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(54) **METHOD AND DEVICE FOR REDUCING SYMPTOMATIC RELAPSE OF SPASTICITY**

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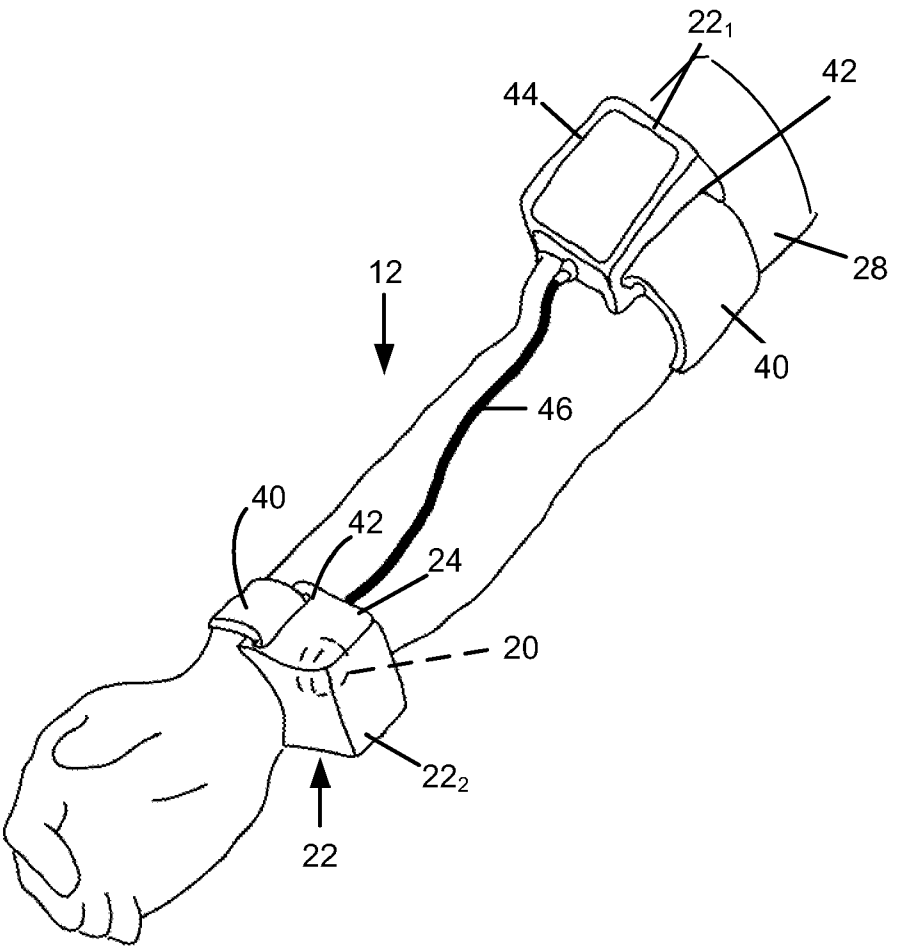
(57) **ABSTRACT**

A wearable maintenance therapy device (**10**, **12**, **14**) imparts vibratory stimuli to appendicular muscles of a patient's limb during daily life activity of the patient to reduce symptomatic relapse of spasticity. A vibrator actuator (**20**) contained in a sup port housing (**24**) and configured for placement in operational contact with appendicular muscles of a limb (**28**) of a patient imparts localized vibration to one or more of the patient's appendicular muscles. The localized vibration produces proprioceptive input from the vibrated muscle or muscles (**90**t) to activate sensory areas of the patient's central nervous system. Programmable electrical control circuitry (**50**) controls vibration characteristics of the localized vibration and includes memory sites for storing operating values of the vibration characteristics. The vibration characteristics include pattern and timing of vibration specified to produce the proprioceptive input during the patient's daily life activity to mitigate any symptomatic relapse of spasticity.



