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SLOW-BEAT EMERGENCY MAGNETICALLY VIBRATED ALARM

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Fig. 1.

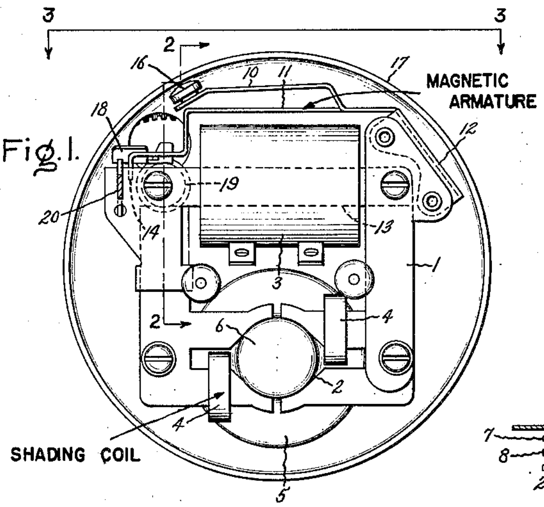


Fig. 2.

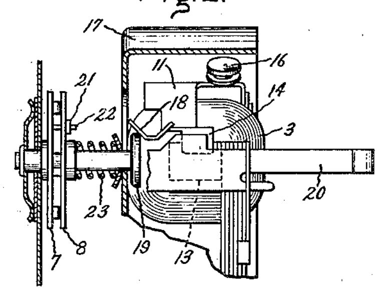


Fig. 3.

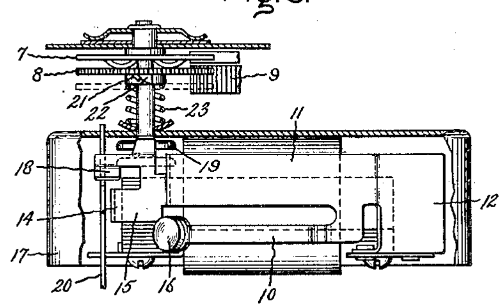
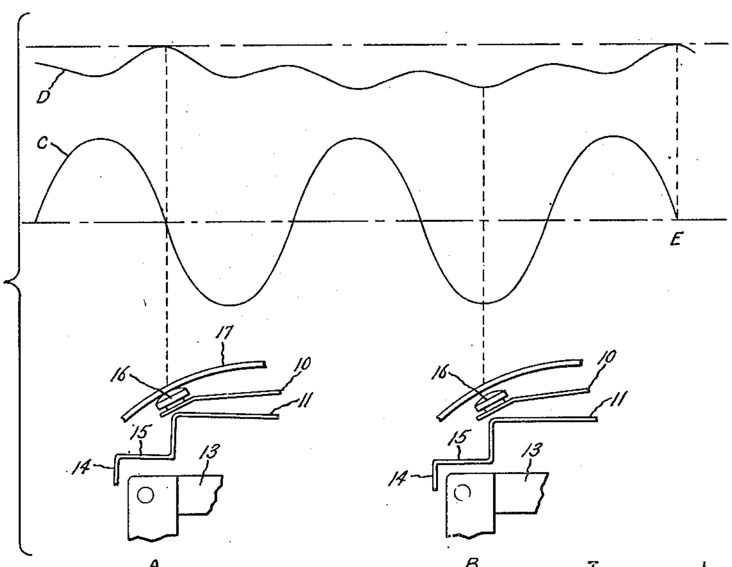


Fig. 4.



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SLOW-BEAT EMERGENCY MAGNETICALLY VIBRATED ALARM

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3 Claims. (Cl. 177—7)

1

Our invention relates to vibrator type alarms, such as are employed on synchronous motor-driven clocks and operated by leakage alternating flux from the clock-driving motor, and it is the object of our invention to provide an alarm of this type which has an effective rate of vibration which is substantially slower than the rate of the flux pulsations producing such vibration in order to produce a more pleasant sounding alarm.

The features of our invention which are believed to be novel and patentable will be pointed out in the claims appended hereto. For a better understanding of our invention reference is made in the following description to the accompanying drawing in which Fig. 1 is a rear view of a clock motor and alarm bell assembly equipped with our improved vibrator alarm mechanism. Fig. 2 is a sectional side view taken on line 2—2 of Fig. 1. Fig. 3 is a top view taken of Fig. 1 with the upper portion of the alarm bell broken away. Fig. 4 is explanatory of the vibrator action of our device in relation to the flux pulsations.

