

May 10, 1938.

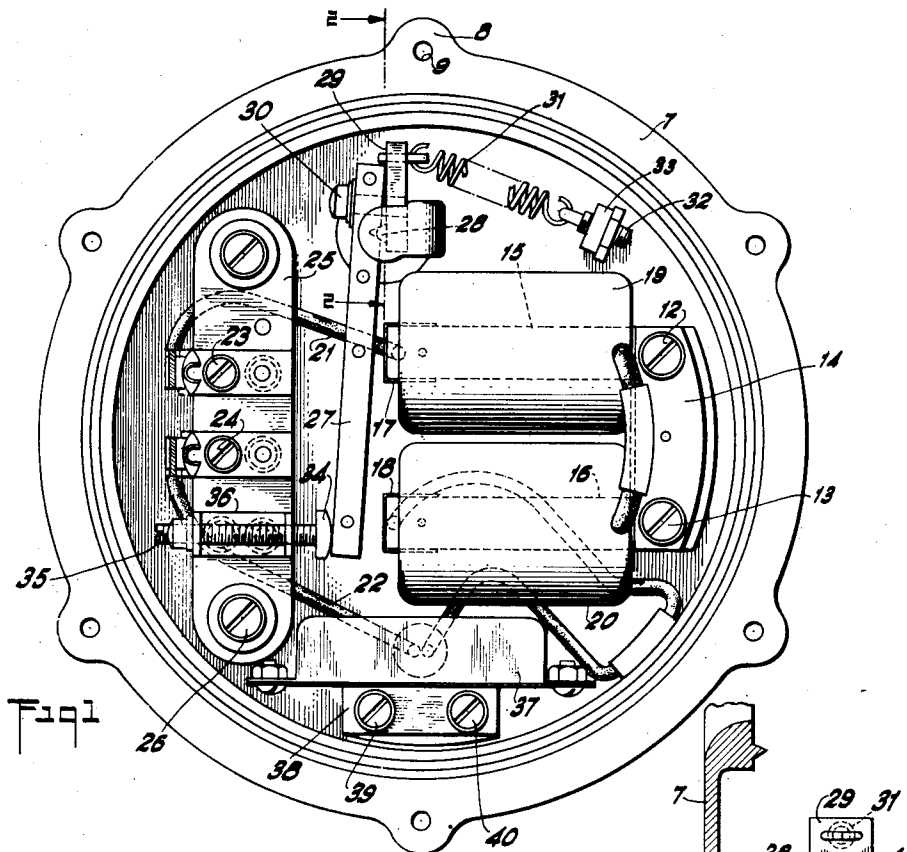
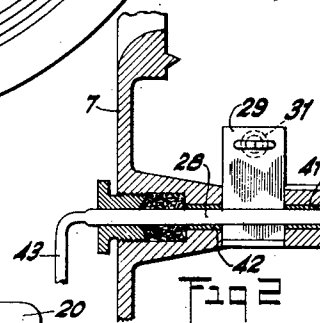
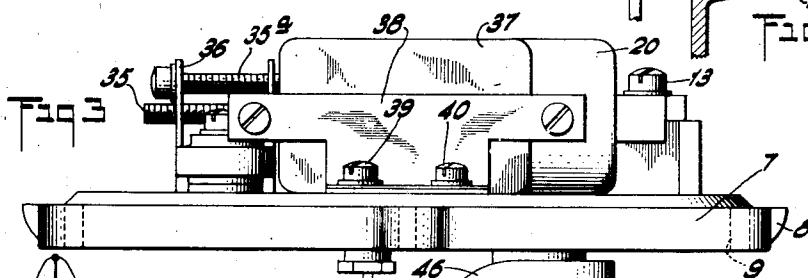
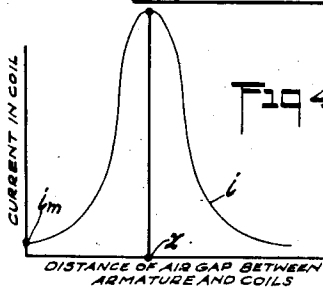
M. F. KETAY

