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(54) **HEATED SHOE INSOLE REMOTE CONTROL SYSTEMS**

FERNSTEUERUNGSSYSTEME FÜR EINE BEHEIZBARE INNENSOHLE

SYSTÈMES DE COMMANDE À DISTANCE DE CHAUFFAGE DE SEMELLE INTÉRIEURE DE
CHAUSSURE

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a remotely controlled heated insole for footwear and to an improved method of control of such heated insoles that provides a more reliable means of ensuring that the temperature desired by the user is realized.

BRIEF DESCRIPTION OF THE INVENTION

[0002] The present invention is directed to heating insoles of footwear, and improving the ability to realize desired temperatures through wireless control signals. Heated insoles are intended to aid a user in withstanding cold weather by providing supplementary heat in the case where normal body heating is not enough or when additional heat is desired to be more comfortable. When an extremity of the body starts to become cold, the body's natural physiological response of vasoconstriction occurs in which the nervous system restricts blood flow to the cold extremity in an effort to keep the rest of the body warm. It is well known that frostbite and other cold related injuries occur first in fingers and toes due to vasoconstriction and keeping these extremities warm will help insure survival or at minimum a more pleasurable outdoor experience.

[0003] Heated insoles are a key component to preventing injury in cold weather and are well known to hunters and outdoorsmen as standard survival gear while in the woods or forest. A problem exists however in the control of such insoles as often the insole temperature needs to be adjusted to accommodate different conditions and comfort levels. Standard temperature adjustment methods require the user needs to remove his or her boot to gain access to the insole in order to make desired adjustments. Not only is this procedure time consuming but removing the user's foot from the boot to gain access to the insole exposes the foot to the cold conditions. This adjustment procedure undoubtedly lowers the foot temperature even further thereby further increasing risk or injury.

[0004] An improved method of control has been developed however utilizing a hand held remote control system which employs a transmitter unit external to the insole and a receiver unit located within the insole assembly inside the boot. The desired heat adjustment is then performed by the user selecting a heat setting on the hand held remote unit which is then wirelessly transmitted to the receiver unit located within the heated insole assembly. Although this improved method of control is an improvement, the design requirements for a proper fitting heated insole yields conditions not optimum for wireless control as will be pointed out in the following discussion.

[0005] Heated insoles are placed in a shoe with its bottom surface against the bottom of the shoe and the upper surface against the user's foot when in use. Antenna

placement within the insole is positioned parallel to the ground surface and also to the foot placed above it. A problem exists in the prior art however in which this restrictive antenna positioning tends to prohibit the reception of information transmitted from the hand held unit to the receiver unit due to the signal grounding effect produced by the earth's surface on the bottom and the user's foot on top of the antenna. This grounding effect is often severe enough that it inhibits information from the transmitter to the receiver unit, therefore preventing any heating adjustments to be made.

[0006] Additionally, the location of the RF receiver, inside shoes, adjacent to the ground requires special consideration to overcome signal loss. Prior art radio controlled insoles include the wire antenna along the midline of the insole. This has been problematic because signal strength is affected. The inventors realized that much of the transmitted signal is blocked by the ground from reaching the receiver antenna located in the insole. The foot and body of the wearer also tend to block the signal. One improvement of this invention for the receiver antenna is to locate it more advantageously for signal reception, for instance, near the outer margin of the insole. Reception is materially improved with such an antenna. Document US 2009/0013554A1 relates to an electrically heated insole that may be controlled remotely. Unlike the claimed invention, it does not disclose or suggest an insole system configured to automatically transmit additional wireless control signals after and corresponding to the same command as an initial wireless control signal. Rather, the remote is limited to sending a single control signal to the heated insole in response to user's command.

[0007] The present invention includes a heated insole device that uses radio frequency communication with an improved transmission system to control the desired insole temperature. The present invention uses a standard frequency of 433 Megahertz but may be used with other frequencies, such as the common 2.4 Gigahertz.

[0008] as described above, the manufacturing of an insole product requires that the device itself be relatively flat and fit within a standard shoe or boot. This requirement forces the necessary power source, control methods and communication means to all exist within the confines of the shoe and lie in a flat plane parallel to the earth's surface. Although this space limitation is achievable with good design practice, radio communication suffers largely due to the horizontal orientation of the antenna, its proximity to the earth and the person standing above it. Furthermore, transmission at the frequencies described above is dictated by governing authorities to be a limited transmission of a just a few seconds per hour, so the notion of continuous transmission, if even in the power budget, would be prohibited.