Referring now to the drawing and, first, primarily to Fig. 1, 1 represents the magnetic stator structure of a self-starting synchronous electric motor of the general type disclosed in United States Patent No. 1,495,936. Such stator contains an armature air gap at 2 and a single-phase energizing coil 3 on the yoke. The coil produces an alternating flux in the core and across the gap. The pole pieces adjacent the gap are of the shaded type, 4 indicating the shading coils so as to produce a rotating magnetic field in the armature air gap. The motor rotor is contained in a sealed gear reduction and lubricating chamber 5 having a reduced portion 6 containing the rotor which is fitted into the air gap. So far as our invention is concerned, the motor may be of any alternating current type or, in fact, may simply be an alternating current electromagnet. The clock gear train and features of the clock not concerned with the present invention are not shown, although a suitable alarm release cam mechanism is shown at 7 and 8, Figs. 2 and 3, and the part 8 is driven from the clock motor through gearing, part of which is shown at 9.

The vibrator of our alarm comprises the parts 10 and 11 which may be made from a single piece of resilient magnetic material. The part 11 is the armature. It has a bent over part 12 at one end which is bolted or riveted to some stationary part of the structure 1 of the motor

2

near one end of the yoke or core portion 13 on which coil 3 is wound, and extends over the coil to the vicinity of the other end of such core part. The supporting part 1 does not necessarily need to be of magnetic material. The last-mentioned end, designated 14, of the armature shown is free to vibrate and has three right angle bends therein as best shown in Fig. 4, designed to produce a more nearly constant air gap with respect to this end of the core 13 for different vibratory positions of the armature than is the case with the usual type of vibratory armature of the prior art.

Thus, in Fig. 4 at A, the armature 11 is represented in substantially its farthest position from the core 13, and at B at substantially its nearest position to the core 13. However, the turned down end part 14 of the armature has essentially the same minimum air gap spacing with respect to the end of core part 13 in both positions A and B, and the horizontal spacing between part 14 and the end of core part 13 is essentially the minimum air gap spacing of any part of this end of the armature in all armature positions. Thus, the air gap spacing between part 14 and the core 13 is approximately the same or slightly less than the air gap spacing between the horizontal part 15 and the core 13 when the armature approaches closest to the core at Fig. 4B. This is important to the manner of operation of the armature as will be explained. The part 10 of the vibrator, while it may be magnetic, does not carry any controlling leakage flux but serves merely as a resilient striker part and has a hammer button 16 which may be integral or riveted to its free end for striking against the inside of the bell 17.

Another end branch 18 of the armature shown has beveled surfaces for cooperating with an automatic alarm release member 19 and a manual alarm shutoff slider cam 20. In Fig. 2 the armature 11 and its end branch 18 are released for alarm sounding vibration. When the automatic alarm release member 19 is moved to the right in Fig. 2, it raises part 18 and prevents the armature from vibrating. Such non-vibrating position of part 19 is shown in dotted lines in Fig. 3. When the manual alarm shutoff slider 20 is moved to the left in Fig. 2, it raises armature 11 and its branch 18 and prevents vibration. These alarm control devices, when in their alarm shutoff positions, move beneath the lowest portion of the branch 18 and raise the complete armature and prevent its audible vibration. Both the automatic release part 19 and the manual shutoff part 20 may be in the armature raising position at the same time because as shown in Fig. 1, they are offset from each other horizontally so as not to interfere with each other. Any shutoff means, other than that described, could be employed. The automatic alarm gear 8 is driven by the motor in accordance with clock time one revolution per 12- or 24-hour day, and gear 8 has a cam slot opening punched therethrough at one point between its periphery and axis. The punched out part for such opening may be seen at 21 in Figs. 2 and 3. The cam member 7 may be in the form of a gear. It is normally stationary but may be rotatively set manually to a position corresponding to the time when it is desired to automatically sound the alarm. Such cam wheel or gear 7 has a cam finger projecting from one side toward gear 8 on the radius of the opening at 21 punched therethrough. This cam finger may be seen at 22 in Figs. 2 and 3. When the slot rotates in line with the cam finger, the latter will enter the slot and release the alarm. This is the condition of the parts shown in Figs. 2 and 3 in full lines. A compression spring 23 moves the gear 8 and member 19 to alarm release position (from dotted lines to full lines in Fig. 3) when the time for the automatic alarm arrives.

