the motor shaft to which the eccentric weight is attached is substantially parallel to the surface of the base plate. The known watch is provided with a battery, an electronic circuit, and wheel trains disposed in a vacant space within the watch casing on the same side of the base plate as the motor.

The construction of the prior art vibrating alarm watch is shown in Figures 5 and 6. A battery 1 and a motor 3, having a motor shaft 3a, are mounted on a base plate 10, an eccentric weight 4 being rigidly attached to the motor shaft 3a. The motor 3 is controlled by an electronic circuit 2 powered by the battery 1. The battery 1, electronic circuit 2, motor 3, eccentric weight 4 and base plate 10 are disposed within a watch casing 11, 12. The latter comprises an annular portion 11, which is provided with a watch glass 14 and a dial 13, and a rear cover portion 12. The watch is provided with hands 16 driven, via wheel trains 33, by a step motor having a coil 31, powered by the battery 2, a stator 32 and a rotor 30.

The Japanese Patent Preliminary Publication No. Heisei 1-129187 is cited as an example of literature disclosing the structure of the known vibrating alarm watch.

In the known vibrating alarm watch, the motor shaft 3a is arranged parallel to the surface of the rear cover 2 and the eccentric weight 4 is made to rotate close to the rear cover 12. That is, the distance between the rear cover 12 of the watch, which acts as a fulcrum or transmitter of vibration, and the vibrating member 4 is small, so that the watch casing 11, 12 is not oscillated strongly enough to transmit a sufficient amount of vibrations to the human body.

Further, since the battery 1 and the motor 3 are arranged in almost the same plane as the base plate 10, the watch size in the horizontal plane necessarily becomes large.

According to the present invention, there is therefore provided a vibrating alarm timekeeping device comprising a casing having a rear cover portion; a motor which is mounted within the casing, the motor having a motor shaft which carries an eccentric weight which is arranged to be driven by the motor at a preset alarm time so as to impart vibrations to the casing; and motor control means for effecting operation of the motor at the said preset alarm time, characterised in that the motor shaft is substantially perpendicular to the rear cover portion, the motor shaft extending from the motor on the side of the latter remote from the rear cover portion.

Preferably, a power source is disposed between the motor and the rear cover portion, the power source being connected to the motor control means so as to power the latter.

The motor may, if desired, be an ultrasonic motor.

The device may have a dial, the eccentric weight being disposed in a hole in the dial.

The motor control means preferably comprises setting means for setting the said preset alarm time; memory means, connected to the setting means for storing the preset alarm time; time processing means, connected to the memory means, for processing the present time and for comparing the latter with the preset alarm time; and motor drive means, connected to the processing means, for driving the motor at the preset alarm time.

The device may have time indicating means driven by a second motor.

Preferably, the operation of the second motor is controlled by the said time processing means.

The second motor may be a step motor which drives time indicating hands.

The invention enables a vibrating alarm and a vibrating timer to be made small in size and able to transmit the vibrations well to the human body.

The power source may be a battery, a secondary battery or a high-capacity capacitor.

Although the eccentric weight secured to the motor shaft may be accommodated on the side of a base plate opposite to that on which the first-mentioned motor is mounted, it is also possible to cut a hole in the base plate and mount the eccentric weight in the said hole.

The motor may be-a DC electromagnetic motor, a stepmotor or an ultrasonic motor.

In a device according to the present invention, when the preset alarm time has come, the first-mentioned motor may be driven by a motor drive signal from an electronic circuit so as to rotate the eccentric weight secured to the motor shaft, thus causing the watch to oscillate.

Since the eccentric weight is located at a point remote from the rear cover, when the watch is worn on a wrist or is put in a breast pocket, the vibrating source is situated away from the wrist or from the

body of the user. This allows the generation of substantial vibrations for transmission to the wrist or body of the user.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

Figure 1 is a cross-section of a vibrating alarm watch according to the present invention;

Figure 2 is a plan view of the watch shown in Figure 1;

Figure 3 is a cross-section of an ultrasonic motor and its associated components which may be used in a vibrating alarm watch according to the present invention;

Figure 4 is a block diagram of the circuit used in the watches of Figures 1-3; and

Figures 5 and 6 are a plan view and a cross section respectively of a known vibrating alarm watch.

