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(54) **Electrically heated insoles for footwear and remote control heating system for electrical insoles for footwear**

(57) A wire-free, rechargeable electrically heated insole for footwear. The insole comprises an upper sole and a bottom sole separated by electrical components for controlling the continuous monitoring and heating of the insole. An insert and fiber plane are also provided as a cushion for the electrical components between the upper and bottom soles. The electrical components comprise a printed circuit board electrically coupled with a thermostat, an amplifier and transistor, resistors, and a light emitting diode to form the electrical system. An integrated battery is used to power the system. The insole is designed to be automatically activated to generate heat when the temperature of the foot inside the footwear cools to a certain temperature and automatically de-activated or discontinue generating heat when the temperature of the foot inside the footwear heats to a certain temperature. Alternatively, the electrical insole for footwear may be heated using a remote control heating system comprising a remote transmitter coupled with a receiver and other additional electrical components provided in the sole.

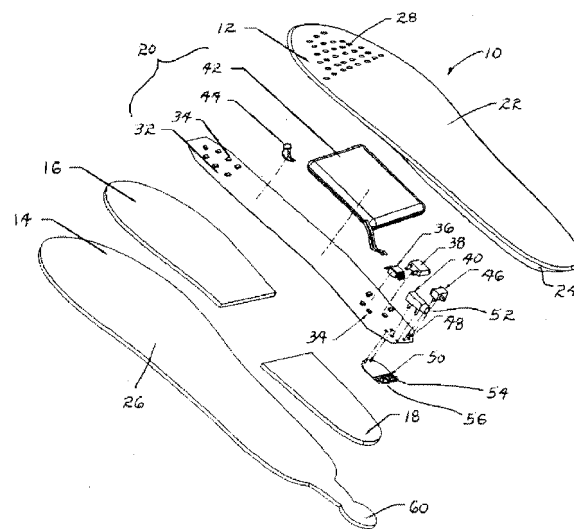


FIG.1

DescriptionFIELD OF THE INVENTION

[0001] The present invention relates to remotely controlling the electrically heating of footwear and, in particular, to a wire-free, rechargeable electrically heated insole for footwear.

DESCRIPTION OF THE PRIOR ART

[0002] Electrically heated insoles for footwear are designed to provide comfort and heat to the foot of a person within their shoe or footwear during the cold weather. One such example is depicted in U.S. Patent 6,657,164 entitled "Customizable Heated Insole" which discloses two heated assembly packages that combine into a kit for making a heated insole for footwear. In one example, a heating element is inserted into a sealable opening in the insole with an extended flexible power cable extending out of the sealable opening and across the length of the insole in a channel formed in the bottom of the insole for connection to a separate battery pack situated outside the footwear, and a rheostat. In certain circumstances, although electrically connected, this separation of components is cumbersome and inconvenient for the user, and the separately exposed battery pack is susceptible to possible damage apart from the insole components. Thus, there is a need and there has never been disclosed an electrically heated insole for footwear that is completely contained and operable within the insole.

SUMMARY OF THE INVENTION

[0003] The present invention is a wire-free, rechargeable electrically heated insole for footwear. The insole comprises an upper sole and a bottom sole separated by electrical components for controlling the continuous monitoring and heating of the insole. An insert and fiber plane are also provided as a cushion for the electrical components between the upper and bottom soles. The electrical components comprise a printed circuit board electrically coupled with a thermostat, an amplifier and transistor, resistors, and a light emitting diode to form the electrical system. An integrated battery is used to power the system. The insole is designed to be automatically activated to generate heat when the temperature of the foot inside the footwear cools to a certain temperature and automatically de-activated or discontinue generating heat when the temperature of the foot inside the footwear heats to a certain temperature. Alternatively, the electrically heated insole for footwear may be remotely controlled by a remote transmitter coupled with various additional electrical components provided in the insole.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The Description of the Preferred Embodiment

will be better understood with reference to the following figures:

Figure 1 is an exploded perspective view of an electrically heated insole for footwear.

Figure 2 is an electrical schematic or circuit board diagram of the components used to operate the electrically heated insole for the footwear.

Figure 3 is an alternate printed circuit board diagram of the electrically heated insole for footwear.

Figure 4 is an exploded perspective view of a transmitter.

Figure 5 is an electrical schematic or circuit board diagram of the components used to operate the transmitter.

Figure 6 is an exploded perspective view of an alternate embodiment of the remotely controlled electrically heated insole for footwear.

Figure 7 is an electrical schematic or circuit board diagram of the components used to operate the alternate embodiment of the remotely controlled electrically heated insole for footwear.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0005] Turning first to Figure 1, there is illustrated an electrically heated insole 10 for footwear. The electrically heated insole 10 comprises an upper sole 12, a bottom sole 14, an insert 16, a fiber plane 18, and a plurality of components 20 for electrically controlling the continuous monitoring and heating of the insole 10.

[0006] The upper sole 12 and the bottom sole 14 are ergonomically designed for forming the insole 10 for insertion into any footwear worn in cold weather. The upper sole 12 is preferably made of a heat preserving synthetic material, fabric lining 22 having a shock absorbing, ergonomically shaped polyurethane heel 24. The upper sole 12 is also provided with a plurality of holes 28 for permitting the heat from the electrical components 20 to pass through the plurality of holes 28 for more directly reaching the toes and foot of the person wearing the footwear. The bottom sole 14 is preferably made of a heat preserving synthetic material, insulating fabric lining 26 designed with heat preserving synthetic material. Alternatively, the upper sole 12 and the bottom sole 14 can be made or designed of any materials known to one skilled in the art provided that they are used in the manner described herein. A tab 30 is also provided which can be used by the person for removing or pulling the insole 10 from the footwear.

[0007] The upper sole 12 is preferably integrally bond-

ed or molded to the bottom sole along their circumference to form the assembled insole 10 with the plurality of electrical components 20 contained there between. Alternatively, the upper sole 12 and the bottom sole may be attached to one another using any means known to one skilled in the art provided that the attachment is sufficient to form an assembled insole 10 for use as described herein.

[0008] In the preferred embodiment, the insole 10 is designed for use within footwear or shoes worn in the colder temperatures that include but are not limited to outdoor footwear, work boots, ski boots, etc... Alternatively, the insole 10 may be used in any footwear or shoe where the foot or feet of the person wearing the shoe is concerned about keeping their foot or feet warm or at least at a normal body temperature. In the preferred embodiment, and as discussed in more detail below, the electrically heated insole 10 is designed to be automatically activated to generate heat when the temperature of the foot inside the footwear drops below 78.8°F or 26°C and automatically de-activated or discontinue generating heat when the temperature of the foot inside the foot wear reaches 98.6°F or 37°C. In this manner, the insole 10 provides a safe and warm temperature range within the footwear for maintaining the warmth of the feet of the person wearing the footwear during the colder temperature weather.

[0009] Alternatively, it is contemplated that the insole 10 could be designed to activate, or generate heat, and de-activate, or discontinue generating heat, at any temperature range. However, any such modification of the temperature range should deactivate prior to any temperatures of the foot becoming too warm which may cause the insole 10 to inflict any pain, burn, or discomfort to the foot of the person and/or should activate prior to any temperatures of the foot becoming too cold causing the insole 10 to inflict or allow pain or discomfort to the foot of the person due to the temperature within the insole 10 or the foot reaching undesired or harmful cold temperatures.