The shape of cam parts 21 and 22 is such that the gear 8 can be driven and the automatic release returned to shut off the alarm automatically after a suitable time interval. Other forms of alarm release and shutoff devices may be employed with our invention, which is primary concerned with the design and arrangement of the armature to obtain an effective alarm striking rate appreciably slower than the frequency of the flux pulsations causing the vibration, as will now be more fully explained.

It will be evident from the description of the armature structure and motor core arrangement that when the motor is energized with alternating current, the magnetic armature part 11 will intercept some leakage flux between the ends of the core part 13 and tend to cause such armature to vibrate at a rate corresponding closely to the flux pulsations which in a 60-cycle motor will be 120 vibrations per second. In the usual alarm clock of the magnetic vibrator type the armature or hammer part thereof strikes against some sounding device at or near the flux pulsation vibration rate and while this is usually effective as an alarm device, the resulting sound pulsations are so frequent that the sound is not particularly pleasant and might be described as a harsh buzz. Our alarm armature vibrates at or near the flux pulsation rate but its resilient arm and hammer strikes the bell or other sounding device at a substantially slower rate, for example, every fourth or fifth flux pulsation. The vibratory movement of our armature is of relatively high amplitude which is possible due to the relatively constant armature air gap maintained between parts 14 and 13 than in vibrator alarms heretofore used.

Superimposed on this high amplitude vibration at the high flux pulsation frequency rate is another vibration of greater amplitude and lower effective frequency that is due to the bouncing of the resilient armature away from the bell or other sounder so that it does not again approach within striking distance of the bell for several of its higher rate vibrations. We have sought to picture this action in Fig. 4. In such figure the larger amplitude sine wave curve C

may represent the 60-cycle flux pulsations of the motor which cause the armature to vibrate magnetically. The wave shown at D represents the vibratory action of the striking arm of our armature. It has two wave components, one which is greater than the frequency of wave C and another which is less than the frequency of wave C. At point A the hammer strikes the bell 17 when the flux is at or near zero and the armature is moving away from the motor field core. This causes the armature to bounce away from the bell. This bounce energy is first conveyed to the resilient upper part 10 and then to the lower armature part 11 of the combined armature assembly. Both parts 10 and 11 of the vibrator take part in both vibration components.

The bounce frequency is much slower than the magnetic pulsation frequency, and the weight and resiliency of the armature assembly largely determine this. As a result, the hammer of the armature assembly does not return to within striking distance of the bell at the same cyclic rate of wave C. The strike beat rate is slower than the cyclic rate of the magnetic field. In the meantime the complete vibrator has been vibrated by the intervening plus and minus flux pulsations, and during the pictured second and third intervening flux pulsations has approached closest to the motor core 13, B representing approximately one of the closest of such positions. The hammer will strike the bell again at time E when it is moving away from the core, when the flux is at or near zero value, and will then receive another bounce impulse. The normal position of the armature parts is approximately as indicated in Fig. 1, when the motor is deenergized and the armature is free to vibrate but not vibrating. At this time the hammer 16 is spaced a small distance from bell 17 such that if now vibrated magnetically, it will strike the bell when moving towards the same. When the motor is energized and the vibrator is free to vibrate, it will start to vibrate at or near the leakage flux frequency. When the hammer strikes the bell, it receives a bounce impulse which imparts to the armature a lower frequency vibration component which produces the low frequency striking action described and upon which the higher frequency flux pulse component is superimposed. When first assembled in the idle position, one or both vibrator parts 10 and 11 may require slight adjustment by bending to obtain the best results. The bell striking vibration rate can be changed by changes in the weight, resiliency, geometry and magnetic air gap relation employed. In a 60-cycle alarm clock we have found it feasible to obtain a well striking vibration rate of approximately ¼ or ⅕ of the frequency pulse rate.