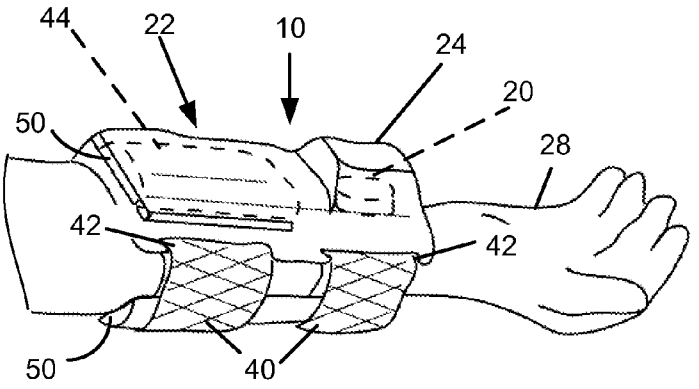


Fig. 1

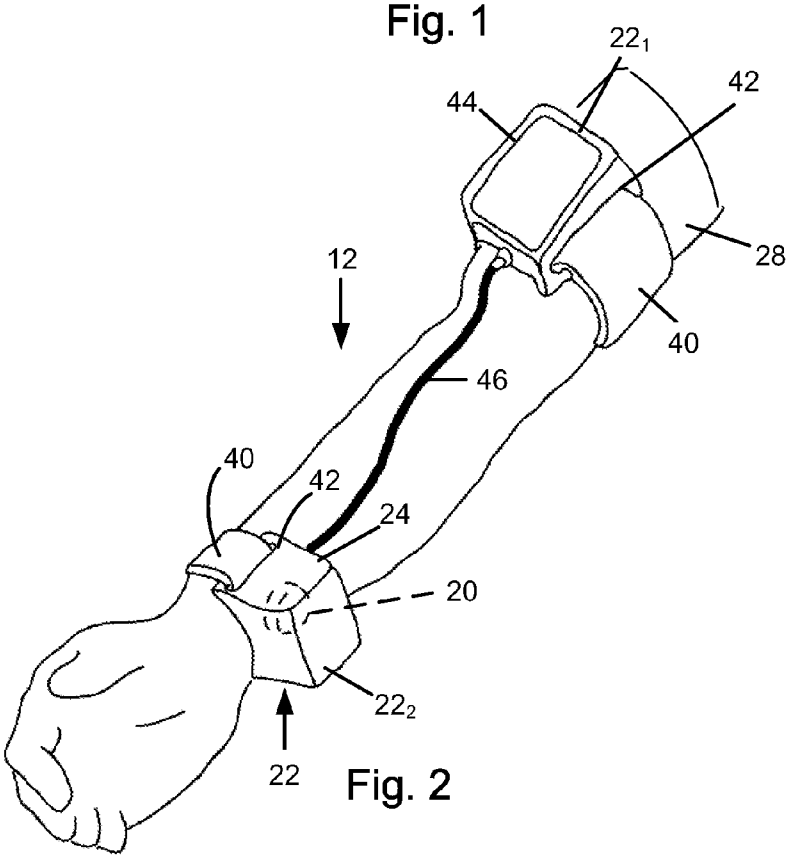


Fig. 2

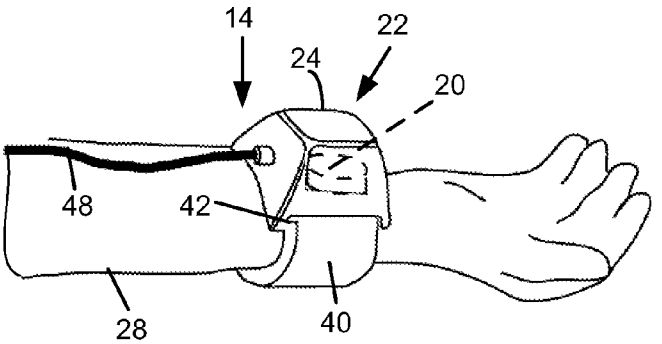


Fig. 3

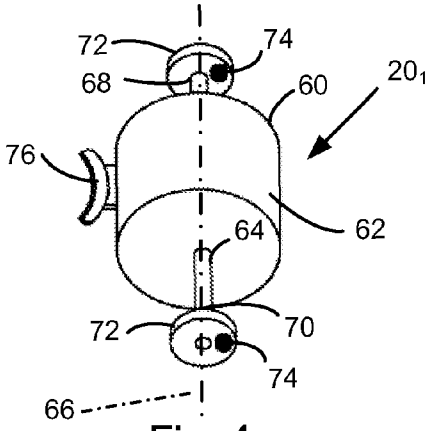


Fig. 4

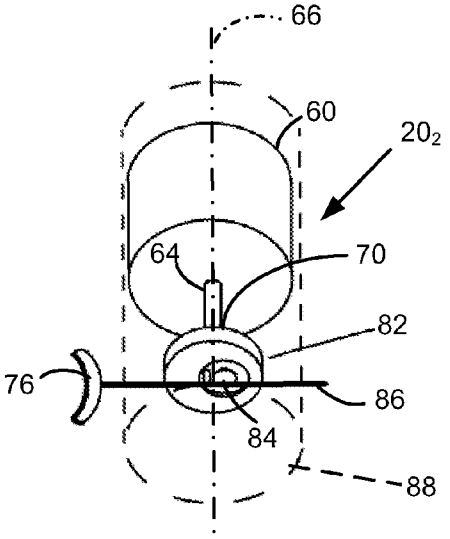


Fig. 5

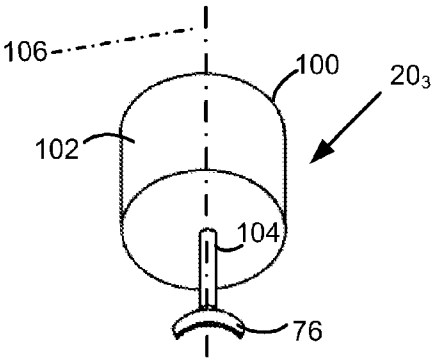


Fig. 6

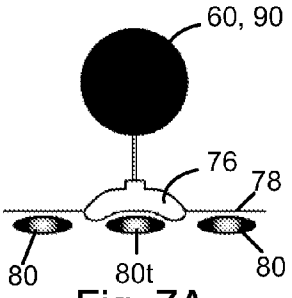


Fig. 7A

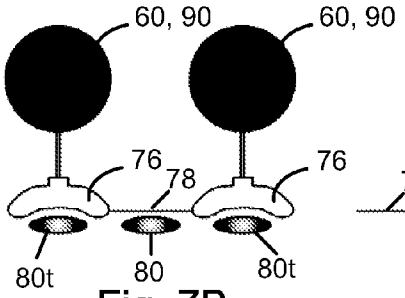


Fig. 7B

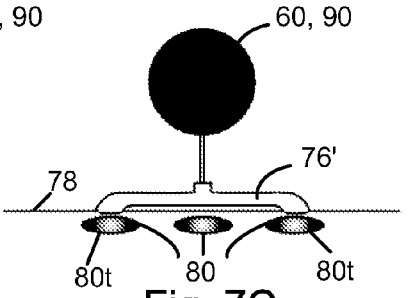


Fig. 7C

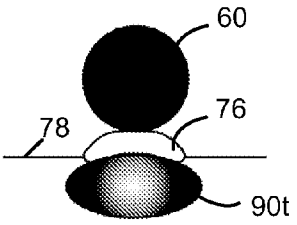


Fig. 7D

METHOD AND DEVICE FOR REDUCING SYMPTOMATIC RELAPSE OF SPASTICITY

RELATED APPLICATION

[0001] This application claims benefit of U.S. patent application Ser. No. 61/363,571, filed Jul. 12, 2010.

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TECHNICAL FIELD

[0003] This disclosure pertains to the use of a therapy and a device to treat motor disorders that produce dysfunctional patterns of muscle contraction. A wearable device vibrates appendicular muscles of a patient's limb during normal daily life activity to reduce symptomatic relapse of spasticity.

BACKGROUND INFORMATION

[0004] Among the various injuries and disorders affecting volitional movement, a subset of these conditions produces dysfunctional patterns of muscle contraction, including too much involuntary postural muscle tone (i.e., "hypertonia") and contraction of the wrong muscles during intentional movement (i.e., "dyssynergia"). Symptoms such as these can occur following stroke, traumatic brain injury, cerebral palsy, focal dystonia, spastic paraparesis, and several other disorders. Collectively, this type of motor disorder and the resulting disability affects over 15 million U.S. citizens with annual health care costs over $100 billion.

[0005] While a number of rehabilitation therapies for these motor disorders are effective at reducing dysfunctional patterns of muscle contraction during the therapy session, these symptoms relapse over hours-to-days between therapy sessions. Post-therapy relapse may not cause the patient's symptoms to return to their original levels, but the recovery from therapy sessions is incremental, at best, and inefficient in that all or most of the gains achieved during a therapy session are lost before the patient returns to the clinic for the next session.

[0006] Muscle vibration is a potent stimulus for la afferents, which are the nerve processes emanating from muscle spindle sensory receptors located in all skeletal muscles. Muscle spindles are a major source of somatic sensory feedback to the brain which feedback provides the sense of body position and movement (i.e., proprioception). Recent studies indicate that muscle vibration, by itself or in combination with specific types of volitional movement, can mitigate the effects of dysfunctional patterns of muscle contraction including hypertonia and dyssynergia. However, like other forms of rehabilitation therapy, the mitigation of symptoms from muscle vibration is not fully sustained after vibration treatment.