[0009] The present invention also discloses a system and method of communication that helps to ensure that user commands are more effectively transmitted by providing a plurality of transmissions by way of wireless con-

trol signals at specific spaced intervals of time. By providing discrete, timed transmissions by way of wireless control signals after the user temperature control has been initiated, the probability of transmissions by way of wireless control signals coinciding with the user taking a step and lifting his foot off the ground is increased. The timed control signal may be initiated by the remote or may be controlled by a microprocessor within the insole. With the foot off the ground, the distance between the horizontally placed antenna within the insole and the earth's surface is greatly increased, thus increasing the reception range for the insole.

[0010] A secondary action that occurs while a foot is in the air is that the pressure of the person wearing the shoe is relieved from the insole, decompressing the foam some measurable amount between the antenna and the person. This decompression although small, tends to increase the transmission success thus providing a better user experience.

[0011] For example, it is well known that an adult person walks at a rate of three miles per hour, which equates to a four feet per second with a stride length of about eighteen inches. This stride and pace suggests approximately 2.6 steps to be taken every second.

[0012] Since bipedal humans alternate feet while walking, this suggests that each foot is lifted off the ground every 1.3 seconds or approximately once per second.

[0013] Knowing that each foot is off the ground once per second for almost a second, allows more robust communication by providing transmissions by way of wireless control signals that occur while the foot position is in the air and not on the ground surface. Transmissions by way of wireless control signals every half second will insure some of the broadcasted signal will be simultaneous with the foot being in the air, thus delivering the intended command to the insole device. Other time periods may be chosen in accordance with prevailing governmental regulation.

[0014] For skiers or snowboarders who use this invention, the position of the foot also shifts from purely horizontal to some vertical orientation, such as when the skier uses edges or a boarder shifts positions. Still further, the heating operation may occur while the user is in a lift chair which also alters the orientation of the sole.

[0015] Transmitting the sequence of coded signals periodically for a short period of time after the initiation of the process to heat the insole increases the ability of the user to more effectively communicate the heating instructions to the insole.

[0016] The instant invention includes a battery powered electrically heated pair of insoles that are in radio communication with a key fob R/F transmitter. The battery is a lithium ion polymer battery and is provided with a self-contained conventional protective circuit. The transmitter sends out an encoded signal to be received and decoded by a unique pair of insoles. The insole has an on/off switch. This switch may be placed in the on position before the insole is placed inside the shoe.

[0017] When the switch is placed in the on position, the insole does not produce heat, but the R/F system in the insole is ready to receive commands from the key fob transmitter. Each insole has an on/off switch and may have a unique code permitting selected insoles to be heated. When both switches are on, both insoles will respond to the key fob transmitter. The user may utilize the key fob transmitter to select among; no heat, medium heat, and high heat by pressing the appropriate button on the key fob transmitter. Settings other than discrete may be used.

[0018] When a heat setting is selected on the key fob transmitter, the RF receiver in the insole detects the signal and, if intended for a specific insole, activates the process therein. The microprocessor senses the temperature near the heater, and if the temperature is too low for the selected setting, current flows from the battery to the heater until a thermistor reaches a predetermined temperature. The thermistor generates a signal which is sent to the microprocessor. The microprocessor controls the flow of current to achieve and maintain the desired temperature until the user selects another setting. Other methods of controlling the heat in the insole may be employed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

Fig. 1 is a block diagram of the transmitter unit;
Fig. 2 is a block diagram of the electronic circuit within the insole; and
Fig. 3A and 3B are partial sectional views of the insole showing the location of the antenna in the present invention and in the prior art.

DETAILED DESCRIPTION

[0020] Fig. 1 is a block diagram showing the transmitter 10 of this invention. The transmitter comprises an integrated circuit S14010 which is connected to a plurality of push buttons 12, 14 and 16. The push buttons generate signals to cause high, medium and no heat conditions, respectively, to be generated within the insole. The user selects a push button to be activated in order to control the temperature within the insole.

[0021] An LED 18 may be connected to the transmitter to indicate that the transmitter is transmitting and/or to indicate that the transmitter is on and capable of transmitting. An antenna 19 connected to the transmitter wirelessly transmits electronic signals generated in transmitter 10 to the electrical circuit within the insole.