[0010] The insert 16 and the fiber plane 18 are used in combination with the plurality of electrical components 20 to create a cushion with and for assisting in securing the plurality of electrical components 20 between the upper sole 12 and the bottom sole 14.

[0011] One of the electrical components 20 comprises a circuit board 32. In the preferred embodiment, the circuit board 32 is a printed circuit board or PCB that is used to mechanically support and electrically connect the other electrical components 20 using conductive pathways, or traces, etched from copper sheets laminated onto a non-conductive 10 substrate. Alternatively, the circuit board 32 may be any type of circuit board known to one skilled in the art that may be used to accomplish the invention described herein.

[0012] Electrically coupled to the circuit board 32 are an integrated circuit 36, a plurality of resistors 34, a transistor 38, a direct current connector 40, and a battery 42.

The battery 42 is preferably a rechargeable, lithium-ion battery providing 880 milli-ampere per hour, no memory effect, and a holding charge time of substantially 6 to 8 hours. In the preferred embodiment, the integrated circuit 36, the plurality of resistors 34, the transistor 38, the direct current connector 40, a thermostat 44, and the battery 42 are all well known electrical components and include any and all types or variations known to those skilled in the art for use in the manner described herein. Also, electrically coupled to the circuit board 32 is an on/off switch 46 and a light emitting diode 48.

[0013] Prior to use, the battery 42 of the insole 10 should be fully charged. The on/off switch 46 is protected by a soft, rubber protector cap 50. Upon removing this protector cap 50, the on/off switch 50 should be switched or toggled to the "off" position (i.e., as shown in a non-limiting example as being moved in the direction toward the direct current connector 40). An adaptor (not illustrated) is plugged into an electrical outlet (not illustrated) and then an adaptor cable (not illustrated) from the adaptor is then plugged into a charging socket 52 within the direct current connector 40 to begin charging the battery 42. It is recommended that both the left and right insole 10 for a pair of shoes be charged at the same time. This is easily facilitated by the adaptor cable from the adaptor being split into a dual end for connection and charging of both the left and right insole 10 at the same time. It is contemplated that the adaptor may be provided with a light emitting diode to display a red light during charging of the battery 42 which is changed to a green light after charging is complete. The initial charging of the battery 42 of the insole 10 may take approximately 8 hours to be fully charged. After the initial charge, regular charging of the battery 42 should only take approximately 2 hours to be fully charged again. Upon completion of the battery 42 being fully charged, unplug the adaptor and adaptor cable and the insole 10 is ready for use. Alternatively, any other means for charging the battery 42 known to one skilled in the art may be used.

[0014] To begin using the insole 10 and prior to inserting the insole 10 into the footwear, the on/off switch 46 should be switched or toggled to the "on" position (i.e., as shown in the non-limiting example as being moved in the direction toward the direct current connector 40). The soft, rubber protector cap 50 should be reattached for covering the on/off switch 46. In the preferred embodiment, the protector cap 50 has a rectangular and open box wall 54 for 4 containing and protecting the on/off switch 46 when covered. The protector cap 50 is also provided with an adjacent plug 56 for insertion into and protection of the charging socket 52. Alternatively, it is contemplated that any means known to one skilled in the art may be used for covering and protecting both the on/off switch 46 and the charging socket 52 of the direct current connector 40. The insole 10, now after being fully charged for use, may then be inserted into the footwear.

[0015] While the insole 10 is inside the footwear, the heating of the insole 10 is continuously monitored and

operated by the plurality of electrical components 20. The application and use of these electrical components 20 is more clearly illustrated in the electrical schematic or circuit board diagram as shown in Figure 2.

[0016] As discussed, when the on/off switch 46 is switched or toggled to the "off" position (i.e., S1 switch moved to A1 position), the battery 42 can be initially charged or later recharged through the direct current connector 40 from the adaptor. When the on/off switch 46 is switched or toggled to the "on" position (i.e., S1 switch moved from A1 position to A2 position), the battery 42 begins to power the circuit. If the temperature is low enough (preferably 78. 8°F or 26°C) to cause the resistance in the thermostat 44 (i.e., RT 1) to be high enough to make the potential difference at amplifier 58 (i.e., U1A,) negative terminal (2) higher than the potential difference at amplifier 58 (i.e., U1A), positive terminal (3), the amplifier 58 (i.e., U1A) output (1) will be a low level to close the transistor 38 (i.e., Q1), or in other words, power the resistors 34 (i.e., R4, R5, R6, R7, R8, R9, R10, and R13). When the resistors 34 are being powered, the insole 10 is being heated. The light emitting diode 48 will also depict a red light to indicate that the insole 10 is on or being powered by the battery 42. In the preferred embodiment, the battery life to continue heating is approximately eight hours depending upon outside temperature and quality of shoes.

[0017] While the circuit remains closed, the insole 10 is being heated. As this occurs, the temperature of the thermostat 44 (i.e., RT1) will be rising and as it does its resistance will be lowered to make the potential difference at amplifier 58 (i.e., U1 A), negative terminal (2) lower. When the temperature is high enough (preferably 98.6°F or 37°C) to cause the resistance in the thermostat 44 (i.e., RT1) to be low enough to make the potential difference at amplifier 58 (i.e., U1A,) negative terminal (2), lower than the potential difference at amplifier 58 (i.e., U1A), positive terminal (3), the amplifier 58 (i.e., U1A) output (1) will be a high level to open the transistor 38 (i.e., Q1), or in other words, discontinue power to the resistors 34 (i.e., R4, R5, R6, R7, R8, R9, R10 and R13). In this manner, the insole 10 stops generating heat. The light emitting diode 48 (i.e., L1) will likewise no longer depict a red light to indicate that the insole 10 is no longer being heated. This on-off cycle will automatically continue for the duration that the insole 10 is being used or until the battery 42 completely discharges.

[0018] When the insole 10 is no longer needed for use, the tab 60 may be gripped by the person's fingers for easily removing the insole 10 from the footwear. Upon removal, the on/off switch 46 should be switched or toggled to the "off" position thereby opening the circuit to prevent undesired continuous monitoring and powering of the insole 10. Depending upon the length of use, the battery 42 of the insole 10 may require recharging prior to further use.

[0019] Referring to Figure 3, there is illustrated a diagram of an alternate embodiment of the printed circuit

board 62 for the insole 10. In this alternate embodiment, the printed circuit board 62 is designed such that it may accommodate the insole 10 for various sizes of footwear. This embodiment also assists in standardizing components and inventory management. In the preferred embodiment, the length of the printed circuit board 32 is predetermined. In this alternate embodiment, the printed circuit board 62 may be altered to fit the insole 10 for commonly used sizes of footwear. Situated along the edges of the printed circuit board 62 are a plurality of markers 64. These plurality of markers 64 represent the length or size of foot wear ranging from a European shoe size of 33 through a shoe size of 44 or even up to shoe size 46 and 47. Alternatively, the plurality of markers 64 may be changed to accommodate or represent any countries' measurement or nomenclature for footwear sizes. To fit the printed circuit board 62 to an insole 10 for a desired shoe size, the printed circuit board 62 may be folded upon itself at the proper marker 64 to achieve the exact length or size required. In this alternate embodiment, if the footwear size is less than size 44, the initial fold would occur at the size 44 position. This initial fold would then be substantially aligned with the actual desired footwear size. Thus, if the actual desired footwear size was 36, the fold at the size 44 position would be engaged and aligned with the size 36 position thereby shortening the length of the printed circuit board 62 from a size 44 to a size 36. After the printed circuit board 62 is folded (as described), the area of the printed circuit board 62 that was folded (e.g., size 44 marker to size 36 marker) can be further connected with soldering to insure permanent connection of the circuitry and the system.

