May 17, 1966 C. B. MARBLE 3,251,182

VARIABLE LOUDNESS ALARM MECHANISM

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Fig. 1.

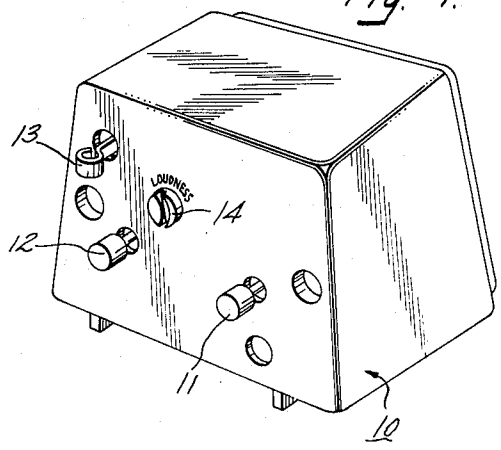


Fig. 2.

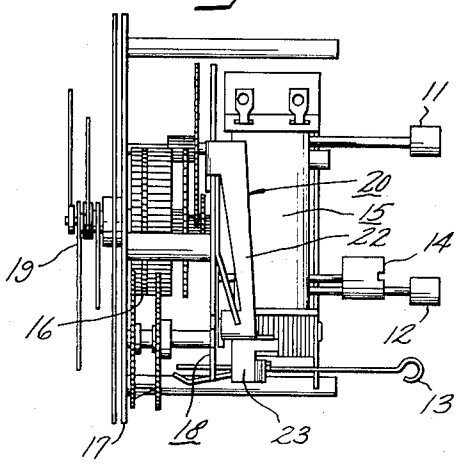


Fig. 3.

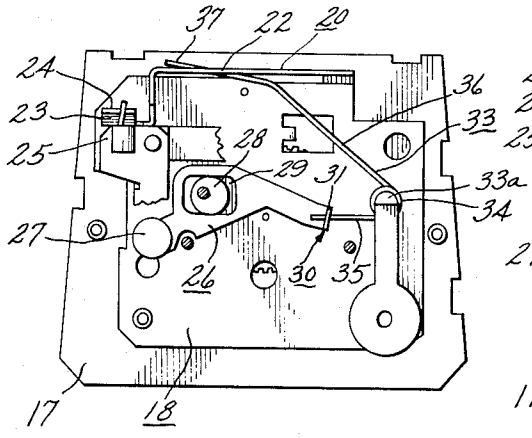


Fig. 4.

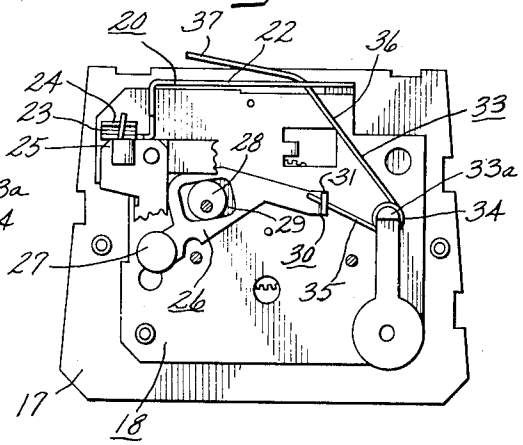


Fig. 5.

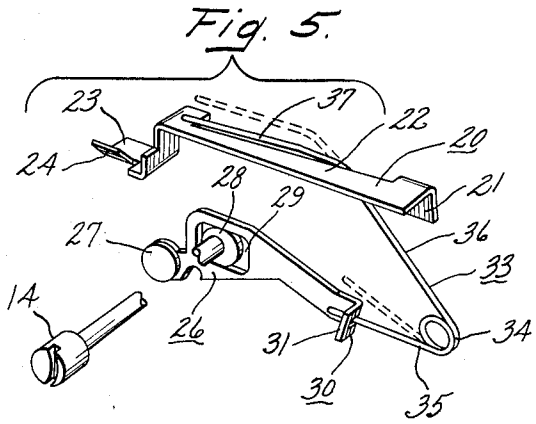
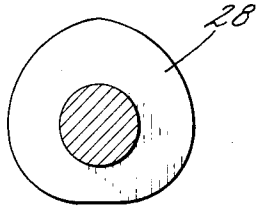


Fig. 6.