[0022] The transmitter 10 decodes the user command by determining which of the push buttons is selected, and the transmitter provides a burst of four packets of information or electrical signals with each packet consisting of an address and data. The packet length, by example, is 120 ms in length and the entire four packets takes

approximately 512 ms to transmit. To ensure the command is received properly, the four packet sequence is repeated every 15 seconds over the next minute for a total of 20 packets. This is within current FCC regulations.

[0023] Referring to Fig. 2, there is shown an electrical circuit located within the insole. Transmitted data packets are received and decoded through receiver 24 and connected to microcontroller 26. The decoded signal is sent to the microcontroller for processing, which creates a control signal for heater control 28 to achieve the desired temperature condition for the insole. Additionally, the address data identifies the insole to be controlled. The heater control 28 is connected to heater assembly 30 located within the insole to heat the insole to a desired temperature. The heater assembly also includes a temperature sensing device such as a thermistor to determine the real time temperature of the heated insole to determine if further heating is required under control of microcontroller 26.

[0024] The microcontroller 26 and heater assembly 30 are powered by a 4.2 volt lithium ion polymer battery 32 having an internal safety circuit 34.

[0025] The lithium battery 32 is recharged by using an external DC charger 22 connected to input jacks 36 located within the insole. The charging is thus controlled outside of the insoles. A voltage limiter 38 is connected to the output of the external charging input to ensure that the voltage supplied to recharge battery 32 is maintained below a certain level. Battery charging is achieved by using the external charger to control voltage and current to the batteries, and the voltage limiter 38 provides fine voltage control to optimize battery charging. An LED 23 is provided with the external DC charger 22 to display the battery status so it can be determined when the battery has been sufficiently charged, and the external charger may be unplugged from the insoles. A three volt regulator circuit 42 is provided to ensure that the microcontroller and heater assembly properly operate. The control circuit for the system shown in Fig. 2 includes voltage regulator 42 to control the voltage at microcontroller 36.

[0026] Locating the protective circuit 34 within the battery is an improvement over having a protective circuit outside of the lithium battery. Providing the protective circuit within the lithium battery is important because if the battery leads short circuit, a hazard will be prevented by having the protective circuit therein. If the protective circuit is remote from the lithium battery, damage from such short circuit to the battery will not be prevented.

[0027] In normal use, the user sets the on/off switch 44 to the on position in the insole to allow the battery voltage to control the electronic circuitry therein. The microcontroller 26 receives a command signal from RF receiver 24 and decodes the information to see if the unique address matches that of the insole. If such a match is found, the microcontroller then determines from the command signal the heat setting which is desired. Once such heat setting is decoded, the microcontroller 26 then com-

mands the control circuit 28 to turn on the heater and maintain a desired heating set point. This continues until the user switches the on/off switch to off or the battery power is exhausted. Additionally, there is a heat control (No Heat) in the transmitter which also can turn off the heating unit.

[0028] The instant invention includes a battery powered electrically heated pair of insoles that are in radio communication with the key fob R/F transmitter 8 (see Fig. 1). The transmitter 10 sends out an encoded signal that may be received and decoded by a unique pair of insoles. When the switch in the insole is on, the insole does not produce heat, but the R/F system in the insole is ready to receive commands from the key fob transmitter. Each insole has its own on/off switch. When both switches are on, both insoles may respond to the key fob transmitter depending on the address data. The user may utilize the key fob transmitter 8 to select among; no heat, medium heat, and high heat by pressing the appropriate button on the key fob transmitter 8.

[0029] When a heat setting is selected on the key fob transmitter 8, the RF receiver 24 in the insole detects the signal and activates microprocessor 26. The microprocessor 26 senses the state of a temperature measuring thermistor located near the heater, and if the temperature is too low for the selected setting, current flows from the battery 32 to the heater 30 until the thermistor reaches a desired temperature.

Then, the microprocessor 26 reduces the flow of the current to keep the predetermined temperature. The temperature is maintained until the user selects another setting.

[0030] The location of the RF receiver, inside shoes, adjacent to the ground requires special consideration to overcome signal loss. Prior art radio controlled insoles locate the wire antenna 40 along the midline of the insole (see Fig. 3b). This has been problematic because signal strength is not sufficient. Much of the transmitted signal is blocked by the ground from reaching the receiver antenna located in the insole. The foot and body of the wearer also tend to block the signal. The receiver antenna 444 of this invention is located near the outer margin of the insole (see Fig. 3a).