[0020] In an alternate embodiment, the insole 10 may be provided with a remote control heating system for regulating or controlling the temperature of the insole 10. The remote control heating system comprises a radio frequency transmitter 70, as illustrated in Figures 4 and 5, and the insole 10, as illustrated in Figures 6 and 7.

[0021] Referring to the transmitter 70, as illustrated in Figure 4, the transmitter 70 comprises an upper housing 72 and a bottom housing 74. The upper housing 72 engages the bottom housing 74 along their circumference to form the assembled transmitter 70 with a plurality of electrical components, discussed below, being contained there between. In the preferred embodiment, the upper housing 72 is secured to the bottom housing 74 using a plurality of screws frictionally received into a corresponding threaded cylinder 78. Additionally, the upper housing 72 and bottom housing 74 each have an adjacent hole 90 to receive an attachment ring 92 that attaches to a key ring 94. Alternatively, the upper housing 72 and the bottom housing 74 maybe attached or secured to one another using any means known to one skilled in the art provided that the attachment is sufficient to form an assembled transmitter 70 for use as described herein.

[0022] Situated within the upper housing 72 are a plurality of light emitting diode covers 82, 84, and 86, and a press switch button 88. One of the electrical components

contained within the transmitter 70 is a circuit board 80. In the preferred embodiment, the circuit board 80 is a printed circuit board or PCB that is used to mechanically support and electrically connect the other electrical components contained within the transmitter 70 using conductive pathways, or traces, etched from copper sheets laminated onto a non-conductive substrate. Alternatively, the circuit board 80 may be any type of circuit board known to one skilled in the art that may be used to accomplish the invention described herein.

[0023] Electrically coupled to the circuit board 80 are a micro-controller 96, an antenna with coil 98, a plurality of transistors 100, a plurality of crystals 102, a plurality of resistors 104, a plurality of capacitors 106, an inductor 108, a press switch plate 110, a light emitting diode 112, and a battery 114 (preferably a 3 volt battery) secured by a battery plate 116. In the preferred embodiment, these electrical components are all well known electrical components and include any and all types or variations known to those skilled in the art for use in the manner described herein.

[0024] The application and use of these electrical components in the transmitter 70 are more clearly illustrated in the electrical schematic or circuit board diagram as shown in Figure 5. When all of these electrical components are connected as illustrated, the circuit is in a default standby mode. When the press switch button 88 is depressed to engage the press switch plate 110 (see Figure 4), the switch 120 is closed at a special duration and the circuit is changed to an operation mode. The micro-controller 96 output pin P60 changes from "High" level to "LOW" level, and then the micro-controller 96, according to the pre-programming commands, the output levels of output pins (P53, P50, P51 and P52) changes for emitting a radio frequency and for controlling the light emitting diode flashing sequences through their corresponding components.

[0025] For example, when the circuit is in the default standby mode and the press switch button 88 is depressed to engage the press switch plate 110 (see Figure 4) closing the switch 120 for two (2) seconds, the micro-controller 96 output pin P60 changes from "High" level to "Low" level and the micro-controller 96 instructs the output pin P50 to change from "Low" level to "High" level and the output pin P53 to generate a series of pre-determined coding signals (LOW temperature controlled signal) alternated with "High" and "Low" level. In the preferred embodiment, the LOW temperature is preferably 90.0°F or 32°C. The light emitting diode (LED1) will then light up and a series of radio frequencies are emitted out through the antenna 98 (ANT) generated by the transistor 100 (Q1), crystal 102 (XT1), resistors 104 (R1, R2), inductor 108 (L1), and capacitors 106 (C4, C5, C6), respectively. After that, if the switch 120 closes for another preset time, the micro-controller 96 output pin P60 changes from "High" level to "Low" level again and micro-controller 96 instructs the output pin P51 to change from "Low" level to "High" level and the output pin P53 to gen-

erate a series of pre-determined coding signals (MID temperature controlled signal) alternated with "High" and "Low" level. In the preferred embodiment, the MID temperature is preferably 100.0°F or 38°C. The light emitting diode (LED2) will then light up and a series of radio frequencies are emitted out through the antenna 98 (ANT) generated by the transistor 100 (Q1), crystal 102 (XT1), resistors 104 (R1, R2), inductor 108 (L1), and capacitors 106 (C4, C5, C6), respectively. Then, if the switch 120 closes for another preset time, the microcontroller 96 output pin P60 changes from "High" level to "Low" level again and microcontroller 96 instructs the output pin P52 to change from "Low" level to "High" level and the output pin P53 to generate a series of pre-determined coding signals (HIGH temperature controlled signal) alternated with "High" and "Low" level. In the preferred embodiment, the HIGH temperature is preferably 108.0°F or 42°C. The light emitting diode (LED3) will then light up and a series of radio frequencies are emitted out through the antenna 98 (ANT) generated by the transistor 100 (Q1), crystal 102 (XT1), resistors 104 (R1, R2), inductor 108 (L1), and capacitors 106 (C4, C5, C6), respectively.

[0026] When the circuit is in the operation mode and the switch 120 is closed for two (2) seconds, the circuit will turn to the default standby mode. The capacitors 106 (C1, C2 and C3) and inductor 108 (L2) are used to filter the noise coming from control signals controlled by the micro-controller 96 and vice versa. To enhance the stability of the circuits, the transistor 100 (Q3) and the resistors 104 (R3, R4 and R5) are used to detect the input voltage level. In the preferred embodiment, the default output pin P67 is at "High" level. When the battery voltage is higher than the voltage at the transistor 100 (Q3) base terminal, the transistor 100 (Q3) will conduct and the micro-controller 96 input pin P64 becomes "Low" level. When the battery voltage is lower than the voltage at the transistor 100 (Q3) base terminal, the transistor 100 (Q3) non-conducts and the micro-controller 96 input pin P64 becomes "High" level. These changes are reflected by the micro-controller 96 sending a pre determined command to make the light emitting diodes (LED 1, LED2, LED3) flash.

[0027] Referring to the insole 10, as illustrated in Figure 6, the insole 10 contains many of the same components in the original embodiment as illustrated in Figure 1 and further comprises additional electrical components coupled to the circuit board 32 to achieve the remote heating system invention. In the preferred embodiment, these additional electrical components include a micro-controller 96, a plurality of transistors 100, a plurality of capacitors 106, an inductor 108, a heat sink tube 122, a shunt regulator 124, a radio frequency receiver 126, and wires 128 along with a foam member 130. In the preferred embodiment, these electrical components are all well known electrical components and include any and all types or variations known to those skilled in the art for use in the manner described herein.

