

DESCRIPTION

TITLE OF INVENTION: [A PORTABLE PULSED ELECTROMAGNETIC FIELD THERAPY SYSTEM, APPARATUS AND DEVICE]

TECHNICAL FIELD

[0001] The present disclosure relates generally to the technical field of traditional Chinese Medical (TCM) apparatuses, specifically relating to a portable pulsed electromagnetic field therapy (PEMFT) apparatuses that aid in improving the conditions of ischemic heart disease.

BACKGROUND

[0002] The following discussion of the background to the invention is intended to facilitate an understanding of the present invention only. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was published, known or part of the common general knowledge of the person skilled in the art in any jurisdiction as at the priority date of the invention.

[0003] In traditional Chinese acupuncture therapy, there have been documented cases where patients suffering from life-threatening heart diseases, in the absence of any other medical interventions, achieved clinically significant treatment results through acupuncture alone. Even in modern times, many Chinese medical institutions and hospitals continue to utilize acupuncture as a treatment for a wide range of both common and complex diseases, establishing it as one of the effective non-pharmaceutical treatment methods available.

[0004] On the palm of the human hand lies a well-known meridian point, or acupuncture point, called the "Laogong acupoint" ("劳宫穴"), a vital point on the Pericardium Meridian of Hand-Jueyin ("手厥阴心包经"). According to traditional Chinese meridian theory, properly stimulating the Laogong acupoint can alleviate heart pain, commonly known as angina. TCM textbooks suggest that in emergencies, when symptoms like angina occur and medical facilities are unavailable, applying firm pressure or massaging acupoints such as Laogong and Neiguan ("内关穴") can be used as an emergency response measure.

[0005] Acupuncture has historically been a primary treatment method used by physicians for sudden heart conditions. In earlier times, when medical science was less advanced, acupuncture for heart disease was highly valued. However, the effectiveness of acupuncture treatments varies significantly depending on the practitioner's skill, expertise and experiences, especially the critical technique of needle manipulation. The frequency and intensity of needle manipulation directly affect the treatment outcome, a skill that requires years of practice and extensive hands-on experience. Unfortunately, due to various factors leading to the loss of such specialized knowledge, the effectiveness of acupuncture in treating complex conditions has gradually declined compared to its historical success.

[0006] With the rapid advancements in modern medicine, there are now a greater variety of drugs, medications, and surgical options available for treating ischemic heart disease, often yielding more immediate and noticeable results compared to TCM treatments. Additionally, the sensations of soreness, numbness, swelling, and pain caused by acupuncture can impose a psychological burden, leading to discomfort or even fear in many patients. Consequently, patients have increasingly opted against traditional acupuncture, and many Chinese medical institutions and hospitals have gradually stopped using acupuncture as a treatment for myocardial ischemia. Furthermore, as mentioned earlier, acupuncture requires highly specialized skills and expertise to be performed effectively, and it cannot be self-administered by patients. As a result, acupuncture for ischemic heart disease such as myocardial ischemia has, over time, been largely excluded from clinical treatment protocols, with modern medications becoming the primary method of treatment today.

[0007] Nevertheless, based on the principle of acupuncture point stimulation, there have been attempts in the conventional art to utilize a pulsed electromagnetic field (PEMF), generated by ferrite core coils, to stimulate the Laogong acupoint, as an alternative to traditional acupuncture for the auxiliary treatment of certain ischemic heart diseases such as myocardial ischemia.

[0008] For example, Chinese patent application CN117180630A, titled "Acupuncture Point Therapeutic Apparatus for Assisting in Improving Ischemic Heart Disease", discloses a PEMFT apparatus designed to help improve the condition of ischemic heart disease. However, this specific PEMFT apparatus has certain technical limitations that

hinder its market adoption. For example, the apparatus is designed in a watch-like configuration to be worn around the wrist, which is inconvenient to adjust and lacks flexibility, making it difficult to precisely direct the PEMF onto the Laogong acupoint, thereby reducing the effectiveness of the treatment. Also, the disclosed apparatus relies on a single pulse waveform that provides limited stimulation, constraining its therapeutic potential.

[0009] Thus, there exists a need to develop an improved portable PEMFT system, device and apparatus, and alleviate at least one of the aforementioned problems.

SUMMARY

[0010] Specifically, to address the above-mentioned technical problems, the present invention specifically uses the following technical solutions:

[0011] Accordingly, in accordance with one aspect of the present invention, there is provided a portable pulsed electromagnetic field therapy (PEMFT) system (100), comprising: a main body (101) configured for generating a pulsed electromagnetic field (PEMF), and a strap (102) configured to be wrapped around a hand (200), wherein the main body (101) comprises a PEMF emitter (7) configured to alternately emit a first pulse signal at a first frequency and a second pulse signal at a second frequency periodically; wherein the first frequency is 20Hz – 45Hz, and the second frequency is 50Hz – 90Hz, and the second frequency is at least 10Hz higher than the first frequency; and, wherein the strap (102) comprises a first attachment section (104) configured to cover a target treatment area (201), and the main body (101) is configured to be detachably mounted on the first attachment section (104).