2,117,064

CONTACTLESS BELL

Original Filed Feb. 12, 1932

2 Sheets-Sheet 1



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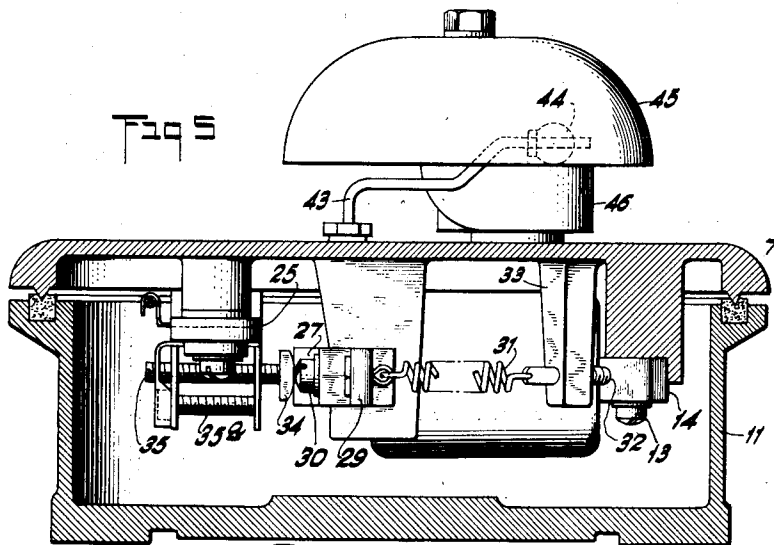
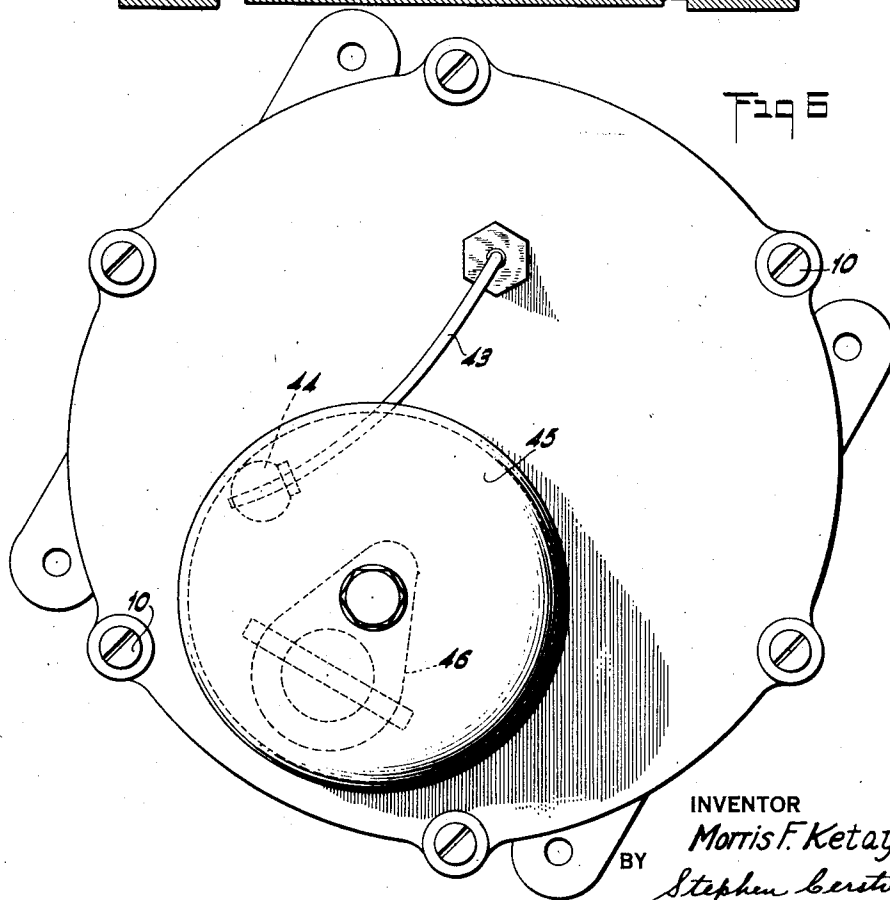
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CONTACTLESS BELL

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2 Sheets-Sheet 2



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2,117,064

CONTACTLESS BELL

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3 Claims. (Cl. 175—335)

The present invention relates to signal devices such as buzzers and/or bells, and more particularly to devices of this type adapted to operate on alternating current without the use of make-and-break contacts.