[0028] The application and use of these electrical com-

ponents in the insole 10 are more clearly illustrated in the electrical schematic or circuit board diagram as shown in Figure 7. When all of these electrical components are connected as illustrated and the switch 46 (SW1) is closed, the micro-controller 96 (U1) and (U3) turns into a default standby mode. The output pin P60 and output pin P51 in micro-controller 96 (U1) are defaulted at "High" level and "Low" level, respectively. As a result, the transistor 100 (Q2) conducts and the input pin P54 has a referred voltage comparing with the voltage at output pin P53. If their voltage difference exceeds the pre-determined limit, the output pin P50 changes to "High" and "Low" alternately with the light emitting diode 48 (LED1) flashing to show low power level detected. This gives a visual indication that the circuits are operating in a normal state. When the antenna (Ant) receives a corresponding radio frequency generated by the receiver, this radio frequency will transmit to the micro-controller 96 (U3) for amplifier and filter. The sensitivity of the micro-controller 96 (U3) is adjusted by the value of capacitors 106 (Ct1, Ct2, C7-C16), inductors 108 (L1, L2, L3) and resistor 34 (R2). Then this amplified radio frequency transmits to the micro-controller 96 (U1) input pin P52 by micro-controller 96 (U3) output data pin no.8 for decoding.

[0029] If the decoding frequency represents LOW temperature, the micro-controller 96 (U1) instructs the output pin P62 and output pin P63 to keep in "Low" level and output pin P50 to change in "High" level per cycle. As a result, the transistors 100 (Q3, Q4) non-conduct and the light emitting diode 48 (LED1) flashes once per cycle respectively. Then a potential difference generated by resistors 34 (R17, R3 and R3a) act on the micro-controller 96 (U1) pin65 (CIN+) and this potential difference is compared with the potential difference at micro-controller 96 (U1) pin66 (CIN-) generated by thermo resistor 44 (RT) --- (the temperature detected by the thermo resistor 44 (RT) is lower than the "LOW" temperature setting. The potential difference at micro-controller 96 (U1) pin66 (CIN-) is higher than microcontroller 96 (U1) pin65 (CIN+)). If the potential difference at micro-controller 96 (U1) pin66 (CIN-) is higher than micro-controller 96 (U1) pin65 (CIN+), the micro-controller 96 (U1) pin64 changes to "Low" level. As a result, the transistor 100 (Q1) conducts and the resistors 34 (R201 - R207) is heating up. Otherwise the transistor 100(Q1) non-conducts and the resistors 34 (R201 - R207) stop heating until the temperature detected by the thermo resistor 44 (RT) is lower than the "LOW" temperature setting.

[0030] If the decoding frequency represents the MID temperature, the micro-controller 96 (U1) instructs the output pin P62 and output pin P63 to keep in "HIGH" level and "LOW" level respectively and instructs output pin P50 to change in "High" "High" level per cycle. As a result, the transistor 100 (Q3) conducts and transistor 100 (Q4) non-conducts with the light emitting diode 48 (LED1) flashing twice per cycle respectively. Then a potential difference generated by resistors 34 (R16, R17, R3 and

R3a) will act on the micro-controller 96 (U1) pin65 (CIN+) and this potential difference is compared with the potential difference at micro-controller 96 (U1) pin66 (CIN-) generated by thermo resistor 44 (RT)---(the temperature detected by the thermo resistor 44 (RT) is lower than the "MID" temperature setting. The potential difference at micro-controller 96 (U1) pin66 (CIN-) is higher than micro-controller 96 (U1) pin65 (CIN+)). If the potential difference at micro-controller 96 (U1) pin66 (CIN-) is higher than micro-controller 96 (U1) pin65 (CIN+), the micro-controller 96 (U1) pin64 changes to "Low" level. As a result, the transistor 100 (Q1) conducts and the resistors 34 (R201-R207) are heating up. Otherwise the transistor 100(Q1) non-conducts and the resistors 34 (R201-R207) stop heating until the temperature detected by the thermo resistor 44 (RT) is lower than the "MID" temperature setting.

[0031] If the decoding frequency represents the HIGH temperature, the micro-controller 96 (U1) instructs the output pin P62 and output pin P63 to keep in "Low" level and "High" level, respectively, and instructs output pin P50 to change in "High" "High" "High" level per cycle. As a result, the transistor 100 (Q4) conducts and transistor 100 (Q3) non-conducts with the light emitting diode 48 (LED1) flashing three times per cycle respectively. Then a potential difference generated by resistors 34 (R14, R17, R3 and R3a) will act on micro-controller 96 (U1) pin65 (CIN+) and this potential difference is compared with the potential difference at micro-controller 96 (U1) pin66 (CIN-) generated by thermo resistor 44 (RT) --- (the temperature detected by the thermo resistor 44 (RT) is lower than the "HIGH" temperature setting. The potential difference at micro-controller 96 (U1) pin66 (CIN-) is higher than micro-controller 96 (U1) pin65 (CIN+)). If the potential difference at micro-controller 96 (U1) pin66 (CIN-) is higher than micro-controller 96 (U1) pin65 (CIN+), the micro-controller 96 (U1) pin64 changes to "Low" level. As a result, the transistor 100 (Q1) conducts and the resistors 34 (R201-R207) are heating up. Otherwise the transistor 100 (Q1) non-conducts and the resistors 34 (R201-R207) stop heating until the temperature detected by the thermo resistor 44 (RT) is lower than the "HIGH" temperature setting. Furthermore, if the jack 40 is plugged with a direct current plug, the battery 42 could be charging.

[0032] One skilled in the art can easily program the circuitry in various configurations. For example, depressing switch button 88 once can activate a low heat level, depressing it one more time can activate a medium heat level, and depressing it one more time can activate a high heat level. Alternatively, depressing the switch button 88 once can activate a low level, depressing it twice in quick succession can activate a medium heat level, and depressing it three times in quick succession can activate a high heat level. Alternatively, the switch button 88 can be replaced by three separate buttons with each button activating a different heat level. Alternatively when heating of the soles is activated, the remote function is auto-

matically on. The "on" / "off" switch of the soles will activate the soles to receive signals and start heating up to the preset LOW temperature. In one embodiment the temperature setting could be LOW: 36°C; MID: 42°C; HIGH: 44°C. Alternately only one LED could be used to indicate the temperature setting by e.g. flashing once for LOW setting and twice for MID and three times for HIGH setting and continuous on for charging and continuous blinking after charging completed. Any other combinations are possible as well.

[0033] Thus, there has been provided a remote controlled, wire-free, rechargeable electrically heated insole for a shoe. While the invention has been described in conjunction with a specific embodiment, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications and variations as fall within the spirit and scope of the appended claims.

