Sept. 12, 1967 JEAN-MARCEL STAMPFLI 3,341,841

ELECTRONIC BUZZER

Filed July 26, 1965

FIG.1

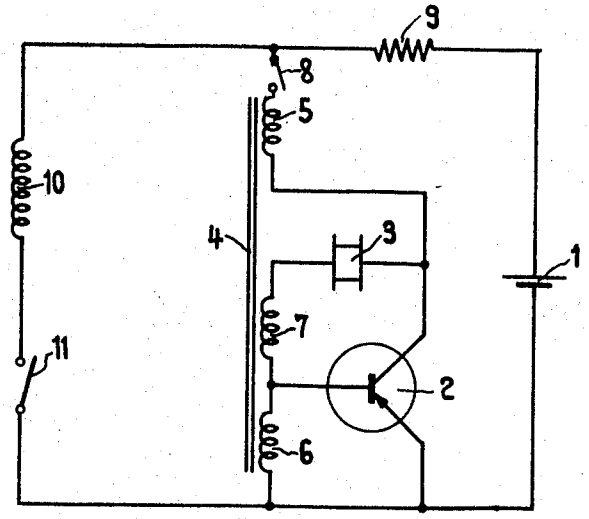
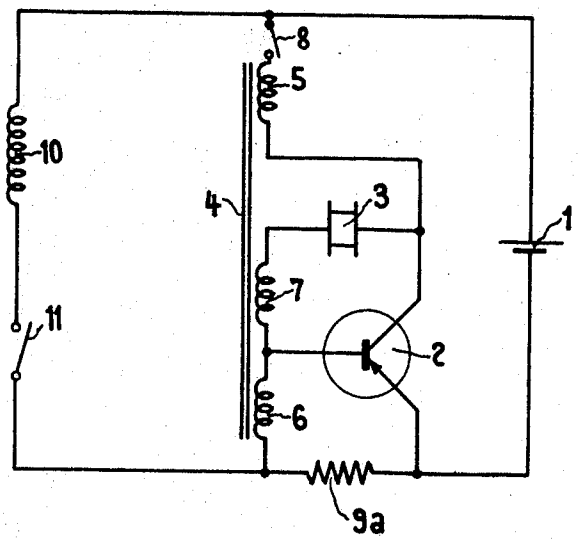


FIG.2



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ELECTRONIC BUZZER

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9 Claims. (Cl. 340—384)

ABSTRACT OF THE DISCLOSURE

An electronic buzzer for time-keeping instruments comprising an electronic oscillator, an electro-acoustical transducer fed by said oscillator for producing an acoustical signal at the frequency of the oscillator and means operable by a timepiece for modulating the oscillator frequency.

This invention relates to an electronic buzzer for time-keeping instruments, particularly alarm clocks and the like, comprising an electronic oscillator and an electro-acoustical transducer energized by said oscillator.

In order that such an electronic buzzer may be used in an alarm clock or similar small time-keeping instrument, the buzzer should be able to produce a sufficiently loud and striking acoustical signal by means of a simple and cheap apparatus of small size. In order to meet with these requirements the buzzer according to this invention broadly comprises a feed-back transformer in said oscillator, said feed-back transformer having a primary and secondary feed-back winding series-connected in the same sense of winding in the circuit of said electro-acoustical transducer, a timepiece and modulating means operable by said timepiece for modulation of the frequency of said oscillator. By the series-connection of the primary and secondary feed-back winding into the circuit of the transducer, a relatively high voltage at the terminals of the transducer and consequently a relatively high power is produced by means of windings also required for the oscillator operation. Due to the modulation of the frequency of the acoustical signal, a sufficiently striking signal is obtained even with small power and with small dimensions of the buzzer.

Two embodiments of the invention will now be explained by way of example with reference to the drawings wherein—

FIG. 1 is a circuit diagram of a buzzer of which the frequency may be modulated by modulating the operating voltage, and

FIG. 2 is a circuit diagram of a buzzer of which the frequency may be modulated by modulating the base-emitter bias voltage of the transistor of the oscillator.

The circuit shown in FIG. 1 has an energy source **1**, a transistor **2**, an electro-acoustical transducer of the piezo-electric type **3** and a feed-back transformer **4** comprising primary and secondary feed-back windings **5** and **6** respectively and a third winding **7**. The transistor circuit may be connected to the energy source by means of a switch **8**. This switch may be actuated by the timing mechanism of an alarm clock in a manner well known in the art. Windings **5–7**, switch **8**, source **1** and transducer **3** are series connected so that the sum of the voltages induced in windings **5** to **7** appears at the terminals of transducer **3**. The winding sense of all windings **5** to **7** is the same. Elements **1**, **5** and **8** are connected into the emitter-collector circuit of transistor **2**. The secondary feed-back winding **6** is connected into the base-emitter circuit of transistor **2**. A resistor **9** is connected between source **1** and winding **5**. A bypass circuit bridging the emitter-collector circuit of the transistor may be opened and closed by a switch **11** series-connected with a choke **10**. The choke **10** may be formed by a coil of an electromagnetic system for sustaining the oscillation of a balance wheel, pendulum or similar oscillating member in a manner well known in the art. The switch **11** may be operated by the balance wheel, pendulum or other oscillating member for periodically producing the current pulses in coil **10** proper for sustaining the oscillation. The switch **11** schematically shown in the drawing may also be replaced by an electronic switch, for instance a transistor in a manner also well known in the art and as disclosed, by way of example, in U.S. Patent No. 2, 961,-587.