Heretofore, devices of the above character adapted for either direct or alternating current energization, included a solenoid arranged to attract an armature upon energization of the former, and contacts which were broken upon attraction of said armature, thereby de-energizing the solenoid and releasing the armature. This cycle was repeated as long as current was supplied to the device to produce a continuous vibration of the armature. These devices, although suitable in installations where low voltages and relatively small currents are used, and relatively small armatures are set into vibration, are not suitable where higher voltages, such as standard commercial voltages are used, because the breaking of the contacts to produce the vibrations of the armature, causes heavy arcing between the contacts thereby burning up and destroying the latter in a relatively short time. Accordingly, one of the objects of the present invention is to provide a novel buzzer or bell wherein make-and-break contacts are eliminated.

Another object of the invention is to provide a novel device of the class described whereby the use of permanent magnets is unnecessary.

Another object is to provide a novel buzzer or bell which is adapted to operate on alternating current of any desired frequency.

Another object is to provide a novel device of the above type which is adapted to operate on alternating current and the vibrating element of which may be adjusted to operate at any desired frequency regardless of the frequency of the alternating current from which the device is energized.

A further object of the invention is to provide an alternating current buzzer or bell which depends for its operation upon the theory of resonance of an alternating current circuit whereby the device may be tuned to operate at any desired frequency of the alternating current supply.

A still further object is to provide a novel construction of an alternating current buzzer or bell whereby the frequency of the armature may be easily and quickly adjusted to any desired frequency and to operate at the selected frequency independently of the frequency of the alternating current supply.

The above and other objects and advantages

of the invention will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying drawings, wherein is illustrated one form of the device embodying the present invention. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only, and are not designed as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views.

Fig. 1 is a plan view, with the cover removed, of one form of the device embodying the present invention;

Fig. 2 is a detailed sectional view taken on line 2—2 of Fig. 1, of a connection to the armature for operating the striker or clapper of a gong;

Fig. 3 is an inverted side elevation as viewed from the bottom of Fig. 1;

Fig. 4 is a graphical representation of the operational characteristics of the device;

Fig. 5 is a side elevation, partly in section, with the cover attached; and

Fig. 6 is a plan view as viewed from the top of Fig. 5.

In accordance with the invention, the armature or vibrating member of the device is set into vibration due to electro-magnetic attraction thereof by a coil or pair of coils energized by an alternating current which increases and decreases as the resonance of a circuit including said coil or coils and a capacity element is approached and departed from by the action of the vibrating member.

Referring now to the drawings, and more particularly to Figs. 1 and 5, the device, in the form shown, comprises a base 7, on which the various elements are mounted and having projecting ears 8, each of which is provided with an aperture 9 for the reception of screws 10 so that a cover 11 may be secured to the base 7, as indicated in Figs. 5 and 6. Upon the base 7, there is mounted in any suitable manner, as by means of screws 12 and 13, a U-shaped laminated soft iron core 14, having legs or pole pieces 15 and 16. The pole pieces 15 and 16 are provided with end protecting members 17 and 18, respectively, of suitable non-ferrous material for preventing the "freezing" or sticking of the vibrating member to the legs or poles 15 and 16. A tuned circuit is now provided including inductance and capacity elements either of which may be varied

so that the circuit may be periodically rendered resonant and non-resonant. The inductance elements comprise a pair of coils 19 and 20 wound upon the legs 15 and 16, respectively, of the core 14 and arranged to be energized from a suitable source of alternating current (not shown) by means of the leads 21 and 22, which connect the coils to terminals or binding posts 23 and 24, respectively. The terminals 23 and 24 are carried by a terminal block 25, of suitable insulating material secured to the base 7 in any suitable manner as by means of screws 26. Cooperating with and adapted to be attracted by the pole pieces 15 and 16 upon energization of coils 19 and 20 for varying the impedance of the latter is an armature 27 consisting of soft iron laminations and is secured to a swivel rod 28 in any suitable manner, as by means of a clamp plate 29 and a screw 30.

