

AUTOMATIC BABY CRADLE

The invention relates to an automatic baby cradle for producing a repetitive motion, for instance for soothing a baby or assisting to induce a state of sleep.

According to the invention, there is provided an automatic cradle comprising attachment means for attachment to a baby carrying means, said attachment means including a ferromagnetic armature; a drive means for imparting repetitive oscillatory motion to the attachment means, said drive means including an electromagnet for cooperating with the armature, whereby said armature comprises a first portion which is opaque and a second portion which is transparent, and a means for emitting and a means for receiving light defining therebetween a light path for intersection by the armature.

The drive means may include a spring connected to the armature and means for repetitively actuating the electromagnet so as to displace the armature against the restoring force of the spring. The actuating means may comprise a transducer for detecting the position of the armature and control means for supplying power to the electromagnet when the armature is within a

predetermined range of positions relative to the electromagnet. The actuating means may include a first timer for disabling the drive means if power is supplied to the electromagnet for more than a predetermined period. The drive means may include variable power supply means for supplying a selectable amount of power to the electromagnet.

The invention will be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a part cross-sectional side-view of the mechanical parts of an automatic baby cradle constituting a preferred embodiment of the invention;

Figure 2 is a part cross-sectional side-view of a second embodiment;

Figure 3 is a cross-sectional through the line A-A in figure 2; and

Figure 4 is a circuit diagram of the electronic parts of the automatic baby cradle.

As shown in Figure 1 of the drawings, the baby cradle includes a housing 1, for instance made of stainless steel, provided with a screw lock arrangement 2 for

fixing the housing so that it is immobile. The housing contains an electromagnet in the form of a coil whose windings are shown at 3. A connector 4 provides connection to the coil 3 and to a displacement transducer comprising a light emitting diode 5 and a photosensor 6, such as a phototransistor or light dependent resistor.

The coil 3 cooperates with an armature 7 made of ferromagnetic material, such as mild steel. The upper end of the armature is provided with a hook or D-shackle 8 engaging a lower end of a helical spring 9, whose upper end is connected to a fixed member 10, such as a ceiling or a floor-mounted frame.

The lower end of the armature is extended by a first portion 11 made of a substantially transparent material, such as transparent nylon, and a portion 12, for instance made of aluminium. The whole armature thus has three portions and is rod-like in shape with the lower end provided with a hanger 13 or a D-shackle and hanger 13, from which a support for a baby such as a cradle may be suspended. A marking line 14 is provided on the portion 12 to indicate the relative starting position of the armature with respect to the housing 1.

The second embodiment shown in figures 2 and 3 have like

parts referenced with the same reference numeral as in figure 1.

The second embodiment differs in that instead of having a transparent portion 11, parts 11 and 12 are both formed from an opaque material, such as aluminium, and have a window 15 disposed therein. The light emitting diodes 5 and photosensors 6 are disposed around the shaft 11, 12 as shown in figure 3.

This embodiment is simpler to manufacture, merely requiring the formation of the shaft from one material and providing the window. The light emitters and receivers are also disposed so as to ensure that the position of the shaft is detectable even if the shaft rotates.

The electronics shown in Figure 4 comprises first and second mains step-down transformers 21 and 22. The secondary winding of the first transformer 21 is connected to a diode rectifier bridge 23 whose output is connected across a reservoir capacitor 24 and to a supply line +12V and a common line -V. The secondary winding of the second transformer 22 has a plurality of taps connected to respective fixed contacts of a switch 25. The moving contact of the switch 25 and the common terminal of the secondary winding of the second

transformer 22 are connected to a diode bridge rectifier 26 whose output is connected across a reservoir capacitor 27 between the common line -V and another supply line +V.

A comparator is formed by a long-tailed pair of Darlington-connected transistors 28 - 31 provided with a tail resistor 32 decoupled by a capacitor 33. The base of the transistor 28 is connected via a circuit point Y and a terminal of a connector 34 to the photosensor 6 shown in Figure 1. The return from the photosensor and from the other electrical parts of Figure 1 is made to the connector 34 via the terminal shown adjacent an earth symbol. The base of the transistor 28 is also connected via an adjustable resistor 35 and a fixed resistor 36 to the supply line +12V. The base of the transistor 30 is connected to a potential divider formed by resistors 37 to 39 connected in series between the common line -V and the supply line +12V.

The collectors of the transistors 30 and 31 are connected to the supply line +12V via a resistor 40 and to the base of a common-emitter connected transistor 41. The emitter of the transistor 41 is connected to the supply line +12V and the collector is connected to one terminal of a resistor 42, whose other terminal is connected to the connection point between the resistors

38 and 39, and via the coil of a relay 43 provided with a suppression capacitor 44 to the common line -V. The relay 43 has a set of normally open contacts which are connected between the supply line +V and a circuit point X connected to a terminal of the connector 34 for connection to the coil 3.

The circuit includes a timer based on a standard integrated circuit known by its type No "555" and available from many sources. The integrated circuit 45 is arranged as a monostable multivibrator provided with a timing capacitor 46. A variable timing resistor 47 is connectable into or out of the circuit by means of a switch 48. A pull-up resistor 49 is connected between the trigger input of the integrated circuit 45 and the supply line +12V. The integrated circuit 45 is provided with a decoupling capacitor 50.

The output of the integrated circuit 45 is connected through the coil of a relay 51, provided with a back-EMF suppressing diode 52, to the supply line +12V. The relay 51 has a set of normally open contacts connected in series with the coil of a relay 54, provided with a back-EMF suppression diode 55, between the supply line +12V and the common line -V. The relay 54 has a set of normally open contacts connected between the common line -V and the common return terminal of the connector 34.