When the switch **8** is closed, a small current flows in the transistor **2**. By this small current flowing in winding **5** a voltage is induced in winding **6** by which the base of transistor **2** becomes more negative. The current in the emitter-collector circuit thereby increases and the potential at the base is further reduced until the saturation current of transistor **2** is attained and the voltages and currents break down in a manner well known in blocking oscillators. By the sudden break-down of current in winding **5** considerable voltage peaks are induced in windings **5** to **7** of transformer **4**. Since these windings are series-connected with the same winding sense, the voltage peaks induced in all windings are additively applied to the transducer **3**. Obviously the circuit is unstable so that the phenomenons set out above periodically occur at the frequency determined by the characteristics of the transistor **2** and of the transformer **4** and by the operating voltage of the transistor.

Since the frequency of the oscillator depends on the operating voltage, the oscillator frequency may be modulated by changes of the operating voltage. This is possible by opening and closing switch **11** for instance in the manner described above. When switch **11** is closed a direct current flows through choke **10** whereby the voltage drop in resistor **9** increases. The operating voltage is reduced whenever the switch **11** is closed whereby modulation of the oscillator frequency is obtained in accordance with the opening and closing cycle of switch **11**.

In FIG. 2 similar elements are designated by the same reference numbers as in FIG. 1. Instead of a resistor **9** in the emitter-collector circuit of the transistor, a resistor **9***a* is connected into the base-emitter circuit of transistor **2**. When switch **11** is closed, the current flowing through choke **10** produces a voltage drop in resistor **9***a* whereby the base-emitter bias voltage is changed, this causing a change in oscillator frequency. The oscillator frequency may thus be modulated by opening and closing switch **11**.

In many applications the voltages induced in windings **5** and **6** are sufficient for properly energizing the transducer **3**, in which case winding **7** may be omitted.

What is claimed:

1. An electric buzzer for time-keeping instruments, particularly alarm clocks and the like, comprising an electronic oscillator and an electro-acoustical transducer energized by said oscillator, a feed-back transformer in said oscillator, said feed-back transformer having a primary and secondary feed-back winding series-connected in the same sense of winding in the circuit of said electro-acoustical transducer, a timepiece and modulating means operable by said timepiece for modulation of the frequency of said oscillator.

2. A buzzer according to claim **1**, wherein said oscillator comprises a transistor, the frequency of the oscillator being determined by the characteristics of the transistor and of the transformer and by the operating voltage of the transistor, said modulating means comprising means for modulating the operating voltage of said transistor.

3. A buzzer according to claim **2**, comprising a switch

operable by said timepiece and a choke series-connected with said switch in a bypass circuit bridging the emitter-collector circuit of said transistor, a battery and a resistor series-connected with said battery, the current and voltage drop in said resistor being increased and the operating voltage reduced when current flows in said bypass circuit upon closure of said switch.

4. A buzzer according to claim 1, wherein said oscillator comprises a transistor, the frequency of the oscillator being determined by the characteristics of the transistor and of the transformer and by the bias voltage at the base of the transistor, said modulating means comprising means for modulating the bias voltage at the base of the transistor.

5. A buzzer according to claim 4, comprising a switch operable by said timepiece and a choke series-connected with said switch in a bypass circuit bridging the emitter-collector circuit of said transistor, a battery connected to said bypass circuit and to said emitter-collector circuit, a resistor series-connected into said bypass circuit, the resistor terminals being connected to the base and emitter respectively of the transistor, the voltage drop in said resistor and the base bias voltage at the base of the transistor being changed when current flows in said bypass circuit upon closure of said switch.

6. A buzzer according to claim 5, wherein said choke is a coil for electromagnetically sustaining the oscillation of a balance wheel and said switch is controlled by the balance wheel of said timepiece.

7. A buzzer according to claim 1, comprising a piezo-electric transducer.

8. A buzzer according to claim 1, comprising a third winding on said transformer having the same sense of winding as the primary and secondary windings and series-connected into the circuit of said electro-acoustical transducer.

9. An electronic buzzer for time-keeping instruments, particularly alarm clocks and the like, comprising an electronic oscillator and an electro-acoustical transducer energized by said oscillator, an amplifying element and a feed-back transformer in said oscillator, the frequency of said oscillator being determined by the characteristics of said transformer and amplifying element respectively and at least one operating voltage of the amplifying element, said feed-back transformer having a primary and secondary feed-back winding series-connected in the same sense of winding in the circuit of said electro-acoustical transducer, a timepiece and modulating means operable by said timepiece for modulation of the frequency of said oscillator.

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