In Figures 1 and 2 there is shown a watch having a watch casing comprising an annular casing member 11, a rear cover 12 and a watch glass 13. The watch has a motor 3 which is mounted within the watch casing and is secured to a base plate 10 which is supported by the casing member 11. The motor 3 has a motor shaft 3a situated on one side of the motor 3 opposite to the rear cover 12. The motor shaft 3a is rigidly secured to an eccentric weight 4. The motor 3, which is wired to an electronic circuit 2 that is driven by a battery 1 as a power source, is arranged to drive the eccentric weight 4 at a preset alarm time so as to impart vibrations to the watch casing.

Mounted on the base plate 10 are wheel trains 33, a rotor 30, a stator 32, a coil 31, and their associated parts. The electronic circuit 2 applies specified drive pulses to the coil 31 to drive the rotor 30 and hence the wheel trains 33, causing hands 16 attached thereto to indicate the present time. The hands 16 may also indicate the alarm setting time in the case of an alarm watch; or the alarm setting time and the residual time in the case of an alarm watch; or the alarm setting time and the residual time in the case of a timer. Instead of using the hands, it is also possible to display these readings with a liquid crystal panel (not shown).

On the rear cover side of a wheel train support 42, which supports the wheel trains 33, there is mounted an insulating plate 41, on which the battery 1 is disposed. Instead of an ordinary battery, the power source may employ a rechargeable secondary cell or a high-capacity capacitor. The electronic circuit 2, which is powered by the battery 1, effects operation of the motor 3 at the preset alarm time, as described in greater detail below.

The eccentric weight 4 attached to the rotating shaft 3a of the motor 3 can be disposed on the base plate side of a dial 13 so that it is concealed from view from the side of the watch glass 14. The eccentric weight 4 may alternatively be disposed in a hole 13a formed in the dial 13 so that its operation can be seen from the glass side.

Figure 3 is a cross-section showing an ultrasonic motor and its associated components of another embodiment, in which the motor 3 in the first embodiment is replaced with the ultrasonic motor.

Bonded to the underside of a vibrating member 35 is a piezo-electric element 34 which is polarized and formed with electrodes of a specified shape. When a plurality of high frequency voltages are applied to the piezo-electric element 34 from the electronic circuit 2 through lead wires 45 attached thereto, the piezo-electric element 34 deflects causing the vibrating member 35 also to deflect, so generating a travelling wave.

A rotating member 36 is rotatably urged into contact with a comb-like portion 35a of the vibrating member 35 by the pressure of a pressure spring 38. The eccentric weight 4 is secured to a support shaft 37 of the rotating member 36. The deflection of the piezo-electric element 34 causes the rotating member 36 to turn, so revolving the eccentric weight 4.

Figure 4 is a block diagram of the circuit of the vibrating alarm watch. The electronic circuit 2 is driven by the battery or other power source 1. The operation of an alarm time setting switch 29 causes time information with respect to a desired alarm setting time to be stored in an alarm time memory circuit 21. When the alarm time comes, the motor 3 is driven by a motor drive circuit 22 so as to rotate the eccentric weight 4 secured to the motor shaft 3a, thus causing the watch casing to vibrate.

A time clocking circuit 23 activates a hands motor drive circuit 24 for driving a stepmotor 40. The latter is arranged to rotate the wheel trains 33 so turning the hands 16 to indicate the present time and the alarm time.

The time clocking circuit 23 has a circuit which processes the present time in the alarm watch and a comparison circuit for comparing the said present time with the alarm time information. The time clocking circuit 23 also has a processing circuit in which the preset alarm time is subtracted in a timer and a comparison circuit for comparing the time information with the lapse of time. The step motor 40 consists of a coil 31, a stator 32, and a rotor 30 as shown in Figures 1 and 2.

Since the motor 3 and the battery 1 are vertically spaced apart, the size of the watch in terms of its horizontal plane area can be reduced. The motor 3 is situated at a point remote from the rear cover 12 and the eccentric weight 4 is secured to a motor shaft 3a which is arranged on the side of the motor 3 which is opposite to the rear cover 12. Hence, when the watch is worn on a wrist or put in a pocket with the rear cover 12 in contact with the

wrist or directed toward the user, the motion of the eccentric weight 4 causes the watch to vibrate to a substantial extent with the rear cover 12 acting as a fulcrum, thus ensuring that the user will be very conscious of the vibrating motion.

