Aug. 4, 1970 W. G. PERRY 3,522,701

AUDIBLE TIMING DEVICE

Filed May 22, 1969

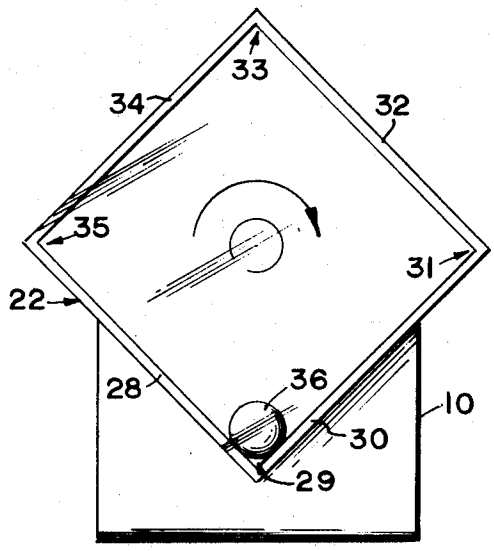



FIG. 2

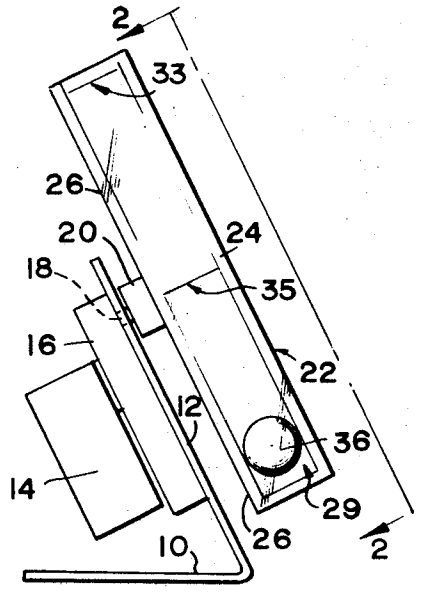



FIG. 1

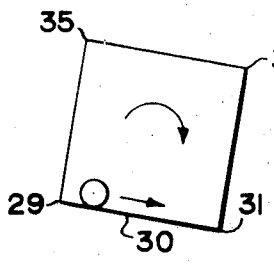



FIG. 3

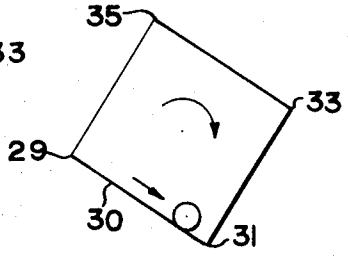



FIG. 4

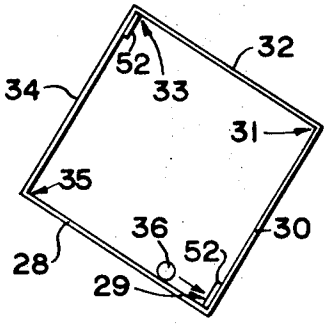



FIG. 5

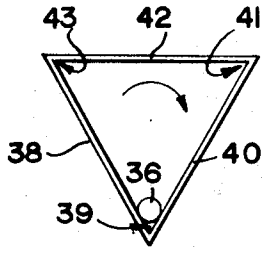



FIG. 6

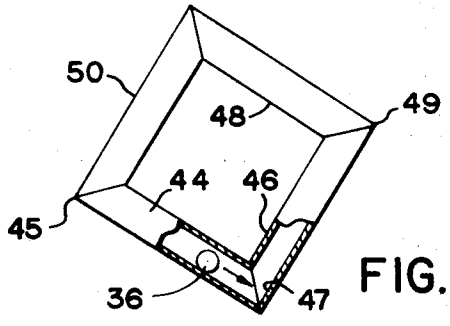



FIG. 7

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United States Patent Office 3,522,701 Patented Aug. 4, 1970



3,522,701

# AUDIBLE TIMING DEVICE

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Filed May 22, 1969, Ser. No. 826,835
Int. Cl. G04b 21/00; G04f 11/00
U.S. Cl. 58—130 13 Claims

## ABSTRACT OF THE DISCLOSURE

An audible timer including a relatively flat, enclosed box-like cam having a plurality of internal corners and mounted for rotation in a substantially vertical plane. A ball is contained and is movable freely within the cam so that it will gravitate to the lowermost internal corner. As the box is rotated continually the corners are rotated in succession to the lowermost position, the ball gravitates progressively to the succeeding corners as they are rotated to the lowermost position. An audible click is produced when the ball engages a corner so that continued rotation of the cam results in the generation of a series of audible clicks in a pattern determined by the distance between successive corners and the rotational speed of the cam.