[0031] When the user is ready to recharge the batteries, the insoles may be removed from the shoes and the switches are placed in the off position. In the alternative, the charging jacks may be available from outside the footwear by suitable protective waterproofing of such jacks.

[0032] It should be understood that the preferred embodiment was described to provide the best illustration of the principles of the invention and its practical application to thereby enable one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated.

Claims

1. A system for remotely adjusting the temperature of a heated insole, said system comprising:

an electronic circuit and a heating element (30) contained within said insole, said electronic circuit comprising:

a receiver (24) configured to receive wireless transmissions, and

a microprocessor (26) in communication with said receiver and said heating element; and

a remote transmitter (10) configured to transmit an initial, wireless control signal to the receiver (24) upon receipt of a command to adjust the temperature of said heating element, said remote transmitter (10) further configured to, after transmission of the initial control signal, automatically transmit two or more additional wireless control signals to the receiver (10) at periodic intervals, the initial wireless control signal and each additional wireless control signal instruct the microprocessor to execute the same received command and adjust the temperature of said heating element.
2. The system according to claim 1, wherein said periodic additional wireless control signals are initiated by the initial wireless control signal.
3. The system according to claim 2, wherein said single control signal is triggered by a switch (44) in said transmitter (10).
4. The system according to claim 3, wherein said switch (44) is depressed once to initiate said heating process.
5. The system according to claim 1, wherein said additional wireless control signals are transmitted periodically for a time period of five minutes or less.
6. The system according to claim 1, wherein said additional wireless control signals are transmitted periodically over a time period of two minutes or less.
7. The system according to claim 5, wherein said additional wireless control signals are generated approximately every fifteen seconds.
8. The system according to claim 5, wherein said insole comprises a flat rechargeable ion lithium battery (32), said electronic circuit further comprising a voltage regulator (42) connected to said lithium battery (32) to regulate the voltage of said lithium battery

(32).

9. The system according to claim 8, wherein said electronic circuit in said insole further comprising a voltage limiter (38) connected to said lithium battery (32).
10. The system according to claim 1, further comprising housing means in said insole for said lithium battery (32), said housing means enabling said lithium battery (32) to be easily removed from said insole.
11. The system according to claim 1, further comprising an antenna (444) in communication with said electronic circuit, said antenna (444) located in the periphery of said insole.
12. The system according to claim 1, wherein said initial and additional wireless control signals comprises unique insole identification.
13. The system according to claim 12, wherein said unique insole identification data comprises data sequences corresponding to or more insoles to be heated.
14. The system according to claim 8, wherein said ion lithium polymer battery (32) comprises safety circuits (34) located between battery poles and connecting wires.
15. The system according to claim 14, wherein said battery (32) further comprises input jacks (36) configured to connect to recharging sources outside of said insole.

Patentansprüche

1. System zur Ferneinstellung der Temperatur einer beheizten Einlegesohle, wobei das System umfasst:

eine in der Einlegesohle enthaltene elektronische Schaltung und ein Heizelement (30), wobei die elektronische Schaltung umfasst:

einen Empfänger (24), der dazu konfiguriert ist, Funkübertragungen zu empfangen; und einen Mikroprozessor (26), der mit dem Empfänger und dem Heizelement verbunden ist; und

einen entfernten Sender (10), der dazu konfiguriert ist, bei Empfang eines Befehls zum Anpassen der Temperatur des Heizelements ein erstes Funksteuersignal an den Empfänger (24) zu senden, wobei der entfernte Sender (10) weiterhin dazu konfiguriert ist, nach Übertragen des ersten Steuersignals automatisch zwei oder