Furthermore, if the dial 13 of the watch has a hole 13a and the eccentric weight 4 is installed therein, the watch body can be reduced in thickness by an amount corresponding to the thickness of the dial. This construction also allows the motion of the eccentric weight 4 to be seen from the glass side.

In this way, a vibrating alarm watch and a vibrating timer in accordance with the present invention can indicate the time only to the person who wears the watch or uses the timer without being a nuisance to other people.

Claims

1. A vibrating alarm timekeeping device comprising a casing (11,12,14) having a rear cover portion (12); a motor (3) which is mounted within the casing (11,12,14), the motor (3) having a motor shaft (3a) which carries an eccentric weight (4) which is arranged to be driven by the motor (3) at a preset alarm time so as to impart vibrations to the casing (11,12,14); and motor control means (2,29) for effecting operation of the motor (3) at the said preset alarm time, characterised in that the motor shaft (3a) is substantially perpendicular to the rear cover portion (12), the motor shaft (3a) extending from the motor (3) on the side of the latter remote from the rear cover portion (12).

2. A device as claimed in claim 1 characterised in that a power source (1) is disposed between the motor (3) and the rear cover portion (12), the power source (1) being connected to the motor control means (2) so as to power the latter.

3. A device as claimed in claim 1 or 2 characterised in that the motor is an ultrasonic motor (34-36).

4. A device as claimed in any preceding claim characterised in that the device has a dial (13), the eccentric weight (4) being disposed in a hole (13a) in the dial (13).

5. A device as claimed in any preceding claim characterised in that the motor control means (2,29) comprises setting means (29) for setting the said preset alarm time; memory means (21), connected to the setting means (29), for storing the preset alarm time; time processing means (23), connected to the memory means (21), for processing the present time and for comparing the latter with the preset alarm time; and motor drive means (22), connected to the processing means (23), for driving the motor (3) at the preset alarm time.

6. A device as claimed in any preceding claim characterised in that the device has time indicating means (16) driven by a second motor (40).

7. A device as claimed in claim 6 when dependent upon claim 5 characterised in that the operation of the second motor (40) is controlled by the said time processing means (23).

8. A device as claimed in claim 6 or 7 characterised in that the second motor (40) is a step motor which drives time indicating hands (16).

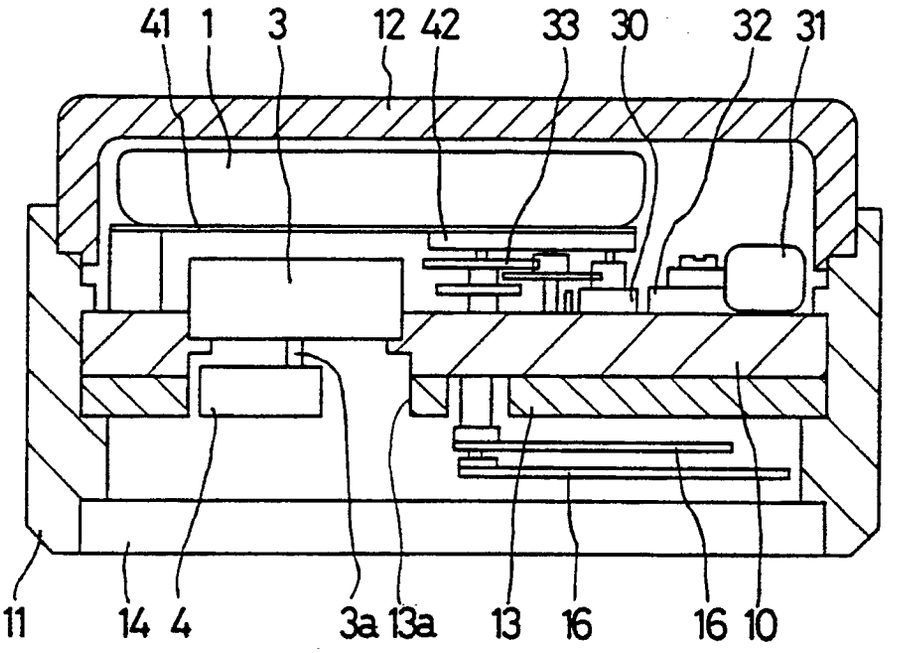
9. A vibrating alarm timekeeping device comprising: switching means for setting time information; alarm time memory means for storing said time information; time clocking means for processing a present time and simultaneously calculating said time information for alarming; motor drive means for driving a motor at the present time for said time information; a motor arranged so that its shaft is almost perpendicular to a rear cover of the watch and that the motor shaft projects on one side of the motor opposite to the rear cover; an eccentric weight secured to said motor shaft; and a power source such as a battery installed between the motor and the rear cover of the watch.