## SUMMARY OF THE INVENTION

My invention is directed to an audible timing device for producing a series of repetitive audible clicks in a predetermined, rythmic pattern. It is intended for use as a metronome or as a classroom aid but is adaptable readily to any other environment in which a repetitive audible timing signal is desired. My invention may be incorporated in a number of specific embodiments, some of which are described below, which are relatively simple and inexpensive to construct. Thus, it is among the objects of my invention to provide an audible timer which is highly accurate yet is of simple, inexpensive construction.

In brief, my timer produces a series of repetitive, audible clicks by repeatedly elevating a striker ball and then permitting it to roll downwardly along a predetermined path into striking engagement with a plate or other member to produce the audible click. More specifically, one of the embodiments of my invention includes a relatively thin box-like cam mounted for rotation in a substantially vertical plane. The box is enclosed by a sidewall that extends continuously about and defines its perimeter, the sidewall being formed from a plurality of substantially straight sidewall segments which are connected in end to end series and at an angle with respect to each other to form an internal corner at the juncture of adjacent sidewall segments. A ball which acts as a striker, is contained within the box and tends to gravitate to that corner of the box which is in the lowermost position. By rotating the box, successive corners progressively are presented to the lowermost position and the ball will roll to the succeeding corner as soon as that corner is rotated to the lowermost position. When the ball engages the corner an audible click is produced.

The repetition rate of the clicks may be varied either by varying the speed at which the box is rotated or by substituting another box having different internal dimensions between the corners. It will be appreciated further that the box may be constructed so that the path of travel between successive corners varies in such a manner so as to produce a repetitive series of irregular but predetermined audible noises or clicks.

Another aspect of my invention is directed to an arrangement by which the frequency of the audible clicks may be varied by providing some of the internal corners



of the box with felt pads or the like so that when the striker ball rolls to a padded corner there will be no audible click, the click being produced only at the unpadded corners.

Other objects and advantages of my invention will be apparent from the foregoing description with reference to the accompanying drawings wherein:

FIG. 1 is a side elevation of one embodiment of my timer;

FIG. 2 is a front view of the device as seen from the line 2—2 of FIG. 1;

FIG. 3 is a substantially diagrammatical view of the embodiment of FIGS. 1 and 2 illustrating the position of the rotating box as the striker ball begins to roll downwardly toward the newly presented lowermost corner;

FIG. 4 is a diagrammatical illustration similar to that of FIG. 3 illustrating the position of the rotated box and striker ball just before the striker ball engages the lowermost corner of the box;

FIG. 5 is an illustration similar to that of FIG. 2 illustrating the use of soft pads in selected corners of the box so that the audible click will be produced only at the unpadded corners of the box;

FIG. 6 is a somewhat diagrammatical view of a triangular timing box; and

FIG. 7 shows an alternative embodiment of my invention wherein the striker ball is movable in an endless tube.

FIGS. 1 and 2 illustrate one embodiment of my invention which includes a stand **10** having an upstanding support member **12** that is somewhat inclined from the vertical for a purpose later described. For ease of explanation the support member **12** will be considered presently as extending in a substantially vertical direction. A synchronous motor **14** and a gear reduction box **16** are mounted to the rearward side of the support member **12**. The gear reduction box **16** has an output shaft **18** which extends forwardly through the support member **12**. The output shaft **18** is received within a hole formed in the hub **20** which is secured, in turn, to a cam **22**. The output shaft **18** is preferably splined or provided with a flat (not shown) to preclude relative rotation between the hub **20** and cam **22**, the hole in the hub **20** being shaped to receive the shaft **18**.