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VARIABLE LOUDNESS ALARM MECHANISM

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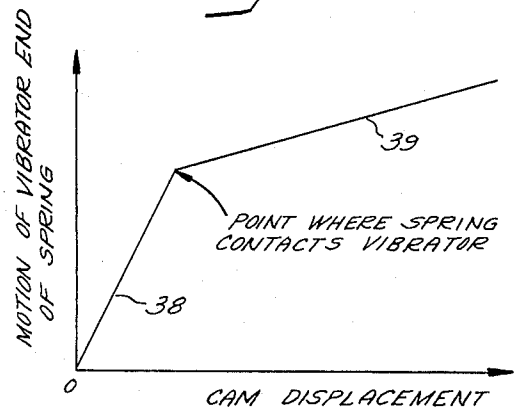
Fig. 7.



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VARIABLE LOUDNESS ALARM MECHANISM

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8 Claims. (Cl. 58—21.12)

This invention relates to electric clocks including a vibrator alarm. More specifically, it relates to a mechanism for varying the loudness of an electromagnetic vibrator alarm.

An electromagnetic vibrator alarm which is incorporated in an electric clock comprises a resilient arm or vibrator, one end of which is secured to the clock assembly in proximity to the motor, and the free end of which is also in proximity to the motor, but is spaced from the motor. A portion of the motor flux passes through the vibrator such that during periods of maximum flux the free end of the vibrator is attracted to and engages the motor, thereby sounding the alarm. The loudness of the alarm can be varied by varying the amplitude of oscillation of the free end of the vibrator, or in other terms by varying the air gap between the free end of the vibrator and the stationary member which it engages. In prior art alarm intensity controls the amplitude of vibration has been limited by a cam which engages the vibrator or a member connected to the vibrator. Due to variations in the manufacturing tolerances of these prior art controls, a relatively large portion of the cam movement is used in merely bringing the cam into engagement with the vibrator. The use of a large portion of the cam movement for bringing the cam into engagement with the vibrator may result in insufficient or only very limited cam movement remaining for alarm intensity control.

In accordance with this invention, an improved variable loudness alarm mechanism is provided which permits wide variation in the component dimensions and the assembly dimensions of the alarm and variable loudness mechanism, while at the same time providing accurate loudness control of the alarm. Furthermore, the variable loudness mechanism constructed in accordance with this invention not only provides accurate loudness control, but this control is of the vernier type, whereby easy adjustments can be made in the alarm loudness.

It is an object of this invention to provide a variable loudness alarm mechanism which provides accurate loudness control in spite of wide tolerances of the dimensions and materials of the clock and the variable loudness alarm mechanism assemblies.

It is another object of this invention to provide a variable loudness alarm mechanism which permits accurate vernier type control of the loudness of the alarm, while at the same time permitting dimensional variations in the components and their assembly.

These objects are accomplished in accordance with this invention, in one form thereof, by employing a vibrator, spring, cam and lever mounted on the electric clock assembly in a predetermined spaced relationship. A first arm of the spring, which has two arms, is positioned so that it may be brought into engagement with the vibrator near its free end. In response to movement of the second arm of the spring by the lever, the first arm is brought into engagement with and then displaces the free end of the vibrator. The loudness of the alarm is adjusted by varying the position of the vibrator in response to movement of the spring arms and the lever by a cam engaging the lever. The cam, lever, and spring arrangement provides a large mechanical ratio for multiplying the cam displacement to bring the first arm of the spring into engagement with the vibrator. After engagement of the first arm of the spring with the vibrator,

deflection of the spring results in a vernier type adjustment of the vibrator position.

Other objects and further details of that which is believed to be novel and the invention will be clear from the following description and claims taken with the accompanying drawing wherein:

FIG. 1 is a rear perspective view of an electric clock incorporating the variable loudness alarm mechanism contemplated by this invention;

FIG. 2 is a top view of the electric clock with the cover removed;

FIG. 3 is a rear view of the clock with the cover removed and portions broken away, and with the variable loudness alarm mechanism in an operating position;

FIG. 4 is similar to FIG. 3, but with the variable loudness alarm mechanism in an inoperative position;

FIG. 5 is an exploded view of the principal components of the variable loudness alarm mechanism and the vibrator of the alarm;

FIG. 6 is an enlarged view of the adjustment cam; and

FIG. 7 is a displacement chart for the variable loudness alarm mechanism.