[0012] In some embodiments, the main body (101) is detachably mounted on the first attachment section (104) by means of an adhesive element.

[0013] In some embodiments, the adhesive element is Velcro tape.

[0014] In some embodiments, the first attachment section (104) is configured to comprise one or more markers for positioning the main body (101) to cover the target treatment area (201).

[0015] In some embodiments, the strap (102) further comprising a second attachment section (202) configured to be wrapped around a wrist.

[0016] In some embodiments, the PEMFT system (100) comprises a controller (6) configured to operate the PEMF emitter (7), wherein the controller (6) is located either inside the main body (101).

[0017] In some embodiments, the PEMFT system (100) further comprises an acupoint detection module arranged to be in data communication with the controller (6), wherein the an acupoint detection module is programmed to detect the target treatment area (201); and, upon correct detection of the target treatment area (201), the acupoint detection module is configured to issue a confirmation signal.

[0018] In some embodiments, the strap (102) is configured to comprise a vital signal sensor for real-time collection of user vital sign data; and the vital sign sensor is arranged to be in data communication with the controller (6) to communicate the user vital sign data to the controller (6).

[0019] In some embodiments, the user vital sign data comprises pulse and/or blood oxygen level.

[0020] In some embodiments, the controller (6) is operable to determine whether the user vital sign data monitored in real-time by the vital sign sensor is abnormal.

[0021] In some embodiments, the main body (101) further comprises a temperature sensor (10) arranged to be in data communication with the controller (6); wherein the controller (6) is operable to receive temperature data from the temperature sensor (10), and determine whether the temperature data is lower than a temperature threshold.

[0022] In some embodiments, the main body (101) further comprises a wireless communication module configured to facilitate data communication between the main body (101) and external electronic apparatus.

[0023] In some embodiments, the external electronic apparatus is a smart communication device.

[0024] In some embodiments, the wireless communication module comprises a Bluetooth module and a WIFI module.

[0025] In some embodiments, the main body (101) further comprises a vibrator, and the vibrator is configured to generate a vibration signal when the PEMF emitter (7) emits

the PEMF.

[0026] In some embodiments, the strap is made of nylon.

[0027] In some embodiments, the first pulse signal and the second pulse signal are configured to be emitted alternately at a first interval.

[0028] In some embodiments, the first interval is programmed to vary in duration according to a treatment program.

[0029] In some embodiments, the first interval is programmed to increase as the treatment program progresses.

[0030] In some embodiments, the target treatment area is an acupoint.

[0031] In some embodiments, the acupoint is Laogong acupoint.

[0032] Other aspects and features of the present invention will become apparent to those of ordinary skill in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] In the figures, which illustrate, by way of non-limiting examples only, embodiments of the present invention,

[0034] **[Fig. 1a]:** illustrates a perspective top view of a portable PEMFT system (100) according to various embodiments of the present invention.

[0035] **[Fig. 1b]:** illustrates a perspective top view of the main body (101) portable PEMFT system (100) according to various embodiments of the present invention.

[0036] **[Fig. 1c]:** illustrates a perspective bottom view of the main body (101) portable PEMFT system (100) according to various embodiments of the present invention.

[0037] **[Fig. 2a]:** illustrates an exploded top view of the main body (101) portable PEMFT system (100) according to various embodiments of the present invention.

[0038] **[Fig. 2b]:** illustrates an exploded bottom view of the main body (101) portable PEMFT system (100) according to various embodiments of the present invention.

[0039] **[Fig. 3a]:** illustrates a perspective top view of a portable PEMFT system (100) worn on a human hand according to various embodiments of the present invention.

[0040] **[Fig. 3b]:** illustrates a side view of the portable PEMFT system (100) worn on a human hand according to various embodiments of the present invention.

[0041] **[Fig. 3c]:** illustrates a bottom view of the portable PEMFT system (100) worn on a human hand according to various embodiments of the present invention.

[0042] **[Fig. 3d]:** illustrates the portable PEMFT system (100) removed from the human hand according to various embodiments of the present invention.

[0043] **[Fig. 4]:** illustrates, in a block diagram, a system for operating a portable PEMFT device according to various embodiments of the present invention.

DETAILED DESCRIPTION

[0044] Throughout this document, unless otherwise indicated to the contrary, the terms “comprising”, “consisting of”, “having” and the like, are to be construed as non-exhaustive, or in other words, as meaning “including, but not limited to”.