Claims

1. An insole for inserting inside footwear and resting adjacent to the bottom of the footwear, comprising:
 - a body having an upper side and a bottom side, the body substantially conforming to the bottom of the footwear; and
 - means for continuously monitoring and regulating heat from the insole for heating the footwear, the means for continuously monitoring and regulating the heat self-contained within the body.
2. The insole of Claim 1 wherein the means for continuously monitoring and regulating heat automatically activates generating heat when the temperature within the footwear becomes too low and automatically stops generating heat when the temperature within the footwear becomes too hot.
3. The insole of Claim 2 wherein the means for continuously monitoring and regulating heat from the insole further comprising a battery electrically coupled to the circuit board.
4. The insole of Claim 3 and further comprising a switch electrically coupled to the circuit board that regulates when the circuit board is powered by the battery.
5. The insole of Claim 4 and further comprising a direct current connector electrically coupled to the circuit board that acts as a conduit with an external device to charge the battery.
6. The insole of Claim 4 and further comprising a light emitting diode electrically coupled to the circuit board and indicating when the circuit board is powered by the battery.
7. The insole of Claim 2 and further comprising a plurality of holes situated in the upper side of the body and adjacent to the means for continuously monitoring and regulating heat.
8. The insole of Claim 1 and further comprising a cushion insert situated adjacent to the means for continuously monitoring and regulating heat and within the body.
9. The insole of Claim 1 and further comprising a finer tab extending outwardly from the bottom side of the body.
10. A system for heating the inside of footwear comprising:
 - an insole for inserting inside footwear and resting adjacent to the bottom of the footwear, the insole comprising a body having an upper side and a bottom side, the body substantially conforming to the bottom of the footwear;
 - electrical resistance means for heating the insole;
 - a battery for providing power to the electrical resistance means;
 - switching means for electrically connecting the battery to the resistance means;
 - a remotely operated switch for controlling the switching means; and
 - means for continuously monitoring and regulating heat from the insole for heating the footwear, the means for continuously monitoring and regulating the heat self-contained within the body.
11. The system of Claim 10 wherein the remotely operated switch means comprises a transmitter remote from the insole for transmitting a signal and receiving means in the insole for receiving the transmitted signal.
12. The system of Claim 11 wherein the means for continuously monitoring and regulating heat automatically activates heat generating means when the temperature within the footwear becomes too low and automatically stops the heat generating means when the temperature within the footwear becomes too hot.
13. The system of Claim 11 wherein the means for continuously monitoring and regulating heat from the insole comprising a circuit board having a thermostat, a transistor, and at least one resistor.
14. The system of Claim 12 and further comprising a direct current connector electrically coupled to the

circuit board for connecting an external power source to the battery.

15. The system of Claim 14 and further comprising a flexible cap attached to the body, the flexible cap moveable between a first position covering the switch and direct current connector exposed from within the body and a second position uncovering the switch and direct current connector for use. 5
16. The system of Claim 12 and further comprising a plurality of holes situated in the upper side of the body and adjacent to the at least one resistor. 10
17. The system of Claim 10 and further comprising a cushion insert situated adjacent to the means for continuously monitoring and regulating heat and within the body. 15

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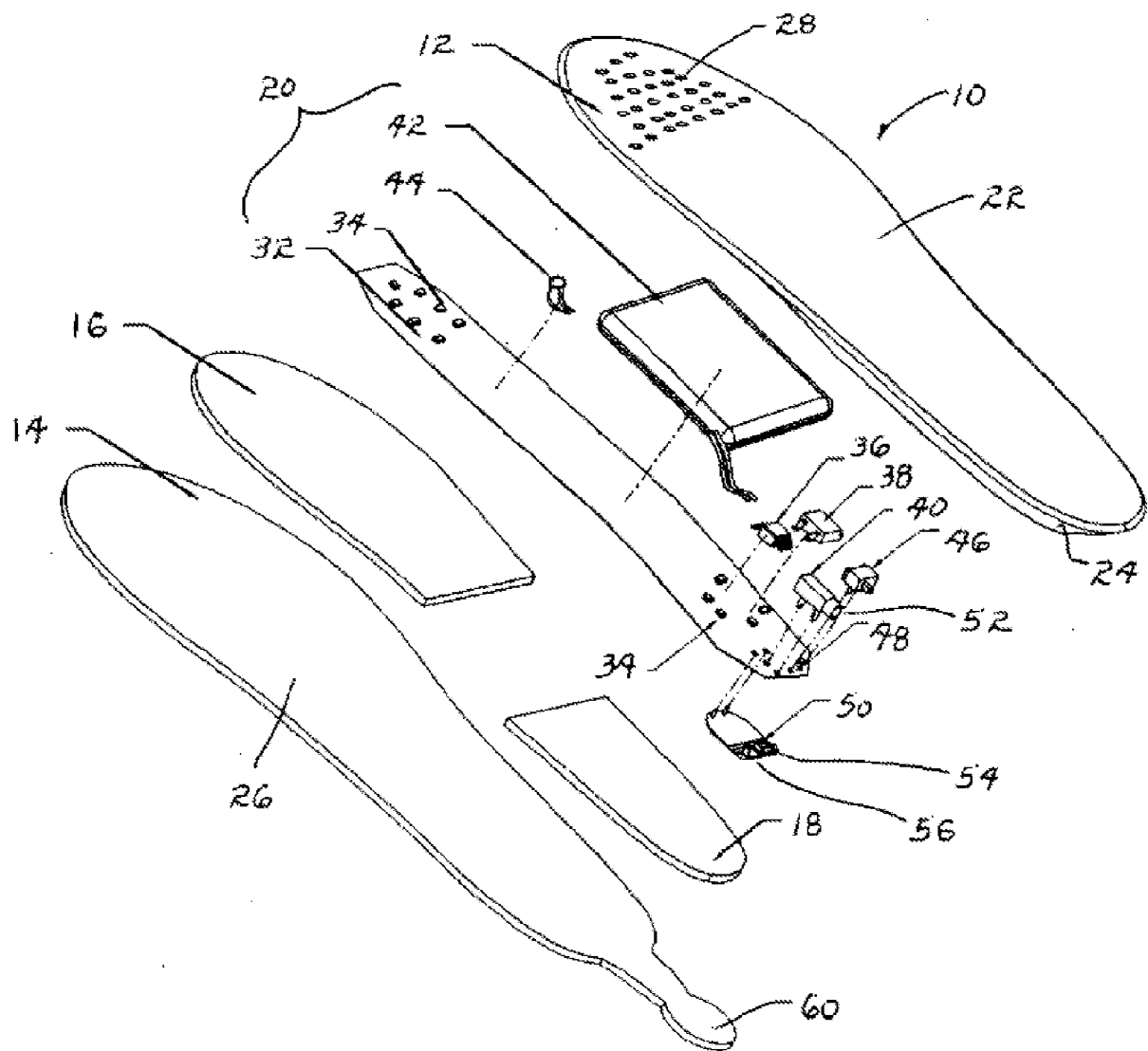