Another important feature of our invention is that the more desirable slow-beat alarm sound described is not impaired by the armature striking against the magnetic core part of the motor since a constant armature air gap permits large and more remote amplitude of vibration of the armature. As represented in Fig. 4 at B, the armature parts 14 and 15 preferably do not strike against the core in their nearest approach thereto. While it might be possible to obtain the slow-beat bell striking action if the armature is allowed to strike against the core 13 or some other part when it is farthest from the bell, we consider this would be undesirable because it would produce another sound different from and less pleasing than that of the bell which would detract from the clarity of the bell sound. Also, if the armature were allowed to strike against the armature core, the minimum air gap relation between armature and core for different armature positions would no longer be nearly constant, and the benefit gained in this respect by reason of the end armature part **14** would be largely nullified. The preferred arrangement is to have the armature part **14** move essentially parallel to the nearest part of the core during armature vibration, and the spacing between it and the core to represent the minimum air gap or at least one of the minimum air gaps between any part of the armature and magnetic core for all vibratory armature positions. By such arrangement the effective air gap between armature and core is in general much more nearly uniform over the vibration range than in previous magnetic vibrators, and the high rate magnetic pulse vibration amplitude of the armature is of a magnitude where it is in proper proportion to the bounce impulses imparted thereto to obtain the slow-beat bell striking result described. A pleasing, clear-ringing bell alarm results. The blow against the bell by the hammer part **16** is relatively light and quick, and the bell tone is not muffled by prolonged contact with the hammer.

While we have represented a bell as the sounding device, other forms of sounders may also be used.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A vibrator type alarm comprising a magnetic core, an alternating current winding for magnetizing said core, a sounder such as a bell, a vibrator having a resilient magnetic armature arm with one end secured in fixed relation to said magnetic core but otherwise being free to vibrate and extending adjacent said core between it and said sounding device so as to be vibrated toward and away from said core by and in response to the leakage flux from said core, said armature arm having a portion adjacent its free end which moves substantially parallel to the nearest adjacent portion of the core when vibrating and which determines the minimum air gap between the core and the free end of the armature such that the flux vibration impulses conveyed to the armature are of sufficient magnitude to permit the vibration of the free end of the armature over wide amplitudes, said vibrator also having a resilient hammer arm secured to the armature arm such that the vibrations of one are largely conveyed to the other, said vibrator having a stationary free position closely adjacent to but out of contact with the sounder such that if the armature arm is then vibrated in response to flux pulsations the hammer arm will strike the sounder as the arms move away from the core and toward the sounder, and when the sounder is thus struck the vibrator then bounces away from the sounder and is vibrated by several flux pulsations before returning to sounder striking position.

2. A slow-beat magnetic type vibrator audible alarm device comprising an alternating current electromagnet, a sounder, and a vibrator member said vibrator member having a resilient magnetic armature arm fixed at one end with respect to the electromagnet and with its other end free to vibrate and extending in a leakage flux path

of the electromagnet so as to be vibrated by and in synchronism with the flux pulsations therefrom when the electromagnet is energized, said vibrator member also having a resilient hammer arm secured to the armature arm such that if one arm is vibrated such vibrations are largely conveyed to the other arm, said vibrator member having a normal position out of contact with the sounder but such that if started into vibration by energization of the electromagnet the hammer arm will strike the sounder and rebound therefrom giving to the vibrating resilient arm member a vibratory motion having a larger effective amplitude and greater time period than the magnetic vibratory motion of the complete armature, said two vibratory motions being superimposed on the vibrator member such that the hammer arm strikes the sounder at a frequency which is a fraction of the frequency of the flux pulsations which produce magnetic vibration.

3. A vibrator alarm device comprising an alternating current electromagnet, a vibrator having a resilient magnetic armature part secured at one end with respect to a magnetic core portion of said electromagnet and extending generally parallel and to one side of such core part and having a free end approaching the core and positioned to be vibrated toward and away from such core in synchronism with the alternating flux pulsations of said electromagnet by leakage flux therefrom when the electromagnet is energized, such free end of the armature part and the adjacent core part being so shaped and related that in vibrating, such armature end moves substantially parallel to the nearest core part such that a nearly uniform minimum air gap exists between such parts in all vibratory positions of the armature, a bell, a resilient hammer part secured to said armature part and located between the bell and armature part and constituting a portion of the vibrator, said armature and hammer parts vibrating substantially in unison when either is vibrated, said vibrator having a free nonvibrating position where the hammer part is spaced from the bell such distance that when the vibrator is then vibrated magnetically the bell will be struck when moving away from the core and toward the bell, such bell striking action producing a rebound of the vibrator which imparts to it a vibratory action of greater magnitude and of lower frequency than that of its magnetic vibration, whereby when said electromagnet is energized the magnetic vibratory impulses of one frequency and the rebound vibratory impulses of a lower frequency are imparted to the vibrator causing it to vibrate with two superimposed vibratory motions and to strike only the bell and only at said lower frequency rate.

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