[0045] Furthermore, throughout the document, unless the context requires otherwise, the word “include” or variations such as “includes” or “including” will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

[0046] Throughout the description, it is to be appreciated that the term “Velcro tape” refers to a fastening material consisting of two complementary surfaces: one surface with tiny hooks and the other with small loops. When pressed together, the hooks catch onto the loops, creating a temporary bond that can be easily separated by pulling the surfaces apart. Velcro tape is commonly used in a variety of applications for attaching and detaching items quickly. In the context of the present invention, the Velcro tape is configured to allow the main body (101) to be easily attached to and detached from the first attachment section (104) of the strap (102), enabling the user to conveniently adjust the position of the main body (101) for precise targeting of the acupoint.

[0047] Throughout this description, the term “pulsed electromagnetic field therapy” (PEMFT), also known as “low field magnetic stimulation” (LFMS), refers to the application

of low-frequency electromagnetic fields to the body with the aim of promoting healing, alleviating pain, and supporting recovery from various medical conditions. PEMFT is commonly used to stimulate cellular repair, reduce inflammation, improve circulation, and enhance overall tissue regeneration. It operates by delivering pulsed electromagnetic waves that interact with the body's natural magnetic field, encouraging biological responses that facilitate healing processes at the cellular level.

[0048] Unless defined otherwise, all other technical and scientific terms used herein have the same meaning as is commonly understood by a skilled person to which the subject matter herein belongs.

[0049] As shown in Figures 1 to 4, the present invention provides a portable pulsed electromagnetic field therapy (PEMFT) system (100), comprising: a main body (101) configured for generating a pulsed electromagnetic field (PEMF), and a strap (102) configured to be wrapped around a hand (200), wherein the main body (101) comprises a PEMF emitter (7) configured to alternately emit a first pulse signal at a first frequency and a second pulse signal at a second frequency periodically; wherein the first frequency is 20Hz – 45Hz, and the second frequency is 50Hz – 90Hz, and the second frequency is at least 10Hz higher than the first frequency; and, wherein the strap (102) comprises a first attachment section (104) configured to cover a target treatment area (201), and the main body (101) is configured to be detachably mounted on the first attachment section (104).

[0050] Embodiment.1

[0051] In details, the PEMF emitter (7) is configured to periodically and alternately emit a first pulse signal of a first frequency and a second pulse signal of a second frequency. Unlike other PEMFT treatments that involve a gradual shift in pulse frequency, the present invention directly switches from the first frequency, which has a lower value, to the second frequency, which has a higher value, thereby exerting an immediate and direct change in the impact of the PEMF on the target treatment area (e.g., an acupoint). Furthermore, the difference between the first frequency and the second frequency is programmed to be significant (at least 10Hz higher), further amplifying the effect of the frequency shift onto the acupoint, producing a therapeutic result comparable to traditional acupuncture.

[0052] In some treatment programs, to enhance the intensity of the therapy, the first

frequency may be predetermined to a higher value, such as 40 Hz or 45 Hz, while the second frequency is set to a significantly higher value, typically 20 Hz above the first frequency, reaching 60 Hz or 65 Hz. Conversely, for treatment programs intended for milder treatments, the first frequency may be set at a lower value, such as 20Hz, with the second frequency predetermined at 30Hz or 40Hz. Additionally, in treatment programs that comprise multiple treatment segments with varying intensities, each treatment segment is configured to apply a different pair of first and second frequencies. The first pair may be preprogrammed for a milder treatment, while subsequent pairs in the second, third, and further treatment segments can progressively increase in intensity by using higher first and second frequencies, with a larger difference between the two frequencies in each pair, thereby gradually intensifying the treatment effect as the program progresses.

[0053] In some embodiments, the first pulse signal and the second pulse signal are configured to be emitted alternately at a first interval, providing a rest period for the target treatment area, thereby alleviating potential discomfort and ensuring the treatment remains comfortable for the user. In certain treatment programs, the first interval is set to have a fixed duration throughout the entire program. In other treatment programs, the duration of the first interval is programmed to vary according to the treatment protocol. Specifically, in treatment programs that consist of multiple segments, the first interval may be predetermined to be relatively longer during the initial segments to make the treatment more tolerable and comfortable for the user. As the user becomes accustomed to the therapy, the first interval in subsequent treatment segments can gradually shorten, intensifying the treatment as the program progresses.

[0054] In some embodiments, the target treatment area is an acupoint, and the portable PEMFT system (100) is designed to mimic traditional acupuncture treatments by stimulating the acupoint in a controlled and precise manner, generating therapeutic effects while minimizing potential side effects and discomfort for the user. In certain embodiments, the target treatment area is the Laogong acupoint, enabling the portable PEMFT system (100) to deliver healing benefits for conditions such as ischemic heart disease. Unlike other PEMFT treatments that apply electromagnetic fields to broader areas of the body, using PEMFT to stimulate an acupoint requires careful consideration, as only balanced and controlled stimulation of the acupoint can yield favorable therapeutic results without causing significant discomfort or risky side effects. For example,

overstimulation of an acupoint, for instance, could pose health risks, requiring proper regulation of the treatment.