The controls of an electric clock incorporating a preferred embodiment of the variable loudness alarm mechanism of this invention can best be seen by making reference to FIG. 1. Shown protruding through the rear of the casing **10** is a time set knob **11**, an alarm set knob **12**, and an alarm on-off lever **13**. Also protruding from the rear of the housing is a coin slot control knob **14** which is used to adjust the variable loudness alarm mechanism of this invention.

By reference to FIGS. 2 through 5 it will be seen that the clock comprises a motor **15**, a gear train **16** mounted between front plate **17** and back plate **18**, and indicating hands **19**. In a preferred embodiment of an electric clock including the variable loudness alarm mechanism, the vibrator **20** is formed from a piece of steel. The vibrator includes a major portion **22** and a flange **21** which is perpendicular to the major portion. The flange is welded to the back plate **18** of the clock. The free end **23** of the vibrator which engages a portion of the motor stator or a stationary member **25** to sound the alarm, is generally parallel to but offset from the major portion **22** of the vibrator. The free end **23** of the vibrator includes a bent tab **24** which is provided for engagement with the on-off lever **13**.

The vibrator is mounted parallel to and in close proximity with the top portion or yoke of the motor stator **25**. A portion of the alternating leakage flux which would normally pass through the air is shunted through the vibrator **20** thereby causing periodic attraction of the free end **23** of the vibrator to the motor stator **25**. Periodic engagement of the free end **23** of the vibrator and motor stator **25** will cause sounding of the alarm.

As is well-known in the art, it is possible to vary the loudness of an electromagnetic vibrator alarm by varying the air gap between the vibrator and the stationary member which it strikes. This invention is related to an improved mechanism for varying the air gap, and simultaneously the stiffness of the vibrator, and thereby varying the loudness of the alarm. The improved variable loudness mechanism of this invention is best shown in FIG. 5. A lever **26** is pivotally supported by pin **27**. Rotation of a cam **28** in an aperture **29** in the lever causes rotation of the lever about pin **27**. The free end of the lever includes a spring-engaging means **30** which may be a tab **31** bent at right angles to the lever with a hole **32** therein. A sear spring **33**, the convolute section **34** of which is placed over stud **33a**, is provided for adjusting the position and stiffness of vibrator **20**, in response to movement of lever **26**. The sear spring **33**

has arms of unequal length. The shorter arm **35** is connected to the spring-engaging means **30** of the lever, while portion **37** of the longer arm **36** is positioned to engage the top surface of the vibrator **20**.

Rotation of the cam **28** in a clockwise direction causes the lever **26** to be pivoted in a clockwise direction, thereby rotating the short arm **35** of sear spring **33** in a counterclockwise direction. Counterclockwise rotation of the spring **33** brings portion **37** of the longer arm **36** of the spring into engagement with the top surface of the vibrator **20**.

Until the portion **37** of the spring **33** engages the vibrator, the lever system comprising the cam **28**, the lever **26**, and the sear spring **33** has a large mechanical ratio, such as 18 to 1. This large ratio results from positioning the aperture **29** closer to pin **27** than is the spring-engaging means **30**, and by making the spring arm **35** shorter than the spring arm **36**. Slight rotation of the cam **28** will effect a relatively large movement of the portion **37** of the longer spring arm **36**. Even though the mechanical tolerances of the dimensions and positions of the alarm mechanism components are large, it is possible to compensate for these large tolerances by bringing the portion **37** of the longer spring arm **36** into contact with the vibrator **20** by a very slight rotation of the control knob **14**.

After the portion **37** of the spring contacts the vibrator **20**, the mechanical ratio of the lever system becomes smaller due to the tensioning of the spring **33**. Rotation of cam **28** causes gradual deflection of the spring, and at the same time portion **37** of the spring applies a force to the free end **23** of the vibrator, thereby increasing the stiffness of the vibrator and reducing the air gap between the free end **23** of the vibrator and the stationary member **25**. The gradual deflection of the spring **33**, and the gradual application of the force to the top of the vibrator by portion **37** of the spring due to rotation of the cam **28**, results in a vernier type action wherein easy adjustment of the alarm loudness is effected by rotation of the coin slot control knob **14**.