FIG.1

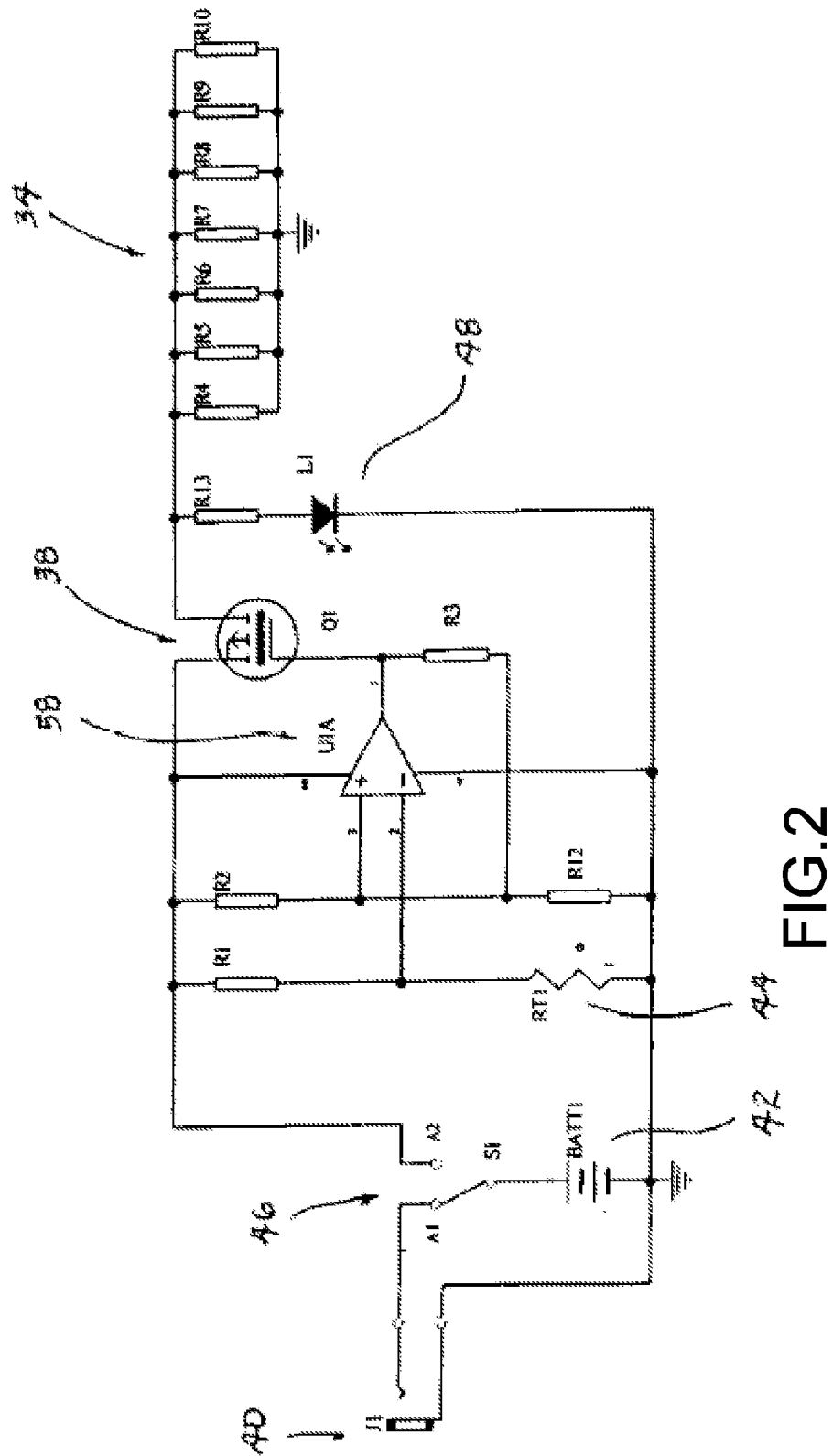


FIG. 2

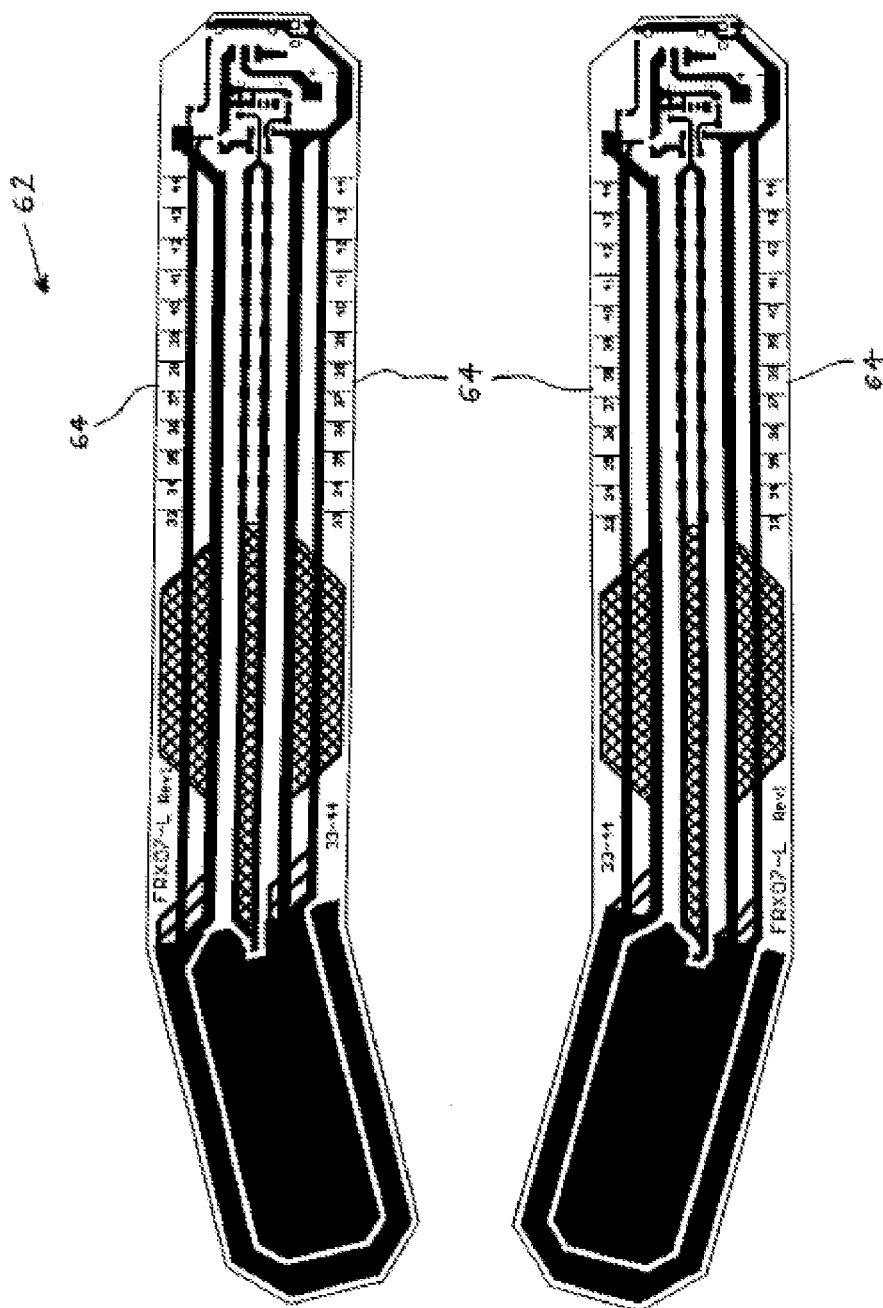


FIG.3

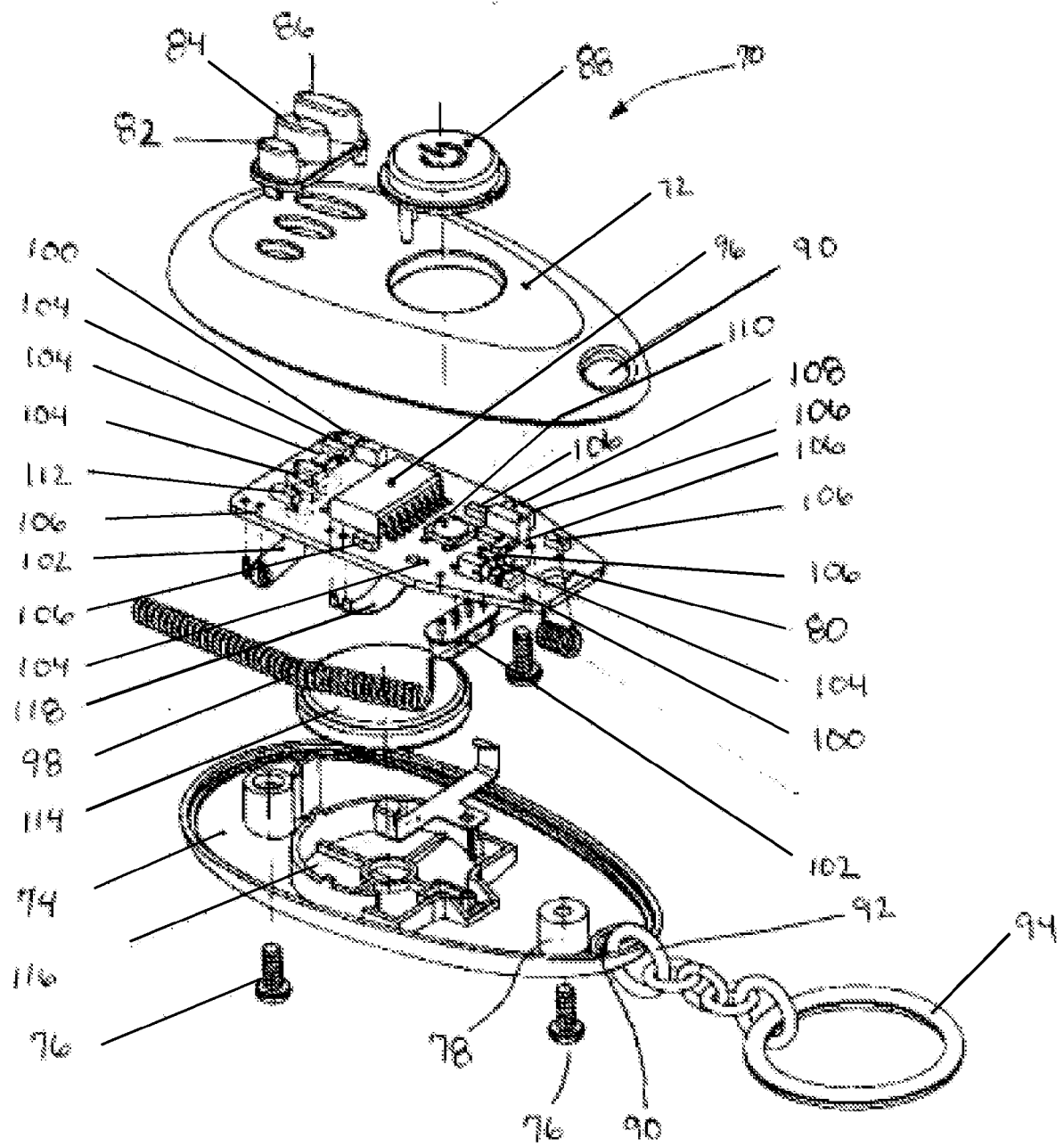