The swivel rod 28 is provided for operating the striker or clapper of a gong, as will be pointed out more fully hereinafter, but may be dispensed with in the event that the device is to be employed only as a buzzer, in which event the armature 27 may be pivoted to the base 7 in any other suitable manner.

The armature 27 is normally held away from the pole pieces by means of a coil spring 31 having one end thereof secured to the clamp plate 29 and the other end to an adjusting screw 32 carried by a bracket 33 secured to the base 7. In this position of the armature the inductive reactance of the coils is equal to capacitive reactance of the capacity element and the circuit including said coils and capacity elements is at resonance. The spring 31 holds the armature 27 against a stop 34 which may be adjusted by means of a screw 35 carried by a bracket 36 secured to the terminal block 25, so that the distance of the armature from the pole pieces 15 and 16 may be adjusted for a purpose which will be apparent hereinafter. The capacity element of the tuned circuit comprises a condenser 37 mounted on a bracket 38 secured to the base 7 in any suitable manner, as by means of screws 39 and 40, and connected in series with the coils 19 and 20. The tuned circuit may be designed for any suitable frequency.

It will be apparent that for a given frequency of the supply line from which the device is energized, and with the armature 27 in the open position shown in Fig. 1, the tuned circuit including the condenser 37 and the coils 19 and 20 will be at resonance, as pointed out above, when the inductive reactance of the coils is equal to the capacitive reactance of the condenser, and at such time a maximum current will flow through the coils thereby attracting the armature 27. However, upon the attraction of the armature 27 the impedance of the coils is immediately greatly increased by virtue of the change or reduction of the air gap between the pole pieces and the armature, thereby throwing the circuit out of resonance, and so offering an extremely high impedance to the flow of current in the coils 19 and 20. Upon the decrease of current in said coils the magnetic field of the pole pieces 15 and 16 is decreased, whereby the spring 31 then pulls the armature 27 away from the pole pieces and the circuit is again restored to resonance, thereby increasing the current flow through the coils and again attracting the armature 27, which in turn again reduces the current flow in the coils and the cycle of operation thus goes on continuously so that the armature 27 is set into vibration.

The operation will be more clearly apparent

from the graphical representation shown in Fig. 4, which represents a resonance curve plotted in terms of the distance of the air gap between the armature and coils as the abscissae and the current in the coils as the ordinates. The current is represented as i and is a maximum when the armature 27 is positioned from the pole pieces 15 and 16 a distance x . Therefore, it will be seen that as the distance between the armature and the pole pieces is decreased, which happens when the armature is attracted by the pole pieces and moved against said pole pieces so that the distance of the air gap is zero, the current in the coils will be a minimum, this minimum being indicated by the point i_m .

The frequency of vibration of the armature 27 is entirely independent of the frequency of the current flowing through the coils 19 and 20 and depends solely upon the tension of the spring 31 and to a slight extent upon the distance that the armature has to travel between the stop 34 and the pole pieces due to its inertia. The tension of the spring 31 must be overcome by the magnetic attraction of the armature by the pole pieces. Therefore the frequency of vibration of the armature may be readily changed by turning the adjusting screw 32 to vary the tension on the spring 31.

The resonance point of the circuit including the coils 19 and 20 and the condenser 37 will of course be changed when an alternating current having a different frequency is employed and, therefore, novel means are provided whereby the circuit may be easily adjusted to resonance at the new frequency by adjusting the initial distance of the armature 27 from the pole pieces 15 and 16 and in the form shown said means comprise the adjusting screw 35 which moves the stop 34 further from or closer to the pole pieces. The adjustment of the stop 34, and hence the distance of the armature 27 from the pole pieces, in effect tunes the circuit because the changing of the air gap changes the impedance of the coils. It will therefore be seen that the device may be adjusted so that the armature 27 can vibrate at any frequency independent of the frequency of the alternating current, and the device may also be adjusted to operate effectively from an alternating current of any frequency, since the energizing circuit may be tuned to resonance at any frequency.