[0055] In a specific example, the PEMF emitter (7) is configured to periodically and alternately emit a first pulse signal at a first frequency and a second pulse signal at a second frequency, simulating the twisting needle technique used in traditional Chinese acupuncture. This method, combined with stimulation of acupoints such as the Laogong acupoint, is intended to enhance cardiovascular function. In this specific example, the first pulse signal is set to 40 Hz, generating a pulse waveform with a frequency of 40 Hz, a period of 25 ms, and a 50% duty cycle.

[0056] The expression for the quasi-square wave pulse signal in one cycle is provided in details as follows:

$$\textbf{[0057] } y(t) = \begin{cases} V \left[\sin \frac{\omega}{\alpha} t \right] & 0 < t < 1ms \\ V & 1ms \leq t \leq 10ms \\ V \left[1 - \sin \frac{\omega}{\alpha} (t - 10) \right] & 10ms \leq t \leq 11ms \\ 0 & 11ms \leq t \leq 25ms \end{cases}$$

[0058] wherein “ V ” is the maximum amplitude of the signal generated; “ α ” refers to the roll-off factor of the waveform is 4; and “ t ” is in milliseconds.

[0059] In some embodiments, the waveform expression of the treatment electrical signal is:

$$\textbf{[0060] } J(t) = \begin{cases} V \frac{\omega}{\alpha} \left[\cos \frac{\omega}{\alpha} t \right] & 0 < t < 1ms \\ 0 & 1ms \leq t \leq 10ms \\ -V \frac{\omega}{\alpha} \left[\cos \frac{\omega}{\alpha} (t - 10) \right] & 10ms \leq t \leq 11ms \\ 0 & 11ms \leq t \leq 25ms \end{cases}$$

[0061] In some embodiments, the second pulse signal is predetermined as 50Hz, having a pulse waveform frequency of 50Hz, a period of 20ms, and a duty cycle of 50%.

[0062] The expression for the quasi-square wave pulse signal in one cycle is as follows:

$$[0063] \quad y(t) = \begin{cases} V \left[\sin \frac{\omega}{\alpha} t \right] & 0 < t < 1ms \\ V & 1ms \leq t \leq 10ms \\ V \left[1 - \sin \frac{\omega}{\alpha} (t - 10) \right] & 10ms \leq t \leq 11ms \\ 0 & 11ms \leq t \leq 20ms \end{cases}$$

[0064] wherein “V” is the maximum amplitude of the signal; “ α ” refers to the roll-off coefficient of the waveform is 4; and “t” is in milliseconds.

[0065] The waveform expression of the treatment electrical signal is:

$$[0066] \quad J(t) = \begin{cases} V \frac{\omega}{\alpha} \left[\cos \frac{\omega}{\alpha} t \right] & 0 < t < 1ms \\ 0 & 1ms \leq t \leq 10ms \\ -V \frac{\omega}{\alpha} \left[\cos \frac{\omega}{\alpha} (t - 10) \right] & 10ms \leq t \leq 11ms \\ 0 & 11ms \leq t \leq 20ms \end{cases}$$

[0067] Embodiment.2

[0068] In some embodiments, the strap (102) comprises a first attachment section (104) that is configured to cover the target treatment area (e.g., an acupoint), with the main body (101) being detachably mounted on the first attachment section, via, for example, an adhesive element such as Velcro tape or an attachment module configured for convenient attachment and detachment of the main body (101).

[0069] In some embodiments, the first attachment section (104) comprises a first

surface of the Velcro tape, and the main body (101) is configured to comprise a second surface of the Velcro tape. The first surface and the second surface form a complementary pair: one surface contains tiny hooks, and the other surface contains small loops. Thus, when the first surface and the second surface of the Velcro tape are pressed together, the main body (101) is fastened to the strap (102). In use, the main body (101) is positioned between the strap (102) and the user's palm, projecting the PEMF emitter (7) towards the Laogong acupoint.

[0070] In some embodiments, the first attachment section (104) comprises an installation opening (103) specifically designed to accommodate the main body (101), allowing one side of the main body (101) to come into direct contact with the user's skin at the acupoint, such as the Laogong acupoint, ensuring effective PEMF delivery. Simultaneously, the installation opening (103) is configured to expose a control panel (106) on the opposite side of the main body (101), providing the user with convenient access to control and operate the portable PEMFT system (100), particularly during active treatment sessions. In some embodiments, the first attachment section (104) further comprises attachment flaps (108a, 108b) surrounding the installation opening (103). These flaps are designed to securely hold the main body (101) in place within the installation opening (103), ensuring stability during use. For example, the main body (101) may comprise securing holes (110a, 110b) corresponding to the attachment flaps (108a, 108b), allowing the flaps to be inserted into the securing holes (110a, 110b) to attach the main body (101) to the strap (102). The attachment flaps can be made of Velcro tape to facilitate easy attachment and detachment, providing flexibility and convenience for the user to adjust or remove the main body (101) of the portable PEMFT system (100) as needed.