SUMMARY OF THE DISCLOSURE

[0007] Improved efficiency of patient rehabilitation therapy, at least where it concerns dysfunctional muscle contraction, reduces the degree of post-therapy relapse with maintenance therapy generated by a wearable device. The wearable maintenance therapy device imparts vibratory stimuli to appendicular muscles of a patient's limb during daily life activity of the patient to reduce symptomatic relapse of spasticity. A vibrator actuator contained in a support housing and configured for placement in operational contact with appendicular muscles of a limb of a patient imparts localized vibration to one or more of the patient's appendicular muscles. The localized vibration produces proprioceptive input from the vibrated muscle or muscles to activate sensory areas of the patient's central nervous system. An attachment device operatively connected to the support housing secures the vibrator actuator in place on the patient's limb. Programmable electrical control circuitry operatively connected to the vibrator actuator controls vibration characteristics of the localized vibration. The programmable electrical control circuitry includes memory sites for storing operating values of the vibration characteristics. The vibration characteristics include pattern and timing of vibration specified to produce the proprioceptive input and thereby activate the sensory areas of the patient's central nervous system during the patient's daily life activity to mitigate any symptomatic relapse of spasticity.

[0008] Preferred embodiments of the wearable device are in the form of a bracelet. The wearable device is composed of one or more vibrators that deliver vibration to the patient's skin in contact with the bracelet, or more specifically, to the tissues underlying the skin (i.e., muscles or tendons). The bracelet is positioned on the patient's arm or leg such that the vibration produced by the bracelet stimulates specific muscles, or tendons connected to those muscles. The bracelet is electrically powered, preferably by a rechargeable battery, and controlled by an electrical circuit that determines the timing of vibration (e.g., time of day, duration); pattern and frequency of vibration; and, if multiple vibrators are used, coordination of stimulation between or among the different vibrators. The vibration is delivered automatically and on a prescribed schedule between therapy sessions, thereby maintaining more completely the improved level of motor function achieved during the last rehabilitation session. Maintenance therapy may also be performed to sustain motor function upon the patient's completion of regularly scheduled therapy sessions. The maintenance therapy may require the conscious participation of the patient, depending on which embodiments of the methodology and the device are being used for that patient's maintenance therapy.

[0009] As a result of the maintenance therapy, one or both of decreased muscle tone and inappropriate muscle recruitment during volitional movement achieved during a rehabilitation session is better sustained over a longer time. In addition, the application of maintenance vibration to a disabled limb in between rehabilitation sessions may produce additional remittance of hypertonia and dyssynergia above and beyond that achieved from the rehabilitation sessions themselves.

[0010] Additional aspects and advantages will be apparent from the following detailed description of preferred embodiments, which proceeds with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is a fragmentary perspective view of a patient's right arm wearing an embodiment of the mainte-

nance therapy device in which a rechargeable battery and a vibrator actuator are located in the same assembly.

[0012] FIG. **2** is a fragmentary perspective view of a patient's right arm wearing an embodiment of the maintenance therapy device in which the rechargeable battery is located remotely (e.g., on the upper arm) from the vibrator actuator.

[0013] FIG. **3** is a fragmentary perspective view of a patient's right arm wearing an embodiment of the maintenance therapy device in which there is no attached battery and the device connects directly into a power outlet.

[0014] FIG. **4** is a perspective view of an embodiment of a vibrator actuator that includes a DC rotary motor having a motor shaft to each end of which is mounted a cam carrying an eccentrically mounted weight.

[0015] FIG. **5** is a perspective view of one embodiment of a vibrator actuator that includes a DC rotary motor having a motor shaft to one end of which is mounted a single cam that drives an orthogonally oriented probe shaft by operation of a cam-follower.

[0016] FIG. **6** is a perspective view of an embodiment of a vibrator actuator implemented with a voice coil and a drive shaft terminating in and causing linear displacement of an attached probe.