10. A vibrating alarm timekeeping device as claimed in claim 9 wherein said time clocking means has comparing means for comparing said present time with said time information.

11. A vibrating alarm timekeeping device as claimed in claim 9 further comprising: hand motor drive means for driving a step motor by the output signal of said time clocking means; a step motor for rotating wheel trains; wheel trains for transmitting the rotation of said step motor; and display means for displaying the present time by rotating from said wheel trains.

12. A vibrating alarm timekeeping device as claimed in claim 9 wherein said time clking means has comparing means for comparing said time information with a lapse of time.

FIG. 1



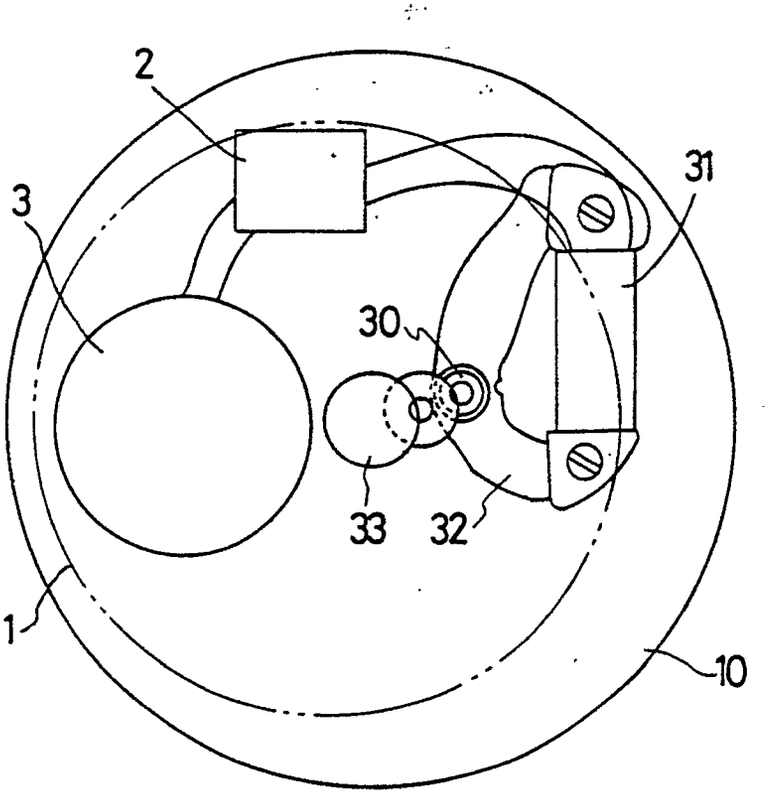
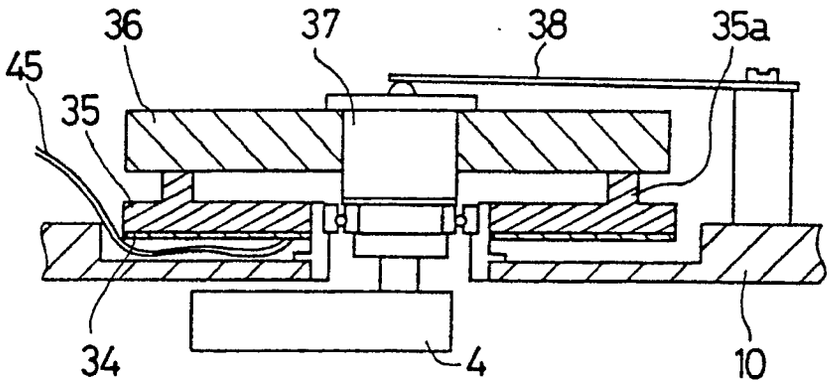