[0071] In some embodiments, the first attachment section (104) is configured to comprise one or more markers to assist in positioning the main body (101) and accordingly the PEMF emitter (103) over the target treatment area (201). For example, these markers may correspond to specific reference points on the user's hand, facilitating that when the markers are properly aligned with those reference points, the PEMF emitter (103) of the main body (101) is accurately positioned over the Laogong acupoint. These markers help guide the user in correctly wearing the portable PEMFT system (100), ensuring precise placement of the PEMF emitter (103) for therapeutic effect.

[0072] In some embodiments, the marker is intended to help locate the target treatment area (e.g., the Laogong acupoint) directly. Specifically, the marker can be a point or mark pre-applied on the first attachment section (104), corresponding to the location of the acupoint (e.g., Laogong) on the palm. For example, since the Laogong acupoint is approximately at the center of the palm, a position mark can be placed directly at the center of the first attachment section (104), which may be made of a simple Velcro tape. When attaching the main body (101) to the first attachment section (104), the position can be confirmed by checking whether the edges of the first attachment section (104) are symmetrical. If the first attachment section (104) is configured as shown in Figures 1–3, marks can be placed around the installation opening (103) to align with other parts of the palm, such as the ends of the fingers. This allows the user to align the installation opening with a finger, enabling convenient placement of the device over the acupoint.

[0073] In some embodiments, the strap (102) further comprises a second attachment section (202) configured to wrap around the wrist. In certain embodiments, the second attachment section (202) comprises two ends (102a, 102b) of the strap (102), which can be fastened together to securely wrap the strap (102) around the user's wrist, ensuring a stable fit during use. When fastening the two ends (102a, 102b) of the strap (102), the strap (102) can be crossed over the back of the hand to provide additional stability, ensuring the portable PEMFT system (100) remains securely attached to the hand (see Figure. 3a – 3c). In some embodiments, the two ends (102a, 102b) of the strap (102) are configured to comprise adhesive elements such as Velcro tape so that when the strap (102) is wrapped around the palm and wrist, the strap (102) can be fixed to the palm by sticking the adhesive element at the end.

[0074] Embodiment.3

[0075] In some embodiments, the main body (101) is configured to house a battery, a PCB circuit board (107), a controller (e.g., central processing unit (CPU)) (6), and a power amplifier (5), all arranged on the PCB circuit board (107). The PEMF emitter (7) is positioned on the bottom side (105) of the main body (101) closest to the user's palm. In some embodiments, the signal output end of the CPU (6) is connected to the signal input end of the power amplifier (5), while the signal output end of the power amplifier (5) is connected to the signal input end of the PEMF emitter (7). In some embodiments, the

main body (101) is equipped with a power switch (8) to activate and deactivate the portable PEMFT system (100).

[0076] In some embodiments, the CPU (6) model used is either STM32F030F4P6 or STM32F070F6P6. The power amplifier (5) model is AD8532ARZ or OPA2333, and the PEMF emitter (7) model is a ferrite core DR1514. In some embodiments, the PEMF emitter (7) additionally includes an impedance converter (e.g., AD5933) for precise frequency generation and measurement.

[0077] In some embodiments, the main body (101) further includes an acupoint detection module electrically connected to the controller. The controller is used to determine the target treatment location based on the signals detected by the acupoint detection module and to prompt the user when the target treatment area is detected.

[0078] The working process and principle of the above structure are further described as follows according to some embodiments of the present invention:

[0079] In some embodiments, during use, the main body (101) is first attached to the strap (102) (e.g., using Velcro tape or through the installation opening (103) as described above), and the strap (102) is then wrapped around the palm and wrist. For example, the strap (102) can be wrapped once between the index finger and thumb, and then around the wrist, secured with Velcro tape or other adhesive elements at the second attachment section (202).

[0080] In some embodiments, the strap (102) can be first wrapped around the palm and wrist. Once the strap (102) is properly positioned, with the first attachment section (104) aligned over the Laogong acupoint (e.g., using position markers for identification of the Laogong acupoint), the main body (101) is then attached to the strap (102) at the first attachment section (104) (e.g., via Velcro tape or the installation opening (103) as described above).

[0081] The strap (10) can be made of nylon, which is lighter and more adjustable than silicone used in some conventional designs, so that the first attachment section (104) can be adjusted more conveniently to cover the intended acupoint (e.g., Laogong acupoint).