[0017] FIGS. **7**A, **7**B, **7**C, and **7**D are pictorial diagrams illustrating in cross section a muscle belly or tendons of a patient's limb stimulated by, respectively, one vibrator actuator probe operating on one tendon, two independent vibrator actuator probes operating on different ones of two tendons, one vibrator actuator probe operating on two dependent tendons, and one vibrator actuator probe operating on the belly of one muscle.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0018] FIGS. **1**, **2**, and **3** show three portable maintenance therapy device embodiments in the form of bracelets that are capable of imparting vibratory stimuli to the muscles of a patient's limbs. FIGS. **4**, **5**, and **6** show three alternative embodiments of a vibrator actuator that can be incorporated in any of the therapy device embodiments of FIGS. **1**, **2**, and **3**.

[0019] With reference to FIGS. **1**, **2**, and **3**, in each of respective portable maintenance therapy devices **10**, **12**, and **14**, a vibrator actuator **20** mounted to a support member **22** and contained within a support housing **24** is configured for operational contact with appendicular muscles of a limb **28** of a patient. Vibrator actuator **20** is positioned over the desired tendon or muscle in limb **28** and secured in place by an attachment device **40**, such as the strap or straps shown passing through slots **42** in support member **22** and wrapping around the patient's limb **28**. Vibrator actuator **20** imparts localized vibration to one or more of the appendicular muscles in limb **28** and produces proprioceptive input from the vibrated muscle or muscles to activate sensory areas of the patient's central nervous system. Although they are shown with a single vibrator actuator **20** contained within support housing **24**, therapy devices **10**, **12**, and **14** can be implemented with two or more vibrator actuators **20** contained within a single support housing.

[0020] Therapy devices **10**, **12**, and **14** receive electrical power in different ways. Therapy device **10** of FIG. **1** provides electrical connection to electrical power supplied by a rechargeable battery pack **44** contained within support housing **24**. Therapy device **12** of FIG. **2** is constructed with support member **22** provided in two remotely located components $\mathbf{22}_1$ and $\mathbf{22}_2$, with support housing **24** being a portion of component $\mathbf{22}_2$. Therapy device **12** provides by a battery cable **46** electrical connection to electrical power supplied by rechargeable battery pack **44** contained within support component $\mathbf{22}_1$, which is positioned on the patient's upper arm as shown or positioned elsewhere such as attached to a belt (not shown) around the patient's waist. Therapy device **14** of FIG. **3** provides by a power cord **48** electrical connection to electrical power supplied by an external power outlet (not shown).

[0021] In each of therapy devices **10**, **12**, and **14**, programmable electrical control circuitry **50** contained in or electrically connected to support member **22** controls the vibration characteristics of the localized vibration imparted by vibrator actuator **20**. Circuitry **50** receives electrical power by rechargeable battery pack **44** or an external power outlet as described above. Circuitry **50** preferably includes a processor or an application specific integrated circuit (ASIC) cooperating with memory sites in which medical practitioner-prescribed operating values of the vibration characteristics are stored. The processor or ASIC provides operational control signals to vibrator actuator **20** to vibrate the patient's muscle in accordance with the stored operating values. The vibration characteristics stored include pattern and timing of vibration specified to produce the proprioceptive input and thereby activate the sensory areas of the patient's central nervous system during the patient's daily life activity to mitigate any symptomatic relapse of spasticity. The timing of vibration includes duration of a period of vibration and temporal spacing between periods of vibration, resulting in establishing frequency of vibration and a number of vibration periods taking place in one day. For example, episodes of severe spasticity would be treated with a longer total time of vibration each day.

[0022] Preferred implementations of devices **10**, **12**, and **14** and the therapy method differ in terms of the pattern and frequency of vibration, which muscles are vibrated, and what the patient does during the vibration. During the maintenance therapy with the device, the pattern of vibration may be either continuous or intermittent (e.g., 3 seconds on and 3 seconds off). The frequency of vibration may be set to values between 20-80 pulses/second, although most commonly to a frequency of 60 pulses/second. Vibration may be applied indirectly to a muscle via its tendon or directly to a muscle, but preferably to a hypertonic muscle or to the muscle functionally antagonistic to a hypertonic muscle. In one implementation of the device, a single vibrator is positioned over a single muscle or group of closely associated muscles, either directly or via their tendons, and in another implementation, two or more vibrators contained in a bracelet are positioned over and deliver mechanical vibration to muscles or their tendons on different sides of a joint. In a further implementation, multiple bracelets stimulate muscles or their tendons at different joints of a limb in a coordinated manner (e.g., simultaneously or separately). In one implementation of the therapy method, the patient keeps the limb relaxed during a continuous pattern of vibration, or in another implementation of the therapy method, the patient volitionally moves the appendicular joint associated with vibrated muscles in time to an intermittent pattern of vibration delivered to one or more muscles or muscle groups.