- mehr zusätzliche Funksteuersignale in periodischen Intervallen an den Empfänger (10) zu senden, wobei das erste Funksteuersignal und jedes zusätzliche Funksteuersignal den Mikroprozessor anweisen, denselben empfangenen Befehl auszuführen und die Temperatur des Heizelements anzupassen.
2. System nach Anspruch 1, wobei die periodischen zusätzlichen Funksteuersignale vom ersten Funksteuersignal ausgelöst werden.
 3. System nach Anspruch 2, wobei das einzige Steuersignal von einem Schalter (44) im Sender (10) ausgelöst wird.
 4. System nach Anspruch 3, wobei der Schalter (44) einmal gedrückt wird, um den Heizprozess auszulösen.
 5. System nach Anspruch 1, wobei zusätzliche Funksteuersignale periodisch in einem Zeitraum von fünf Minuten oder weniger übertragen werden.
 6. System nach Anspruch 1, wobei zusätzliche Funksteuersignale periodisch über einen Zeitraum von zwei Minuten oder weniger übertragen werden.
 7. System nach Anspruch 5, wobei die zusätzlichen Funksteuersignale etwa alle fünfzehn Sekunden generiert werden.
 8. System nach Anspruch 5, wobei die Einlegesohle eine flache wiederaufladbare Lithium-Ionenbatterie (32) umfasst, die elektronische Schaltung weiterhin einen Spannungsregler (42) umfasst, der mit der Lithium-Ionenbatterie (32) verbunden ist, um die Spannung der Lithium-Ionenbatterie (32) zu regulieren.
 9. System nach Anspruch 8, wobei die elektronische Schaltung in der Einlegesohle weiterhin einen Spannungsbegrenzer (38) umfasst, der mit der Lithium-Ionenbatterie (32) verbunden ist.
 10. System nach Anspruch 1, weiterhin umfassend eine Gehäusevorrichtung in der Einlegesohle für die Lithium-Ionenbatterie (32), wobei die Gehäusevorrichtung das mühelose Abnehmen der Lithium-Ionenbatterie (32) von der Einlegesohle ermöglicht.
 11. Verfahren nach Anspruch 1, ferner umfassend eine Antenne (444) in Verbindung mit der elektronischen Schaltung, wobei die Antenne (444) am Umfang der Einlegesohle platziert ist.
 12. System nach Anspruch 1, wobei das erste und zusätzliche Funksteuersignale eine eindeutige Identifizierung der Einlegesohle umfassen.
 13. System nach Anspruch 12, wobei die Daten zur eindeutigen Identifizierung der Einlegesohle Datensequenzen umfassen, die einer oder mehreren zu beheizenden Einlegesohlen entsprechen.
 14. System nach Anspruch 8, wobei die Lithium-Ionenpolymerbatterie (32) Sicherheitsschaltungen (34) umfasst, die zwischen den Batteriepolen und den Anschlusskabeln angeordnet sind.
 15. System nach Anspruch 14, wobei die Batterie (32) weiterhin Eingangsbuchsen (36) umfasst, die dazu konfiguriert sind, die Verbindung mit den Ladequellen außerhalb der Einlegesohle herzustellen.
- ### Revendications
1. Système de réglage à distance de la température d'une semelle intérieure chauffée, ledit système comprenant :
 - un circuit électronique et un élément chauffant (30) contenus dans ladite semelle intérieure, ledit circuit électronique comprenant :
 - un récepteur (24) configuré pour recevoir des transmissions sans fil, et
 - un microprocesseur (26) en communication avec ledit récepteur et ledit élément chauffant ; et
 - un émetteur à distance (10) configuré pour transmettre un signal de commande sans fil initial au récepteur (24) lors de la réception d'un ordre de réglage de la température dudit élément chauffant, ledit émetteur à distance (10) étant en outre configuré, après transmission du signal de commande initial, pour transmettre automatiquement deux ou plusieurs signaux de commande sans fil supplémentaires au récepteur (10) à des intervalles périodiques, le signal de commande sans fil initial et chaque signal de commande sans fil supplémentaire donnent l'instruction au microprocesseur d'exécuter le même ordre reçu et de régler la température dudit élément chauffant.
 2. Système selon la revendication 1, dans lequel lesdits signaux de commande sans fil supplémentaires périodiques sont initiés par le signal de commande sans fil initial.
 3. Système selon la revendication 2, dans lequel ledit signal de commande unique est déclenché par un commutateur (44) dans ledit émetteur (10).