FIG.4

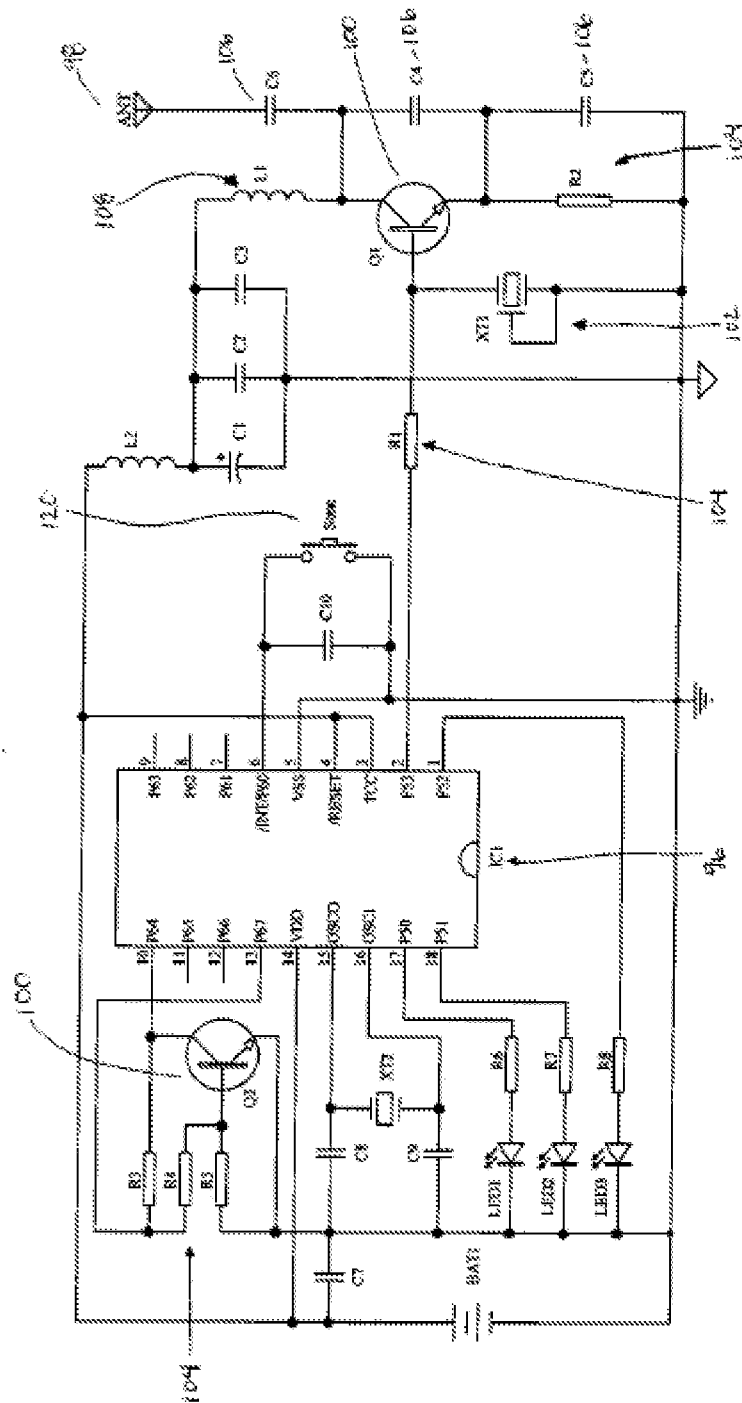


FIG.5

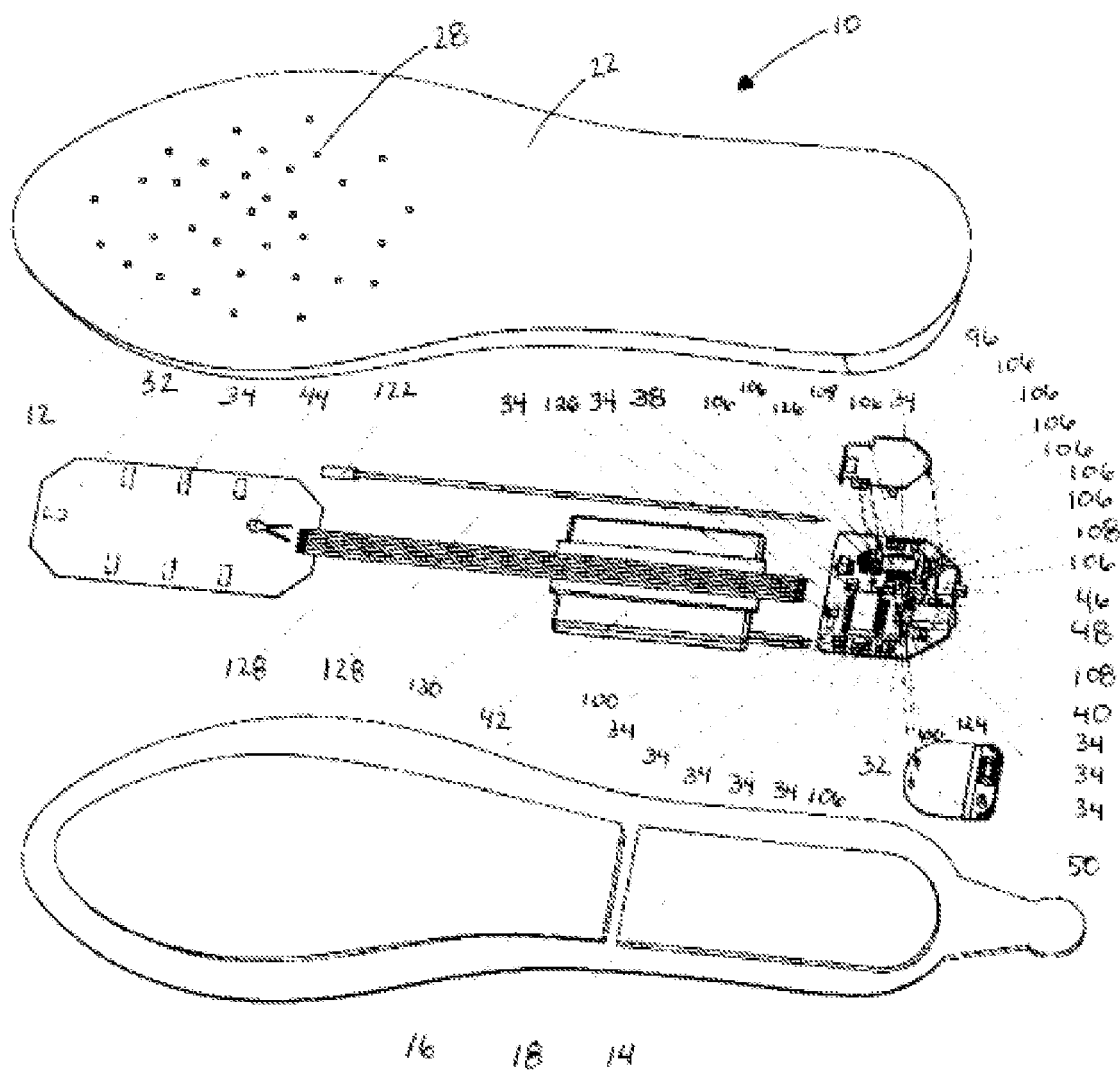


FIG.6