[0023] FIGS. **4**, **5**, and **6** show three alternative embodiments of vibrator actuator **20**. Vibrator actuator $\mathbf{20}_1$ of FIG. **4**

shows a DC rotary motor **60** having a cylindrical motor body **62** and a motor shaft **64** that is rotatable about an axis of rotation **66**. Motor shaft **64** has opposite ends **68** and **70**, and a cam **72** is attached to at least one of them. One or both of cams **72** carry a weight **74** (two weight-carrying cams **72** shown in FIG. **4**) attached eccentrically such that rotation of cams **72** by operation of rotary motor **60** causes motor body **62** to vibrate at a frequency equal to the speed of rotation (i.e., revolutions per second) of cams **72**. Weights **74** provide a rotationally nonuniform weight distribution that causes motor body **62** to vibrate as motor shaft **64** rotates. A probe **76** attached to the side of motor body **62** can be placed in contact with the surface of skin **78** overlying a patient's tendon **80** to reduce localized vibration of only a target tendon **80***t*, as shown in FIG. **7**A. If the vibration is intended to be distributed more generally around the contact point of vibrator actuator $\mathbf{20}_1$ and the skin, probe **76** may not be required. The energizing signal developed by circuitry **50** to produce a constant-frequency vibratory motion of vibrator actuator $\mathbf{20}_1$ is a constant voltage, and the magnitude of voltage characterizing the energizing signal determines the frequency of vibration imparted to target tendon **80***t* (or to attached muscle).

[0024] Vibrator actuator $\mathbf{20}_2$ of FIG. **5** includes DC rotary motor **60** having motor body **62** and motor shaft **64**. A cam **82** is mounted to end **70** of motor shaft **64**. A cam follower **84** is seated in cam **82**, from which projects a probe shaft **86** of probe **76**. Cam follower **84** is set in offset relationship to axis of rotation **66** and thereby forms an eccentric cam arrangement. When motor shaft **64** rotates about axis of rotation **66**, cam **82** correspondingly rotates and thereby causes probe shaft **86** to move repetitively in alternate directions along a path orthogonal to axis of rotation **66**. In the configuration shown in FIG. **5**, probe shaft **86** moves repetitively to the right and left. Vibrator actuator $\mathbf{20}_2$ of FIG. **5** is housed within an external enclosure **88** (shown in phantom lines), preferably of cylindrical shape and constructed from a rigid material (e.g., plastic or metal). External enclosure **88** has two holes (not shown) through which probe shaft **86** passes so that it remains properly aligned with motor shaft **64** while DC rotary motor **60** is energized and its motor shaft **64** rotates. Probe **76** is attached to the free end of probe shaft **86** and is placed in contact with one or more target tendons **86***t* so as to impart localized vibration to that target tendon or to those target tendons **86***t*. The energizing signal required to produce a constant-frequency vibrating motion of vibrator actuator $\mathbf{20}_2$ is a constant voltage, and the magnitude of voltage characterizing the energizing signal determines the frequency of vibration imparted to the target muscle **90***t* (FIG. **7**D) or target tendon or tendons **80***t*. An optional tachometer (not shown) may be attached to DC rotary motor **60** and used to control precisely the frequency of vibration imparted to target muscle **90***t* or target tendon or tendons **80***t*.

[0025] Vibrator actuator $\mathbf{20}_3$ of FIG. **6** includes a voice coil actuator and functions as a linear motor **100**. Linear motor **100** has a motor body **102** and a motor shaft **104** that moves along a longitudinal axis **106** in-and-out of motor body **102** when linear motor **100** is energized. To develop vibratory action of motor shaft **104**, the energizing signal produced by circuitry **50** contains the shape of the vibratory pattern (i.e., a square-wave or sinusoid) with repetition of that vibrator pattern at the desired frequency of vibration. Probe **76** is attached to the free end of motor shaft **104** and is placed in contact with one or more target tendons **80***t* so as to impart localized vibration to that tendon or to those tendons **80***t*.