4. Système selon la revendication 3, dans lequel ledit commutateur (44) est enfoncé une fois pour initier ledit processus chauffant.
5. Système selon la revendication 1, dans lequel lesdits signaux de commande sans fil supplémentaires sont transmis périodiquement pendant une période de cinq minutes ou moins. 5
6. Système selon la revendication 1, dans lequel lesdits signaux de commande sans fil supplémentaires sont transmis périodiquement sur une période de deux minutes ou moins. 10
7. Système selon la revendication 5, dans lequel lesdits signaux de commande sans fil supplémentaires sont générés approximativement toutes les quinze secondes. 15
8. Système selon la revendication 5, dans lequel ladite semelle intérieure comprend une batterie au lithium-ion plate rechargeable (32), ledit circuit électronique comprenant en outre un régulateur de tension (42) connecté à ladite batterie au lithium (32) pour réguler la tension de ladite batterie au lithium (32). 20
25
9. Système selon la revendication 8, dans lequel ledit circuit électronique dans ladite semelle intérieure comprend en outre un limiteur de tension (38) connecté à ladite batterie au lithium (32). 30
10. Système selon la revendication 1, comprenant en outre un moyen de logement dans ladite semelle intérieure pour ladite batterie au lithium (32), ledit moyen de logement permettant d'enlever facilement ladite batterie au lithium (32) de ladite semelle intérieure. 35
11. Système selon la revendication 1, comprenant en outre une antenne (444) en communication avec ledit circuit électronique, ladite antenne (444) étant située à la périphérie de ladite semelle intérieure. 40
12. Système selon la revendication 1, dans lequel ledit signal initial et lesdits signaux supplémentaires de commande sans fil comprennent une identification de semelle intérieure exclusive. 45
13. Système selon la revendication 12, dans lequel lesdites données d'identification de semelle intérieure exclusive comprennent des séquences de données correspondant à une ou plusieurs semelles intérieures à chauffer. 50
14. Système selon la revendication 8, dans lequel ladite batterie polymère au lithium-ion (32) comprend des circuits de sécurité (34) situés entre des pôles de batterie et des fils de connexion. 55
15. Système selon la revendication 14, dans lequel ladite batterie (32) comprend en outre des fiches d'entrée (36) configurées pour se connecter à des sources de recharge à l'extérieur de ladite semelle intérieure.