[0082] In some embodiments, after the main body (101) is properly adhered to the first attachment section (104) at the position of the Laogong acupoint using Velcro tape on

the main body (101), and the PEMF emitter (7) is turned on (e.g., via the power switch (8)), causing the PEMF emitter (7) to alternately emit two pulse signals at 40Hz (i.e., the first pulse signal) and 50Hz (i.e., the second pulse signal) to simulate the twisting needle operation to stimulate the Laogong acupoint. Specifically:

[0083] a. When the power switch (8) on the main body (101) is turned on, the battery supplies power to the PCB (107), CPU (i.e., the controller (6)), power amplifier (5), and PEMF emitter (7). The PEMFT system (100) enters standby mode, outputting 0V.

[0084] b. After 1 minute in standby mode, the CPU starts to generate and transmit a 3.3V square wave to the power amplifier (5) module, which then outputs 5V to the input end of the PEMF emitter (7). The emission head of the PEMF emitter (7) is positioned to face a specific meridian point or acupoint (e.g., the Laogong acupoint) for an 8-minute treatment session. A Hall effect sensor controls the magnetic field intensity through closed-loop feedback with the power amplifier (5), ensuring accuracy. The magnetic field intensity is set at a mid-range value of 210.

[0085] c. After 8 minutes of stimulation, the PEMFT system (100) returns to standby mode (0V). The CPU counts down for 2 hours before reactivating the PEMFT system (100) for another 8-minute treatment cycle.

[0086] d. Following the second treatment, the PEMFT system (100) re-enters standby mode for an additional 2 hours before reactivating for a final 8-minute cycle, after which the PEMFT system (100) shuts down.

[0087] e. For safety, pressing the power button (e.g., located on the control panel (106)) during operation forces the PEMFT system (100) to shut down, cutting off all power supply. This safety feature allows users to manually intervene if they feel uncomfortable continuing the treatment.

[0088] In some embodiments, the main body (101) further comprises a rechargeable battery (e.g., a lithium-ion battery). The rechargeable battery is designed to provide sufficient power for extended treatment periods (e.g., overnight use) and can be charged using a magnetic charging dock with a standard USB-C port, data cable, or other commonly available mechanisms.

[0089] In some embodiments, the main body (101) further comprises indicator lights (9) for displaying power, operational status, and battery level. These indicator lights (9) can remind the user when, for example, charging is needed. The signal input terminal of the indicator light (9) is connected to the signal output terminal of the CPU (6).

[0090] In some embodiments, the main body (101) further comprises a wireless communication module. In some embodiments, this wireless communication module comprises a Bluetooth module (13), enabling the main body (101) to synchronize with a corresponding mobile application in a smart mobile device. In embodiments wherein the controller is installed inside the main body (101) of the PEMFT system (100), this mobile application is operable to provide advanced tracking, personalized recommendations, and remote control of device settings. Available models include nRF52840, nRF52832, CC2640R2F, BC127, HM-10, and the AP1X Series. In some embodiments, certain controller functions can be integrated into the mobile application, reducing the need for the controller (6) within the main body (101) to perform all of these tasks.

[0091] In some embodiments, the wireless communication module may also include a WIFI module (12), allowing the main body (101) to maintain real-time data and cloud status updates. Available models include ESP32-WROOM-32, ATWINC1500, nRF7002, ESP8285, and ESP32-PICO-D4.

[0092] In some embodiments, the main body (101) further comprises a micro-vibrator (14) that synchronizes vibration signals when the PEMF emitter (7) emits pulse signals. Since the pulsed magnetic field acts on the human body without any immediate tactile sensation, the vibration could help enhance the user's experience and sense of realism, improving user experiences to some extent, particularly for those who enjoy sensation during acupuncture treatments (e.g., senior citizens who are used to traditional acupuncture treatments). Available models include CME-60 and LRA-1205.

[0093] In some embodiments, the strap (102) is equipped with a vital sign sensor, such as a pulse oximeter (11), for real-time collection of the user's vital sign data. The sensor is configured to wirelessly communicate the detected data to the controller (6) via Bluetooth or similar communication protocols. The vital sign data may include pulse rate and/or blood oxygen levels. The controller (6) is programmed to receive and analyze the data, determining whether the monitored vital signs are abnormal. If an abnormality is detected, the controller (6) is configured to send an alert message to the user's smart

mobile device and/or a cloud server via the wireless communication module, prompting the user to stop the treatment or alerting healthcare staff monitoring the user. In some embodiments, the vital sign sensor is attached to the strap (102) in the area corresponding to the pulse point using adhesive elements, such as Velcro tape.