The use of the sear spring in the variable loudness alarm mechanism results in a lever system having two mechanical ratios as is best shown by the displacement chart of FIG. 7. Until the portion **37** of the spring **33** engages the vibrator **20**, the load on the lever system is negligible. Therefore, the spring **33** is not tensioned or deflected and a large mechanical ratio results, whereby a slight rotation of the cam will bring the spring into engagement with the vibrator **20**. This action of the lever system is indicated by the steeply sloped portion **38** of the displacement curve shown in the displacement chart. After the portion **37** of the spring **33** engages the vibrator **20**, the spring **33** is tensioned due to the force needed to deflect the vibrator. The deflection of the spring results in a considerable reduction of the mechanical ratio of the lever system, thereby providing vernier type control of the alarm loudness. This vernier type control is indicated by the gradually sloped portion **39** of the displacement curve.

While a preferred embodiment of the invention has been shown, various other modifications and embodiments of the invention will be apparent to those skilled in the art, and it is intended to cover by the appended claims all said modifications falling within the scope thereof.

What I claim is:

1. A variable loudness alarm mechanism for use with an electric clock comprising:

(a) a vibrator for sounding an alarm,

(b) pivot means spaced from said vibrator,

(c) a spring having a first arm, a second arm, and a pivot portion between said arms, the pivot portion of said spring being mounted on said pivot means, and said first arm being arranged to engage said vibrator for urging said vibrator in one direction,

(d) a pivoted lever engaging said second arm,

(e) a cam engaging said lever to effect movement of said lever and said spring to vary the loudness of the alarm.

2. A variable loudness alarm mechanism for use with an electric clock comprising:

(a) a vibrator for sounding an alarm,

(b) pivot means spaced from said vibrator,

(c) a spring having a first arm, a second arm, and a pivot portion between said arms, the pivot portion of said spring being mounted on said pivot means, and said first arm being arranged to engage said vibrator for urging said vibrator in one direction,

(d) a pivoted lever engaging said second arm, said lever having an aperture therein,

(e) a cam engaging a wall of said aperture to effect movement of said lever and said spring to vary the loudness of the alarm.

3. The variable loudness alarm mechanism defined in claim **2** wherein said first arm is longer than said second arm.

4. A variable loudness alarm mechanism for use with an electric clock comprising:

(a) a vibrator for sounding an alarm,

(b) pivot means spaced from said vibrator,

(c) a spring having a longer arm, a shorter arm, and a pivot portion between said arms, the pivot portion of said spring being mounted on said pivot means, and said longer arm being arranged to engage said vibrator for urging said vibrator in one direction,

(d) a pivoted lever engaging said shorter arm, said lever having an aperture therein between the pivot point of said lever and the portion of said lever which engages said shorter arm of said spring,

(e) a cam engaging a wall of said aperture to effect movement of said lever and said spring to vary the loudness of the alarm.

5. The variable loudness alarm mechanism defined in claim **4** wherein said aperture has a major dimension and a minor dimension, the major dimension extending generally in the direction of a line between the pivot point of said lever and the portion of said lever which engages said shorter arm of said spring.

6. The variable loudness alarm mechanism defined in claim **4** wherein the cam is heart-shaped.

7. The variable loudness alarm mechanism defined in claim **4** wherein said aperture is generally rectangular, the longer dimension of said aperture extending generally in the direction of a line between the pivot point of said lever and the portion of said lever which engages said shorter arm of said spring.

8. A variable loudness alarm mechanism for use with an electric clock comprising:

(a) a vibrator for sounding an alarm,

(b) pivot means spaced from said vibrator,

(c) a spring having a longer arm, a shorter arm, and a pivot portion between said arms, the pivot portion of said spring being mounted on said pivot means, and said longer arm being arranged to engage said vibrator for urging said vibrator in one direction,

(d) a pivoted lever engaging said shorter arm, said lever having a generally rectangular aperture therein closer to the pivot point of said lever than to the portion of said lever which engages said shorter arm of said spring, the longer dimension of said aperture extending generally in the direction of a line between the pivot point of said lever and the portion of said lever which engages said shorter arm of said spring,

(e) a cam engaging a wall of said aperture to effect movement of said lever, whereby the cam displacement effected by an initial predetermined rotation of said cam is multiplied to cause substantial dis-

placement of said longer arm into engagement with said vibrator, and a subsequent similar predetermined rotation of said cam causes the deflection and tensioning of said spring and therefore a lesser displacement of said longer arm and said vibrator to give a vernier control of the variation in the loudness of the alarm.

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