FIG. 2

FIG. 3


36
37
38
35a
45
35
34
4
10

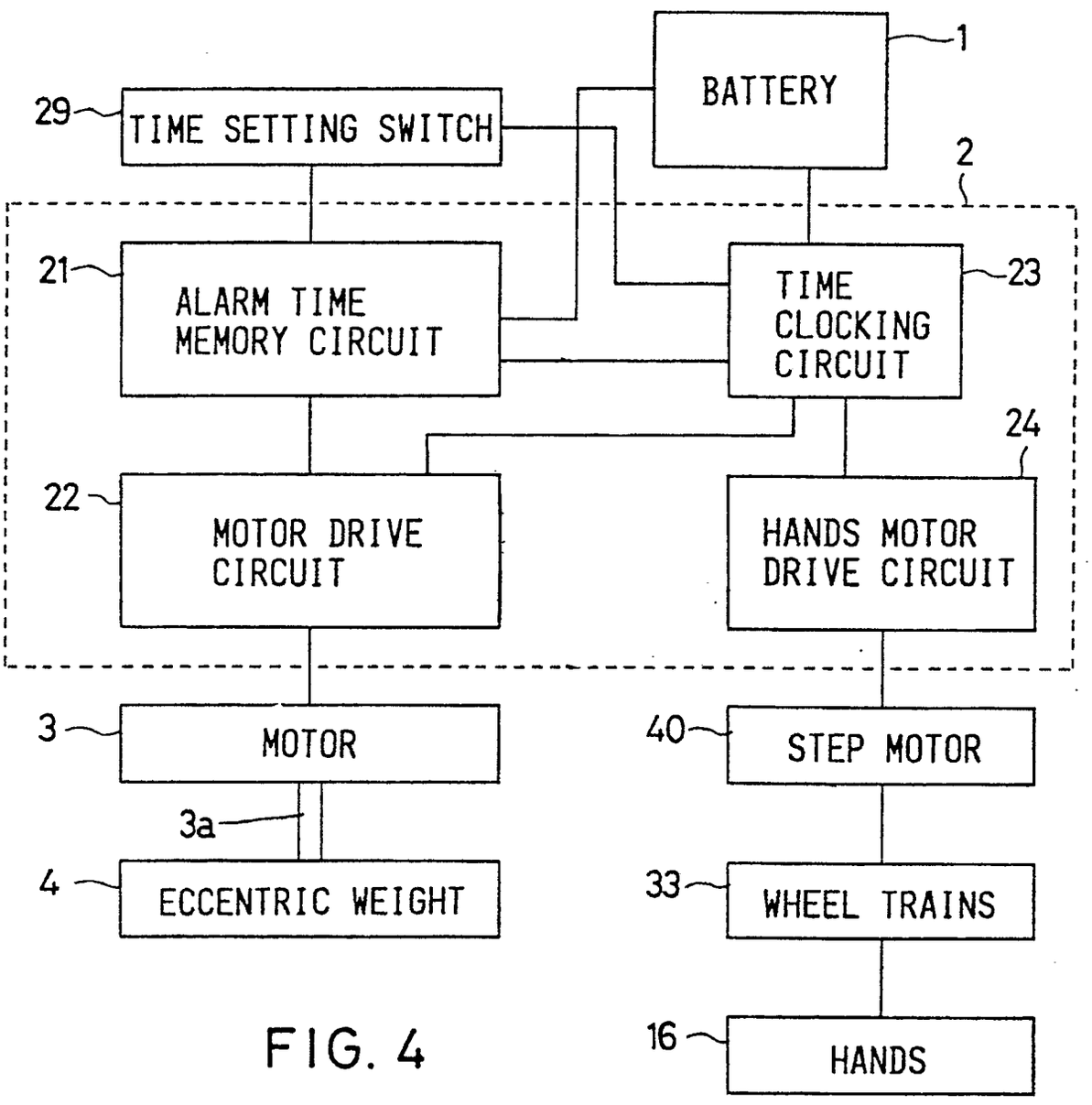
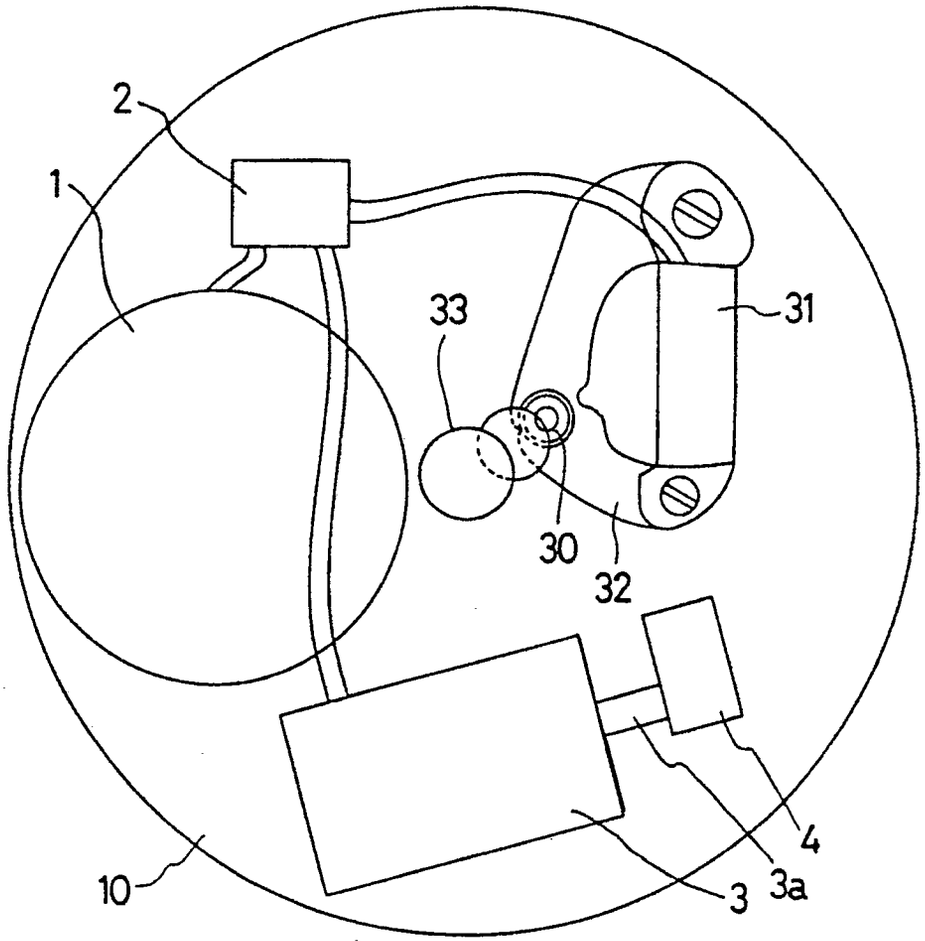