The cam **22**, as shown in FIGS. 1 and 2, is of a box-like construction having spaced front and rear walls **24** and **26**. A number of sidewall segments **28, 30, 32** and **34** are secured to the front and rear walls **24, 26** and to each other to define a continuing endless sidewall which encloses interior of the cam **22**. The interior width of the cam, between the front and rear walls **24** and **26**, is relatively small as compared to the other dimensions of the cam **22**. A striker **36**, which, in the illustrative embodiment of my invention is shown as a ball, is contained within the box and is movable freely therein. The diameter of the ball **36** is less than the space between the front and rear walls **24, 26** to permit freedom of movement of the sphere **36** within the cam **22**.

The sidewall segments **28, 30, 32** and **34** are located end to end and in series about the hub **20** so that each juncture between adjacent sidewalls defines the corners or interior cam lobes **29, 31, 33** and **35**. Although the illustrative embodiment shown in FIGS. 1 and 2 discloses a substantially square cam having right angle interior corners, other geometrical shapes may be used as will be later described.

In the following description of my timing device it will be appreciated that each of the sidewall segments **28, 30, 32** and **34** may be considered as cooperating with the front and rear walls **24** and **26** to define a channel run for guiding the striker **36** as it rolls from corner to

corner. For example, the sidewall **30**, front wall **24** and rear wall **26** define a channel run which runs between the cornered cam lobes **29** and **31**.

The operation of my timer is illustrated, somewhat diagrammatically in FIGS. 3 and 4. In operation, the cam **22** is rotated at a predetermined, constant speed by the synchronous motor **14** and its associated gearings **16**. It will be appreciated further that at any given time one of the internal cam lobes **29**, **31**, **33** or **35** will be in a position that is lower than any of the other lobes. As the cam **22** is continually rotated the next succeeding lobe will be rotated to this lowermost position. For example, assuming the lobe **29** to be at the lowermost position (see FIGS. 1 and 2), continued clockwise rotation of the cam **22** will cause the lobe **29** to rise and the lobe **31** to descend. The lobe **29** remains in the lowermost position until the cam **22** is rotated to the position shown in FIG. 3 at which time the lobe **31** is disposed lower than any of the other lobes. Similarly the lobe **31** will be in the lowermost position until the cam **22** has been rotated to bring the lobe **33** to the lowermost position. Inasmuch as the striker **36** is permitted freedom of movement within the cam it will be biased constantly by gravity and will seek the lowermost possible position within the cam **22**, i.e. the lowermost corner lobe. It will be understood that the speed of rotation is selected to be low enough to prevent centrifugal force from interfering with the gravitation of the striker. Thus as shown in FIGS. 1 and 2 the striker **36** will rest within the corner lobe **29** until the cam **22** has been rotated to the position shown in FIG. 3 where the lobe **31** is in the lowermost position and the ball **36** begins to roll toward the lobe **31** within the channel defined by the sidewall **30** and front and rear walls **24**, **26**. FIG. 4 shows the relative positions of the striker **36** and cam **22** just before the striker engages the corner **31** with a force sufficient to produce the aforementioned audible click.

As used in the description and the appended claims the term "lowermost" is intended to describe that lobe which is lower than any of the other lobes. This particular lobe is in the "lowermost" position as soon as it is rotated downwardly below the level of the preceding lobe. The particular lobe remains in the "lowermost" position until the next succeeding lobe is rotated below the level of the particular lobe.

It should be noted that the angle formed between the adjacent ends of the sidewalls should be small enough to retain the striker **36** within the lowermost lobe until the subsequent lobe is rotated to the lowermost position. This insures that the striker will begin to gravitate toward the next lobe precisely at the intended time.

The cam **22** and striker may be fabricated from any number of materials which will cooperate to produce the desired audible noise. For example a steel or glass striker ball **36** in a plastic cam **22** is satisfactory. Additionally the cam **22** may be of a transparent plastic, such as Lucite, to permit observation of the striker movement within the cam **22**.