[0094] In some embodiments, the vital sign sensor uses a pulse oximeter (11) to monitor the user's pulse and blood oxygen levels during treatment, recording physiological responses in real time. Available models include ADPD1080, MAX30102, TMD2635, and AMB-05. In cases where the pulse is detected as abnormal (e.g., outside the normal range of 60-100 bpm or SpO2 below 95%), the PEMFT system (100) synchronously alerts both the user and cloud operators, allowing for prompt intervention if needed.

[0095] In some embodiments, the area of the main body (101) that fits against the palm is equipped with a temperature sensor (10), which is electrically connected to the controller (6). The main body (101) also includes a wireless communication module (12, 13) linked to the controller (6). The controller (6) is programmed to determine if the real-time temperature data monitored by the sensor falls below a preset threshold. If this occurs, the controller (6) sends an alert to the user's smart mobile device via the wireless communication module (12, 13), notifying the user that the main body (101) may have detached or become loose. This feature allows the temperature sensor (10) to function as a convenient indicator of whether the main body (101) remains securely attached and properly aligned with the acupoint (e.g., Laogong acupoint) during the treatment session.

[0096] In some embodiments, the temperature sensor (10) uses the LM35 model to monitor the contact between the main body (101) and the user's skin by detecting body temperature, ensuring the effectiveness of the treatment. If the temperature falls below the set threshold (e.g., below 23°C), the device notifies the user via a smart mobile terminal that the main body (101) may have detached, prompting the user to make adjustments. In such cases, the PEMFT system (100) enters standby mode until the issue is resolved.

[0097] In some embodiments, the temperature sensor (10) could also function as a measurement of the user's physiological status, such as whether the user is experiencing discomforts. For example, if the temperature data detected increases rapidly and high above a predetermined threshold value, the controller (6) is operable to transmit an alert

signal to the user or the healthcare staff.

[0098] In some embodiments, the main body (101) further includes a charging port for powering the battery. In certain embodiments, the charging port is a Type-C port.

[0099] In some embodiments, the PEMFT system (100) is configured to support customized treatment settings tailored to individual health needs. As mentioned earlier, it can also be integrated with a mobile application for comprehensive tracking and analysis of treatment progress.

[0100] The present invention achieves various technical advantages over the conventional arts in the field.

[0101] First, the present invention leverages the human body's physiological self-repair mechanism by emitting specific frequencies (40-50Hz) of PEMF to simulate the twisting needle technique used in traditional Chinese acupuncture. This non-invasive, painless stimulation of the Laogong acupoint, when applied multiple times a day, aids in the treatment of ischemic heart disease. The invention addresses the common discomforts associated with acupuncture, such as soreness, numbness, swelling, and pain, while reducing the psychological burden on patients. It also lowers the technical requirements for operators, allowing users to independently perform the treatment. As a result, the invention replicates the effects of traditional Chinese acupuncture in a non-drug, non-invasive, and painless manner.

[0102] In the present invention, the strap (102) allows the main body (101) to be detachably attached to the first attachment section (104), enabling the user to secure the strap (102) on the palm according to the size of their hand and personal preferences first. This ensures the target treatment area (e.g., the Laogong acupoint) is properly located before placing the main body (101) onto the first attachment section (104) (e.g., using Velcro tape or an installation opening as described above). The PEMF emitter (7) within the main body (101) of the PEMFT system (100) can then be correctly aligned to project onto the target treatment area (e.g., Laogong acupoint), ensuring precise stimulation and effective treatment.

[0103] Furthermore, in some embodiments, the strap (102) is made of nylon material, allowing the Velcro tape attached to the main body (101) and the pulse oximeter sensor (11) to adhere easily to the adjustable, replaceable, and flexible strap (102). This design

makes it more convenient to wear and adjust the device's position. The nylon strap's hypoallergenic and breathable properties extend wear time, making it suitable for individuals prone to skin irritation or rashes from wearing silicone straps. Additionally, for those who frequently dirty or wet their straps, the nylon strap can be easily replaced, as it is more difficult to clean.

[0104] Compared to silicone watch straps used in the conventional arts, nylon watch straps offer several technical advantages:

[0105] Breathability: Nylon straps are more breathable, helping to reduce skin irritation and keeping the wrist cool and comfortable in hot or humid environments.

[0106] Comfort: Nylon straps are typically softer, more flexible, and more comfortable to wear, especially for long periods.

[0107] Style and Variety: Nylon straps come in various colours, patterns, and textures, offering more style options than typically monochromatic and smooth silicone straps.

[0108] Adjustability: Many nylon straps (such as those with Velcro or buckle closures) offer easy adjustment features to accommodate different wrist sizes and personal preferences.

[0109] Durability: Nylon is generally more durable and resistant to wear, suitable for various activities.

[0110] Lightweight: Nylon material is lightweight, making the watch feel less bulky on the wrist, and may be more comfortable compared to some silicone straps.