[0026] FIGS. **7**A, **7**B, **7**C, and **7**D present several configurations of probes **76** and **76'** and vibrator actuators **20** by which vibration can be imparted in either a localized manner to one or more target tendons **80***t* (FIG. **7**A, **7**B, and **7**C) or a localized manner to the belly of muscle **90***t* (FIG. **7**D). With reference to FIGS. **7**A, **7**B, and **7**C, applying vibration to one or more tendons **80***t* entails transmitting localized vibration to only the muscle or muscles (not shown) attached to target tendons **80***t* but transmitting no vibration to any other muscle or muscles not attached to the target tendons **80***t* (e.g., FIG. **7**A). FIG. **7**A shows a single vibrator actuator **20** configured to apply vibration to a single target tendon **80***t* underlying the patient's skin **78** in contact with probe **76**. FIG. **7**B shows two vibrator actuators **20** configured to apply vibration independently to two independent target tendons **80***t*, for example, so that the two target tendons **80***t* can be vibrated at different times or at the same time but at different frequencies. FIG. **7**C shows a single vibrator actuator **20** with a single probe **76'** that is shaped to contact skin **78** and more than one underlying target tendon **80***t* but no other intervening tendons **80** so that target tendons **80***t* underlying skin **78** in contact with probe **76'** are vibrated dependently. Vibrator actuators **20** in FIGS. **7**A, **7**B, and **7**C are preferably those depicted in FIG. **5** (vibrator actuator $\mathbf{20}_2$) and FIG. **6** (vibrator actuator $\mathbf{20}_3$). FIG. **7**D shows a single vibrator positioned so as to place probe **76** in contact with skin **78** overlying the belly of target muscle **90***t* and thereby impart vibration directly to it, rather than indirectly via an attached tendon (not shown). Vibrator actuator **20** employed in FIG. **7**D is preferably that depicted in FIG. **4** (vibrator actuator $\mathbf{20}_1$) and is used preferably when target muscle **90***t* has no distinct tendon or lies deep within limb **28** underneath other muscles **102** such that the attached tendon is not accessible.

[0027] The following two prophetic examples demonstrate practice of the disclosed method in two of many possible situations.

EXAMPLE 1

[0028] A 34 year-old female patient, 10 weeks post-stroke, with severe paresis and joint rigidity in her right wrist and fingers, is treated by an occupational therapist with conventional rehabilitation methods in the clinic as part of standard outpatient therapy. The patient's wrist and fingers are paretic and spastic in the flexion direction and clinically plegic in the extensor direction. After 30 minutes of joint ranging, assisted motion, and muscle stimulation with a physiotherapy vibrator, the affected arm and hand are looser and the patient is able to open the hand slightly. The patient returns to the clinic 3 days later for her next therapy session without having used the affected hand for daily activities in the interim. The occupational therapist finds the patient's hand, once again, to be tightly clenched and the patient unable to extend her fingers. This process of recovery in the clinic and relapse at home repeats during the patient's period of outpatient therapy. The physician, alerted to this occurrence, subsequently prescribes the maintenance therapy device described above, which is programmed to vibrate, for 5 minutes each hour, the patient's forearm flexor tendons that originate from the spastic muscles. This maintenance therapeutic regimen is repeated every hour from the time the patient straps on the maintenance therapy device in the morning until she removes it in the evening before retiring to bed. When the patient returns to the clinic for the next therapy session, the occupational therapist finds the patient's hand to have remained loose and the

fingers still able to extend slightly. Therefore, by the end of the current therapy session, the patient's condition improves to a new high, because the starting point for the current therapy session began from a higher level as a result of using the maintenance therapy device between therapy sessions. The patient achieves a higher level of recovery than she would have otherwise achieved because of the use of maintenance therapy supplemental to her outpatient therapy.

EXAMPLE 2

[0029] A 48 year-old male individual has been diagnosed with essential tremor, presumably inherited from his mother who had suffered from the disorder for the last 30 years of her life. As with most sufferers of essential tremor, none of the therapeutic approaches tried by clinicians, including antispasmodics or deep-brain stimulation, has been found to significantly mitigate the tremor. A physician prescribes the maintenance therapy device described above for the individual, and the device is programmed to apply vibration to both sides of the wrist on a schedule of 5 minutes of flexor vibration followed by 5 minutes of extensor vibration. This protocol is repeated every 90 minutes, and during each period of vibration, the user need only relax the stimulated arm. After 8 weeks of this daily regimen, the tremor abates in the patient's hand. The physician, upon observing this mitigation of symptoms, changes the treatment regimen to one of maintenance, whereby stimulation takes place for 10 minutes (5 minutes flexion, 5 minutes extension) as before, but only once in the morning and once in the evening. The physician confirms that this maintenance regimen is sufficient to hold the tremor at low levels; and the individual is now able to use the affected arm to eat, to type on a computer keyboard, and to shoot accurately with a bow and arrow.