FIG. 5 shows an arrangement for varying the frequency of the audible clicks generated by the timer, and consists simply of pads **52** or damping material, such as felt, which are glued or otherwise secured at selected lobes within the cam **22**. Thus if the unpadded cam **22** shown in FIG. 5 would produce normally a series of clicks having a frequency of two clicks per second, placement of the pads **52** in the opposite corners **29**, **33** would change the frequency of the cam to one click per second, because the striker **36** would only generate the audible click in the corners **31** and **35**. The damping pads **52** may also be used in an arrangement that would vary the rhythm of the audible clicks as would be the case, for example, if only a single pad were placed in the corner **29**. The timer would generate a series of three regularly spaced slicks followed by a blank. The location of the pads **52** may be varied to produce any number of rhythmic patterns or frequencies.



The cam **22** need not be of the rectangular form discussed this far. As shown in FIG. 6 a triangular cam **22** having sidewalls **38**, **40** and **44** which alternate with and define the acutely cornered lobes **39**, **41** and **43** would be equally effective. Similarly, cams of varying polygonal shapes, both regular and irregular, may be substituted to provide the desired patterns.

It will be appreciated that when the cam has relatively few lobes, as does the triangular cam of FIG. 6, the angles defined at the lobes will be more acute than those of a cam having a greater number of lobes. For example, in the triangular cam shown, each of the lobes defines an angle of 60° whereas in a hexagonal cam each lobe would define an angle of 120°. It will be appreciated further that an acutely angled lobe will be more effective to retain the ball **36** than would be a lobe defined by a greater angle. For this reason, when the cam is to be rotated at higher speeds, it is dsirable to provide a cam with relatively acute cornered lobes to insure that the ball **36** will not bounce about the region of the lobes.

Although my invention has been described as utilizing an enclosed, box-like cam there are other equivalent embodiments which may be substituted to produce equally satisfactory results. In this regard it should be noted that when operating in accordance with my invention, although the striker **36** is permitted complete freedom of movement within the cam, the striker **36** moves only within the aforementioned channels defined by the sidewalls **28**, **30**, **32** and **34** and the front and rear walls **24** and **26**. The striker **36** remains in contact with one of the sidewalls at all times. Thus, as shown in FIG. 7, an alternative embodiment of my invention may include a number of tubes **44**, **46**, **48** and **50**, connected, end to end, in series to define the continuous endless channel. Each of the tubes defines one run of the channel and the ends of adjacent tubes meet to define the corner lobes **45**, **47**, **49** and **51**. The tubes may be formed from any number of materials ranging from metal or plastic to paper, the striker **36** being formed from a material, as mentioned above, which will produce an audible noise as it gravitates successively into engagement with the corner lobes.

The tubular embodiment of the cam shown in FIG. 7 may be advantageous particularly when it is desirable to produce the audible clicks at relatively high frequency. It will be appreciated that if the box-like cam shown in FIGS. 1 and 2 were rotated at a relatively high speed there might be a tendency for the striker **36** to bounce around within the cam **22** and not follow precisely the intended path as it rolls from lobe to lobe. By completely confining the channel runs within the tubes **44**, **46**, **48** and **50** it is insured that when generating high frequency audible clicks by increasing the rotational speed of the cam, the striker will not bounce around and will follow its intended path as it rolls from lobe to lobe.

As described earlier the support member **12** and cam **22** are inclined somewhat to the vertical. Although such inclination is not necessary strictly to enable the timer to function properly it may be desirable to preclude widthwise movement of the striker **36** within the cam **22** as it rolls along the channel from one lobe to the next. Extensive widthwise movement of the striker and the cam **22** might tend to retard movement of the striker to the next lobe. This would be particularly true in longer channel runs. Such widthwise movement, or chattering, will tend to vary the time required for the striker to roll from one corner to the next thereby reducing the accuracy of the timer. Furthermore, widthwise chattering of the striker **36** would also introduce minor, but undesirable, audible clicks as the striker **36** chatters between the front and rear walls **24** and **26**. By inclining the cam **22** as shown in FIG. 1, the striker **36** is gravity biased against the rear wall **26** to reduce the tendency to chatter as the ball **36** rolls along the channel runs.

It will be understood that it is not necessary strictly to enclose completely the juncture of adjacent sidewalls which define the interior cam lobes. In some instances it may be easier to construct a cam in accordance with my invention in which the ends of adjacent sidewalls do not meet but are somewhat spaced. As long as the space is not large enough to permit the striker **36** to fall out of the cam or to otherwise hinder the passage of the striker **36** from one lobe to the next, there is no objection to providing such a space.