[0111] In contrast, while silicone straps have the advantages of being waterproof and easy to clean, they are less breathable and offer fewer style and adjustability options than nylon straps.

[0112] The present invention provides a non-invasive alternative to traditional treatment methods, offering a convenient technical solution for enhancing cardiovascular health. The PEMFT system (100) is lightweight, easy to wear, and suitable for use during daily activities or rest. Its flexible design, customizable settings, and integration with modern technology provide users with a precise, effective, and convenient treatment experience.

[0113] It should be further appreciated by the person skilled in the art that variations and combinations of features described above, not being alternatives or substitutes, may be combined to form yet further embodiments falling within the intended scope of the invention.

[0114] As would be understood by a person skilled in the art, each embodiment, may be used in combination with other embodiment or several embodiments.

Claims

Claim 1. A portable pulsed electromagnetic field therapy (PEMFT) system (100), comprising:

a main body (101) configured for generating a pulsed electromagnetic field (PEMF), and a strap (102) configured to be wrapped around a hand,

wherein the main body (101) comprises a PEMF emitter (7) configured to alternately emit a first pulse signal at a first frequency and a second pulse signal at a second frequency periodically;

wherein the first frequency is 20Hz – 45Hz, and the second frequency is 50Hz – 90Hz, and the second frequency is at least 10Hz higher than the first frequency; and,

wherein the strap (102) comprises a first attachment section (104) configured to cover a target treatment area (201), and the main body (101) is configured to be detachably mounted on the first attachment section (104).

Claim 2. The PEMFT system (100) according to claim 1, wherein the main body (101) is detachably mounted on the first attachment section (104) by means of an adhesive element.

Claim 3. The PEMFT system (100) according to claim 2, wherein the adhesive element is Velcro tape.

Claim 4. The PEMFT system (100) according to any one of the preceding claims, wherein the first attachment section (104) is configured to comprise one or more markers for positioning the main body (101) to cover the target treatment area (201).

Claim 5. The PEMFT system (100) according to any one of the preceding claims, wherein the strap (102) further comprising a second attachment section (202) configured to be wrapped around a wrist.

Claim 6. The PEMFT system (100) according to any one of the preceding claims, further comprising a controller (6) configured to operate the PEMF emitter (7), wherein the controller (6) is located either inside the main body (101).

Claim 7. The PEMFT system (100) according to claim 6, further comprising an acupoint detection module arranged to be in data communication with the controller (6), wherein the an acupoint detection module is programmed to detect the target treatment area (201); and, upon correct detection of the target treatment area (201), the acupoint detection module is configured to issue a confirmation signal.

Claim 8. The PEMFT system (100) according to claim 6 or 7, wherein the strap (102) is configured to comprise a vital signal sensor for real-time collection of user vital sign data; and the vital sign sensor is arranged to be in data communication with the controller (6) to communicate the user vital sign data to the controller (6).

Claim 9. The PEMFT system (100) according to any one of claim 8, wherein the user vital sign data comprises pulse and/or blood oxygen level.

Claim 10. The PEMFT system (100) according to any one of claim 8, wherein the controller (6) is operable to determine whether the user vital sign data monitored in real-time by the vital sign sensor is abnormal.

Claim 11. The PEMFT system (100) according to claims 6 – 10, wherein the main body (101) further comprises a temperature sensor (10) arranged to be in data communication with the controller (6); wherein the controller (6) is operable to receive temperature data from the temperature sensor (10), and determine whether the temperature data is lower than a temperature threshold.

Claim 12. The PEMFT system (100) according to any one of the preceding claims, wherein the main body (101) further comprises a wireless communication module configured to facilitate data communication between the main body (101) and external electronic apparatus.

Claim 13. The PEMFT system (100) according to claim 12, wherein the external electronic apparatus is a smart communication device.

Claim 14. The PEMFT system (100) according to claim 12, wherein the wireless communication module comprises a Bluetooth module and a WIFI module.

Claim 15. The PEMFT system (100) according to any one of preceding claims, wherein the main body (101) further comprises a vibrator, and the vibrator is configured to generate a vibration signal when the PEMF emitter (7) emits the PEMF.

Claim 16. The PEMFT system (100) according to any one of the preceding claims, wherein the strap is made of nylon.

Claim 17. The PEMFT device (100) according to any one of the preceding claims, wherein the first pulse signal and the second pulse signal are configured to be emitted alternately at a first interval.

Claim 18. The PEMFT device (100) according to claim 17, wherein the first interval is programmed to vary in duration according to a treatment program.

Claim 19. The PEMFT device (100) according to claim 17, wherein the first interval is programmed to increase as the treatment program progresses.

Claim 20. The PEMFT device (100) according to any one of the preceding claims, wherein the target treatment area is an Acupoint.

Claim 21. The PEMFT device (100) according to claim 20, wherein the Acupoint is Laogong Acupoint.