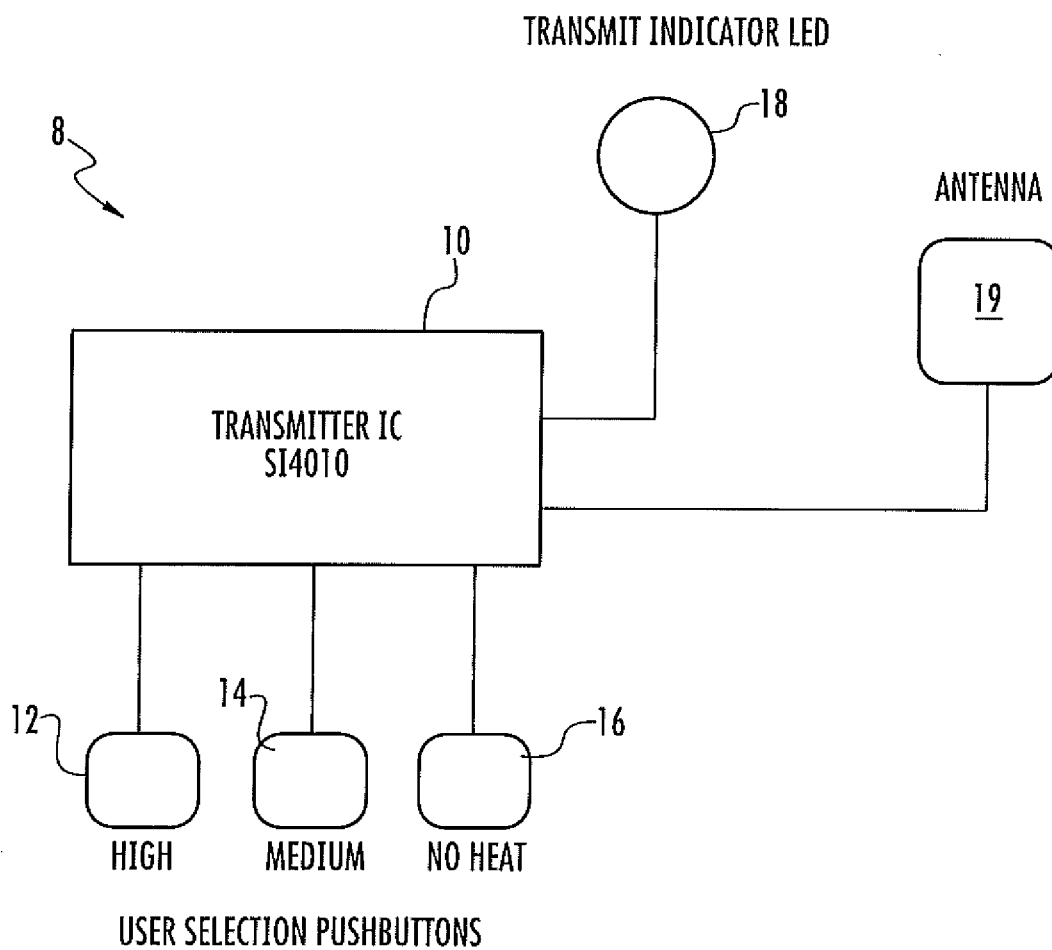
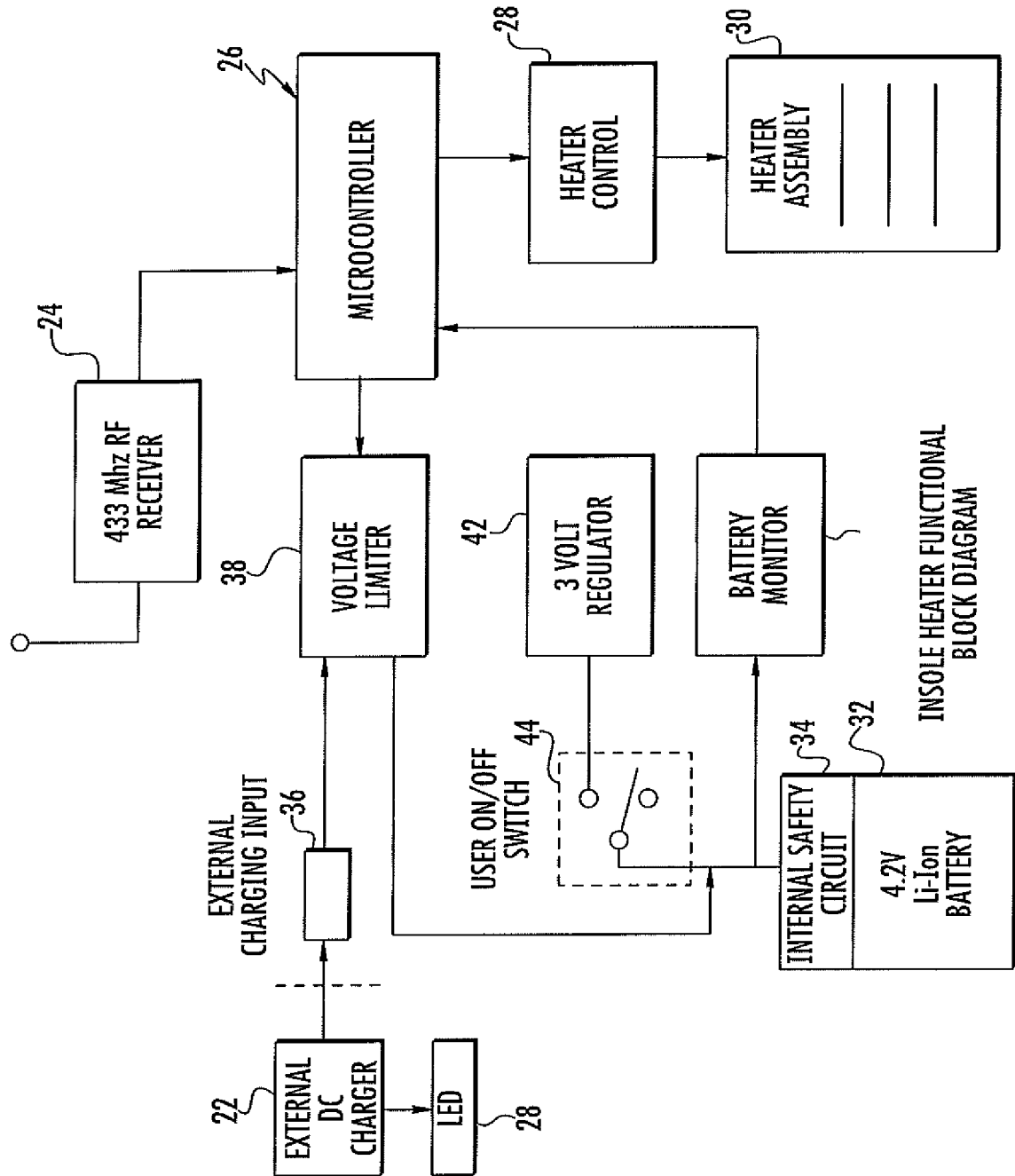