[0030] It will be obvious to those having skill in the art that many changes may be made to the details of the above-described embodiments without departing from the underlying principles of the invention. The scope of the present invention should, therefore, be determined only by the following claims.

1. A wearable maintenance therapy device adapted to impart vibratory stimuli to appendicular muscles of a patient's limb during daily life activity of the patient to reduce symptomatic relapse of spasticity, comprising:

a vibrator actuator contained in a support housing and configured for placement in operational contact with appendicular muscles of a limb of a patient to impart localized vibration to one or more of the patient's appendicular muscles, the localized vibration producing proprioceptive input from the vibrated muscle or muscles to activate sensory areas of the patient's central nervous system;

an attachment device operatively connected to the support housing to secure the vibrator actuator in place on the patient's limb; and

programmable electrical control circuitry operatively connected to the vibrator actuator to control vibration characteristics of the localized vibration, the programmable electrical control circuitry including memory sites for storing operating values of the vibration characteristics including pattern and timing of vibration specified to produce the proprioceptive input and thereby activate the sensory areas of the patient's central nervous system during the patient's daily life activity to mitigate any symptomatic relapse of spasticity.

2. The maintenance therapy device of claim **1**, further comprising an electrical connection to provide electrical power for operating the vibrator actuator and the programmable electrical control circuitry.

3. The maintenance therapy device of claim **2**, further comprising a support member of which the support housing is a portion and which holds a battery functioning as a source of the electrical power, and in which the electrical connection is made on or within the support.

4. The maintenance therapy device of claim **2**, further comprising a first support member component of which the support housing is a portion, a second support member component configured for attachment to the patient's limb and including a battery pack functioning as a source of the electrical power, and a battery cable forming the electrical connection.

5. The maintenance therapy device of claim **2**, in which the electrical connection is a power cord adapted for connection into a power outlet.

6. The maintenance therapy device of claim **1**, in which the vibrator actuator comprises:

a rotary motor including a motor body and a motor shaft rotatable about an axis of rotation and having an end;

a weight operatively connected to the end and configured to provide a rotationally nonuniform weight distribution that causes the motor body to vibrate as the motor shaft rotates; and

a probe operatively connected to the motor body to impart the localized vibration in response to rotation of the motor shaft about the axis of rotation.

7. The maintenance therapy device of claim **6**, in which the end is a first end and the motor shaft has a second end positioned opposite the first end, in which the weight is a first weight, and further comprising a second weight operatively connected to the second end and configured to contribute to the rotationally nonuniform weight distribution.

8. The maintenance therapy device of claim **1**, in which the vibrator actuator comprises:

a rotary motor including a motor shaft rotatable about an axis of rotation and having an end;

a cam mounted to the end of the motor shaft; and

a probe having a probe shaft attached to a cam follower seated in the cam, the probe shaft positioned in transverse relation to the axis of rotation so that, in response to rotation of the motor shaft, the probe moves repetitively in alternate directions along a path that is orthogonal to the axis of rotation to impart the localized vibration.

9. The maintenance therapy device of claim **1**, in which the vibrator actuator comprises:

a linear motor including a motor shaft movable along a longitudinal axis and having an end; and

a probe attached to the end of the motor shaft in a position to move along the longitudinal axis to impart the localized vibration in response to movement of the motor shaft.

10. The maintenance therapy device of claim **9**, in which the linear motor includes a voice coil actuator.

11. A method of mitigating symptomatic relapse of spasticity experienced by a patient during daily life activity, comprising:

mounting, in position for operational contact with appendicular muscles of a limb of a patient, a vibrator actuator to impart localized vibration to one or more of the

patient's appendicular muscles, the localized vibration producing proprioceptive input from the vibrated muscle or muscles to activate sensory areas of the patient's central nervous system; and

activating electrical control circuitry operatively connected to the vibrator actuator to control vibration characteristics of the localized vibration, the electrical control circuitry including memory sites in which are stored operating values of the vibration characteristics including pattern and timing of vibration specified to produce the proprioceptive input and thereby activate sensory areas of the patient's central nervous system to mitigate any symptomatic relapse of spasticity.

12. The method of claim **11**, in which the appendicular muscles are attached to associated tendons, and in which the vibrator actuator imparts localized vibration indirectly to the vibrated muscle or muscles via their associated tendon or tendons.

13. The method of claim **11**, in which the vibrator actuator imparts localized vibration directly to the vibrated muscle or muscles.

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