From the foregoing it will be appreciated that I have provided a timer which produces a repetitive audible noise at predetermined intervals by elevating repeatedly a striker and then permitting the striker to gravitate along a predetermined path into abutment with a stop member to produce the audible noise.

The foregoing is intended merely to be illustrative of my invention and other modifications or alternative embodiments will be apparent to those skilled in the art without departing from its spirit.

Having thus described my invention, I claim:

**1.** An audible timer comprising:

a striker;

channel means defining a non-circular channel adapted to receive and guide said striker along a predetermined path relative to said channel means;

said srtiker being so constructed as to gravitate within said channel means;

said channel means including at least one striker stop means for abruptly terminating gravitational movement of said striker, said striker and said stop means being constructed from materials which will produce an audible noise when said striker engages said stop means; and

means for continually rotating said channel means to cause said striker to engage said stop means at predetermined intervals to produce a series of repetitive audible noises.

**2.** An audible timer comprising:

a striker;

channel means adapted to receive and guide said striker said channel means including a plurality of channel runs connected at their ends, in series, to define an endless perimetric channel, the juncture between adjacent channel runs defining a cornered loke whereby each channel run has a cornered lobe at its ends,

said striker being so constructed as to gravitate within said channel means, said endless perimetric channel being disposed substantially in a plane that is inclined to the horizontal;

and means for continually rotating said endless perimetric channel about an axis that is substantially normal to the plane of said endless channel, whereby as said perimetric channel is rotated, the lowermost corner lobe in which said striker is contained will rotate upwardly while the succeeding corner lobe rotates downwardly whereby said striker will gravitate downwardly towards said succeeding lobe when said succeeding lobe has been rotated to said lowermost position.

**3.** A timer as defined in claim **2** wherein said striker comprises a sphere.

**4.** An audible timer comprising:

a rotatable member having a continuous perimetric channel supported thereon, said perimetric channel being defined by a plurality of channel runs connected to each other in series and about the axis of rotation of said member so that the junction of adjacent runs defines a corner whereby said continuous perimetric channel comprises alternating runs and corners;

a striker contained within said channel for gravitational movement along and within said channel;

means mounting said rotatable member for rotation about a non-vertical axis whereby as said member is rotated, successive corners of said channel may be rotated progressively to a position that is lower than that of the other corners of said channel so that as said corners are rotated in succession to said lowermost position, said striker may gravitate from the preceding lowermost corner to said lowermost corner along the run disposed between said preceding lowermost and said lowermost corners,

the adjacent runs defining said corners being oriented to define a corner angle sufficient to retain said striker within said corner until the next succeeding corner is rotated to said lowermost position;

said striker and at least said corner portions of said channel being formed from materials adapted to produce an audible sound when said striker engages said lowermost corner; and

drive means connected to said member to effect said rotation thereof.

**5.** A device as described in claim **4** wherein said member comprises an enclosed box-like structure having spaced front and rear walls and a plurality of sidewalls disposed between and secured to the perimetric portions of said front and rear walls in polygonal orientation, said channel being defined by said sidewalls and said front and rear walls, said corners being defined by adjacent ends of said spacer walls.

**6.** A device of the type defined in claim **5** wherein said striker comprises a sphere of a diameter less than the spacing between said front and rear walls whereby said sphere may roll along said runs to successive lowermost corners.

**7.** A device as claimed in claim **4** wherein said runs are straight.

**8.** A device of the type defined in claim **4** wherein said channel runs comprise tubes connected to each other in series.

**9.** A device as defined in claim **8** wherein said striker comprises a sphere of a diameter smaller than the internal dimension of said tubes.

**10.** A device as claimed in claim **8** wherein said tubes are straight.

**11.** A device as defined in claim **4** wherein said continuous perimetric channel is defined by at least three runs.

**12.** A device as defined in claim **11** wherein each of said runs is of equal length.

**13.** A device as defined in claim **4** wherein each of said runs is of equal length.


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U.S. Cl. X.R.

58—1; 84—484; 116—67