FIG. 1



INSOLE HEATER FUNCTIONAL
BLOCK DIAGRAM

FIG. 2

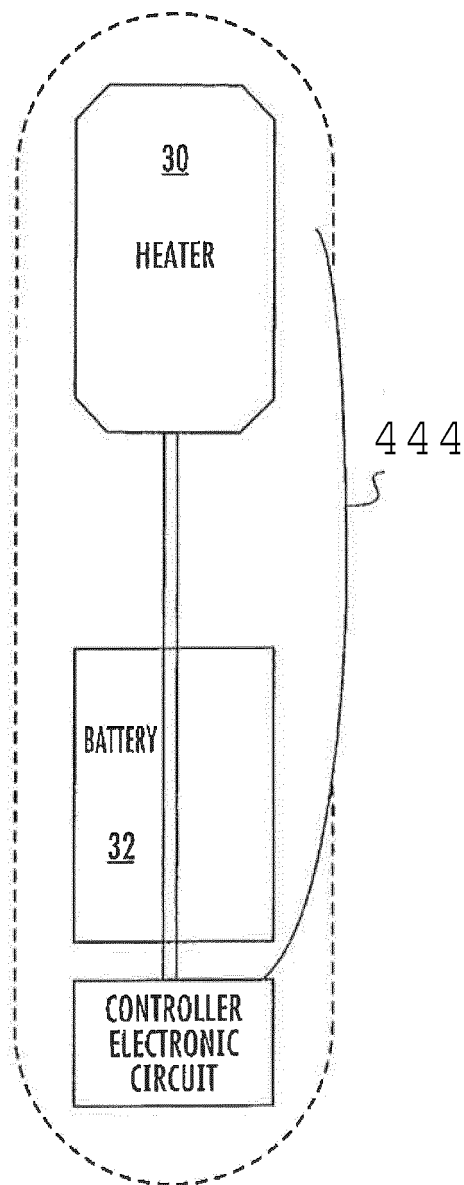


FIG. 3A

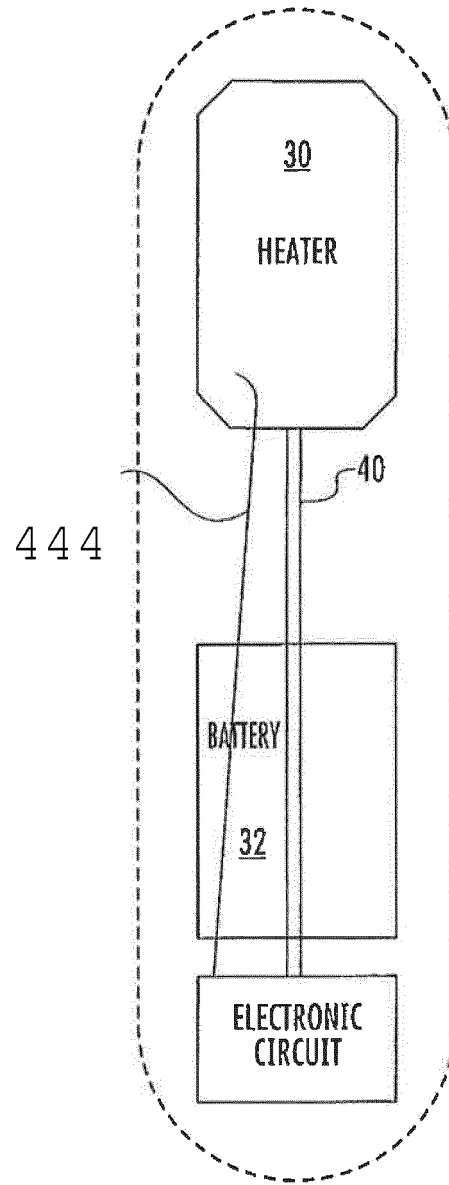


FIG. 3B
(PRIOR ART)

REFERENCES CITED IN THE DESCRIPTION

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