Thus far, the invention described constitutes a device generally known as a buzzer, and may be used as such, but in the present embodiment, the armature has been arranged to operate the striker or clapper of a bell. For this purpose the swivel rod 28 is journaled in bearings 41 and 42 and extends through the base 7 and is provided with an extension 43 at right angles thereto, upon which is secured a striking ball 44 which, when actuated, strikes the bell or gong 45, the latter being secured to the base 7 by the support 46. From the latter arrangement it will be seen that when the armature 27 is vibrated, it will in turn rock the swivel rod 28 in its bearings, thereby imparting an oscillating motion to the striking arm 43 which carries the ball 44 so that the latter rings the gong.

There is thus provided a novel buzzer or bell adapted to be operated from alternating current, which is relatively simple in construction and arrangement of parts, and in which permanent magnets and electrical contacts are eliminated, thereby prolonging the life of the device, since none of the working parts are susceptible to

deterioration by burning due to arcing, which is generally produced in devices employing contacts.

Novel means are also provided for adjusting the device so that it can operate on an alternating current supply having any frequency, and means are also provided whereby the frequency of vibration of the armature of the device may be adjusted to any desired value, which value is independent of the frequency of the alternating current supply.

Although only one embodiment of the invention has been illustrated and described, other changes and modifications, which will now appear to those skilled in the art, may be made without departing from the scope of the invention, as for example, any other suitable means might be employed for adjusting the frequency of vibration of the armature and for tuning the device so that it may be adapted to operate on alternating currents of different frequencies. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A signal device including a core, a pair of coils wound on said core, an armature associated with said coils for attraction by the latter and forming a closed magnetic circuit with the core when attracted by the coils whereby the reactance of said coils is varied, an alternating current circuit including said coils and a condenser whereby said circuit is tuned to a predetermined frequency, said circuit being resonant when the armature is away from the coils and the magnetic circuit of the core is open thereby causing a relatively large current to flow through said coils and causing the latter to attract said armature whereupon the circuit is rendered non-resonant and the current in said coils decreased, means for pulling said armature away from the coils to open the magnetic circuit of the core when the circuit is non-resonant whereby resonance is again established and the armature set into vibration, means for adjusting the position of the armature with respect to the coils to establish the resonance point of the circuit in relation to the frequency of the current employed to energize said coils, and means for adjusting the frequency of vibration of the armature to any desired value independent of the frequency of the circuit.

2. A signal device comprising a core, a pair of coils wound on said core, an armature associated with said coils for attraction by the latter and forming a closed magnetic circuit with the core when attracted by the coils whereby the reactance of said coils is varied, an alternating current circuit including said coils and a condenser whereby said circuit is tuned to a predetermined frequency, said circuit being resonant when the armature is away from the coils and the magnetic circuit of the core is open, thereby causing a relatively large current to flow through said coils and causing the latter to attract said armature whereupon the alternating current circuit is rendered non-resonant and the current in said coils decreased, means for pulling said armature away from the coils to open the magnetic circuit of the core when the alternating current circuit is non-resonant whereby resonance is again established and the armature set into vibration, and means for adjusting the position of the armature with respect to the coils to establish the resonance point of the alternating current circuit in relation to the frequency of the current employed to energize said coils.

3. A signal device comprising a core, a winding on said core, an armature associated with said core for attraction by the latter and forming a closed magnetic circuit with the core whereby the reactance of said winding is varied, an alternating current circuit including said winding and a condenser whereby said circuit is tuned to a predetermined frequency, said circuit being resonant when the armature is away from the core and the magnetic circuit of the core is open thereby causing a relatively large current to flow through said winding and causing the core to attract said armature whereupon the alternating current circuit is rendered non-resonant and the current in said winding decreased, means for pulling said armature away from the core to open the magnetic circuit thereof when the alternating current circuit is non-resonant whereby resonance is again established and the armature set into vibration, and means for adjusting the position of the armature with respect to the core to establish the resonance point of the alternating current circuit in relation to the frequency of the current employed to energize said winding.

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