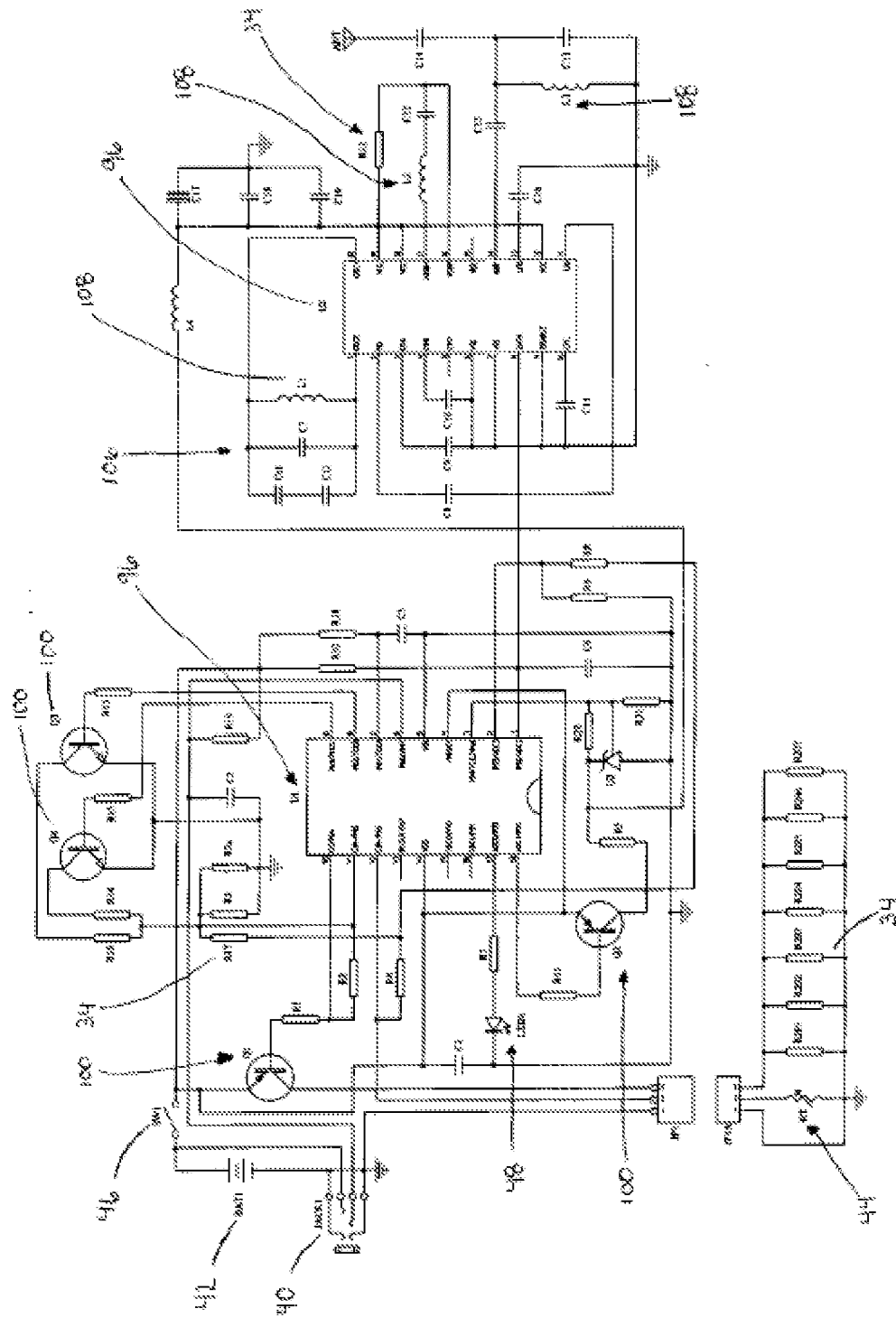


FIG. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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