BATTERY
1
29
TIME SETTING SWITCH
2
21
ALARM TIME MEMORY CIRCUIT
TIME CLOCKING CIRCUIT
23
24
22
MOTOR DRIVE CIRCUIT
HANDS MOTOR DRIVE CIRCUIT
3
MOTOR
40
STEP MOTOR
3a
4
ECCENTRIC WEIGHT
33
WHEEL TRAINS
16
HANDS

FIG. 4

FIG. 5 PRIOR ART



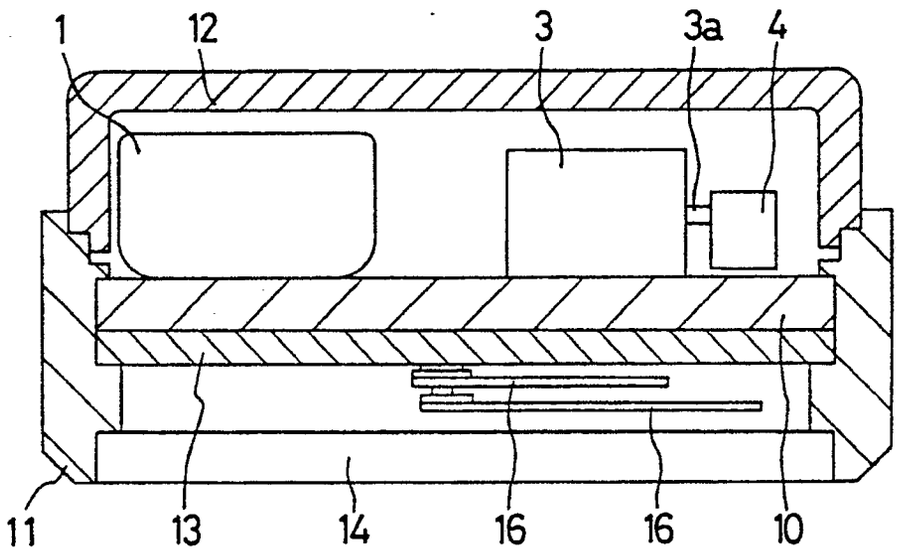


FIG. 6 PRIOR ART