A push-on/release-off switch 56 for starting the automatic baby cradle comprises three terminals connected to the common line -V, the common return terminal of the connector 34, and the trigger input of the integrated circuit 45, and is such that manual actuation of the switch momentarily shorts together these three terminals.

A further timer is provided around the Darlington-connected transistors 57 and 58. The base of the transistor 57 is connected via a capacitor 59 to a local common line 60 and via a parallel-connected resistor 61 and diode 62 to a local supply line 63. The local supply line 63 is connected to the tap of a potential divider formed by series-connected resistors 64 and 65 connected between the local common line 60 and the circuit point X. The emitter of the transistor 58 is connected via the coil of a relay 66, provided with a back-EMF suppression diode 67, to the local common line 60. The relay 66 has a set of normally open contacts connected between the supply line +12V and the timing input of the integrated circuit 45 connected to the timing capacitor 46.

A light emitting diode 68 is connected in series with a resistor 69 between the circuit point X and the local

common line 60. A resistor 70 is connected between the supply line +12V and a circuit point Z which is connected via a terminal of the connector 34 to the sensor light formed by the light emitting diode 5.

Operation of the automatic baby cradle is as follows. A cradle or other suitable support for a baby is suspended from the hanger 13 and, if necessary, the relative heights of the housing 1 and the armature are adjusted so that the marking line 14 is aligned with the lower end of the housing 1. A mains supply is connected across the primary windings of the transformers 21 and 22 so as to activate the cradle. In this initial state, all of the sets of contacts of the relays 43, 51, 54, and 66 are open.

The switch 25 is manually operated so as to select a desired repetition rate by connecting a suitable voltage tap of the secondary winding of the transformer 22 to the bridge rectifier 26. The adjustable resistor 35 has been suitably preset so as to match the sensitivity of the photosensor to the comparator. The switch 48 selects either continuous operation, by disconnecting the variable resistor 47, or timed operation by connecting the variable resistor 47, which is manually adjusted to select the desired period of operation up to one hour. Operation is then actuated by pressing and

releasing the switch 56 which temporarily short-circuits the set of contacts of the relay 54 and triggers the monostable multivibrator formed by the integrated circuit 45. The low power relay 51 is thus actuated so that its contacts are closed and the higher power relay 54 is actuated to close its contacts. Until the timer formed by the integrated circuit 45 is reset or timed out, the local common line 60 is connected via the contacts of the relay 54 to the common line -V, thus connecting the return line connected to the common terminal of the connector 34 to the common line -V.

Initially, the opaque portion 12 of the armature interrupts the light path between the light emitting diode 5 and the photosensor 6. The adjustable resistor 35 is preset so that, under these conditions, the voltage at the base of the transistor 30 is higher than the voltage at the base of the transistor 28. The transistors 30 and 31 therefore conduct and activate the relay 43 via the transistor 41. Power is therefore supplied to the coil 3 which attracts the ferromagnetic armature 7 and draws it downwardly through the housing 1 at a rate set by the switch 25. Also, conduction of the transistor 41 raises the voltage at the base of the transistor 30, which voltage is used as a reference with respect to which the voltage at the base of the transistor 28 is compared.

When the transparent portion 11 of the armature moves into the light path between the light emitting diode 5 and the photosensor 6, the voltage at the base of the transistor 28 rises above that at the base of the transistor 30. The transistors 30 and 31 are switched off and hence the relay 43 is de-activated via the transistor 41. The contacts of the relay 43 open so as to de-energise the coil 3. The armature thus moves vertically under the action of the spring 9 until the light path is again interrupted by the second portion 12, at which time the cycle of operation is repeated. Whenever power is supplied to the coil, the light emitting diode 68 is energised to provide a visual indication of operation.

During normal operation of the cradle, the capacitor 59 is alternately charged and discharged via the resistors 61 and 65; the diode 62 preventing excess reverse voltage appearing across the base-emitter junctions of the transistors 57 and 58. However, if a fault develops such that power to the coil 3 is not switched off after 30 seconds, the capacitor 59 is charged to a voltage sufficient for the transistors 57 and 58 to conduct. The relay 66 is thus activated and its contacts reset the timer by connecting the timing input of the integrated circuit 55 to the supply line +12V. When

this happens, the output of the integrated circuit 45 is disabled so that the relays 51 and 54 are de-activated. The contacts of the relay 54 are thus opened, breaking the supply of power to the coil 3 and disconnecting the light emitting diode and the photosensor. The cradle can then be re-activated by operating the switch 56, preferably after the fault has been cleared. This arrangement avoids damage to the coil by excessively lengthy activation thereof.



CLAIMS: -

1. An automatic cradle comprising attachment means for attachment to a baby carrying means, said attachment means including a ferromagnetic armature; a drive means for imparting repetitive oscillatory motion to the attachment means, said drive means including an electromagnet for cooperating with the armature, whereby said armature comprises a first portion which is opaque and a second portion which is transparent, and a means for emitting and a means for receiving light defining therebetween a light path for intersection by the armature.

2. An automatic cradle as claimed in claim 1 in which the light emitting and receiving means comprises a transducer for detecting the position of the armature and control means for supplying power to the electromagnet when the armature is within a predetermined range of positions relative to the electromagnet.

3. An automatic cradle as claimed in claim 1 or claim 2 in which the drive means includes a spring connected to the armature and means for repetitively actuating the electromagnet so as to displace the armature against the restoring force of the spring.



4. An automatic cradle as claimed in claim 3 in which the actuating means includes a first timer for disabling the drive means if power is supplied to the electromagnet for more than a predetermined period.

5. An automatic cradle as claimed in any one of the preceding claims in which the drive means includes a variable power supply means for supplying a selectable amount of power to the electromagnet.

6. An automatic cradle substantially as hereinbefore described with reference to any one of the figures 1 to

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