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Shrouded Exercise Spring Assemblies

Abstract

A shrouded spring assembly comprises a coil spring and a shroud. The coil spring includes a cylindrical body having a first and second attachment members coupled to the ends thereof. The shroud includes a sleeve portion that substantially encapsulates the cylindrical body of the coil spring, the sleeve portion including first and second end portions configured to enable the first and second attachment members to be operatively couplable to one or more external devices. The sleeve portion of the shroud is expandable and retractable along a longitudinal axis of the coil spring to accommodate stretching and retracting of the cylindrical body along a longitudinal axis.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS [0001] The present application is a divisional of U.S. application Ser. No. 18/189,426 filed on Mar. 24, 2023 (Docket No. LAGR-275). Each of the aforementioned patent applications is herein incorporated by reference in their entirety.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable to this application.

FIELD OF THE INVENTION

[0003] The described example embodiments in general relate to shrouded spring assemblies for use in exercising, and for use in exercise apparatus and exercise machines.

BACKGROUND

[0004] To maintain or improve physical fitness, many people perform exercises by lifting weighted devices, such as dumbbells, kettlebells, or other similar devices. Using such a weighted device, a user may perform exercises by raising or moving the weighted device, working against gravitational forces using desired muscles or portions of the body to achieve the desired effect. It will be appreciated, however, that such devices may not be easily transportable to other locations, and may generally limit the user's ability to perform exercises wherever they desire to do so (e.g. at the office, hotel room, etc.). Therefore, although desirable results have been achieved using such prior art weighted devices, there is room for improvement.

SUMMARY

[0005] Some of the various embodiments of the present disclosure relate to shrouded spring assemblies for use in exercising, and for use in exercise apparatus and exercise machines.

[0006] For example, some of the various embodiments of the present disclosure include a shrouded spring assembly comprising a coil spring and a shroud. The coil spring includes a cylindrical body having a first attachment member (e.g. hook member) coupled to a first end of the cylindrical body, and a second attachment member (e.g. eye member) coupled to a second end of the cylindrical body. The shroud may include a sleeve portion that substantially encapsulates the cylindrical body of the coil spring, the sleeve portion including first and second end portions proximate the first and second attachment members, respectively. Each of the first and second end portions are configured to enable the first and second attachment members to be operatively couplable to one or more external devices. It will be appreciated that the sleeve portion of the shroud is expandable and retractable to accommodate stretching and retracting of the cylindrical body responsive to opposing forces applied to the first and second attachment members along a longitudinal axis of the cylindrical body.

[0007] In some embodiments, the sleeve portion is made from a suitably flexible or stretchable material that enables the sleeve portion to expand in a lengthwise direction along the longitudinal axis as the coil spring is stretched by an exercising force, and then to contract again as the exercising force is relieved. And in some embodiments, the sleeve portion includes a plurality of pleats that enables the sleeve portion to expand and contract in a lengthwise direction along the longitudinal axis with the expansion and contraction of the cylindrical body of the coil spring.

[0008] In further embodiments, an exercise apparatus may comprise a shrouded spring assembly operatively coupled to at least one user interface. In some embodiments, the shrouded spring assembly includes: a coil spring having a cylindrical body that extends along a longitudinal axis, the coil spring including a first attachment member coupled to a first end of the cylindrical body and projecting outwardly from the first end at least partially along the longitudinal axis, and a second attachment member coupled to a second end of the cylindrical body opposite the first end and projecting outwardly from the second end at least partially along the longitudinal axis; and a shroud having a sleeve portion that encapsulates at least the cylindrical body of the coil spring, the

sleeve portion including first and second end portions proximate the first and second attachment members, respectively, at least one of the first and second end portions being configured to enable a corresponding at least one of the first and second attachment members to be operatively coupled to a corresponding at least one user interface, the sleeve portion being expandable and retractable along the longitudinal axis to accommodate stretching and retracting of the cylindrical body responsive to at least one exercising force applied to at least one of the first and second attachment members along the longitudinal axis; and at least one user interface operatively coupled to at least one of the first and second attachment members, the at least one user interface configured to engage with a user for applying the at least one exercising force to the at least one of the first and second attachment members along the longitudinal axis.

[0009] And in still other embodiments, an exercise machine includes: a support frame having a fixed portion and at least one rail; a slidable member slidably coupled to the at least one rail; and at least one shrouded spring assembly coupled between the fixed portion of the support frame and the slidable member. In some embodiments, the at least one shrouded spring assembly includes: a coil spring having a cylindrical body including a first attachment member coupled to a first end of the cylindrical body and projecting outwardly from the first end, and a second attachment member coupled to a second end of the cylindrical body opposite the first end and projecting outwardly from the second end; and a shroud having a sleeve portion that substantially encapsulates the cylindrical body of the coil spring, the sleeve portion including first and second end portions proximate the first and second attachment members, respectively, each of the first and second end portions being configured to enable the first and second attachment members to be operatively couplable to one or more external devices, the sleeve portion being expandable and retractable along a longitudinal axis of the coil spring to accommodate stretching and retracting of the cylindrical body responsive to opposing forces applied to the first and second attachment members along the longitudinal axis as the slidable member is moved on the at least one rail.

[0010] There has thus been outlined, rather broadly, some of the embodiments of the present disclosure in order that the detailed description thereof may be better understood, and in order that the present contribution to the art may be better appreciated. There are additional embodiments that will be described hereinafter and that will form the subject matter of the claims appended hereto. In this respect, before explaining at least one embodiment in detail, it is to be understood that the various embodiments are not limited in its application to the details of construction or to the arrangements of the components set forth in the following description or illustrated in the drawings. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of the description and should not be regarded as limiting.

[0011] To better understand the nature and advantages of the present disclosure, reference should be made to the following description and the accompanying figures. It is to be understood, however, that each of the figures is provided for the purpose of illustration only and is not intended as a definition of the limits of the scope of the present disclosure. Also, as a general rule, and unless it is evidence to the contrary from the description, where elements in different figures use identical reference numbers, the elements are generally either identical or at least similar in function or purpose.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is an elevational view of a shrouded spring assembly in accordance with an example embodiment.

[0013] FIG. 2 is a partially exploded, perspective view of the shrouded spring assembly of FIG. 1 in accordance with an example embodiment.

[0014] FIG. 3 is an enlarged perspective view of a second end of a coil spring of the shrouded spring assembly of FIG. 1 in accordance with an example embodiment.

[0015] FIG. 4 is a perspective view of an exercise apparatus that includes a shrouded spring assembly in a first use scenario in accordance with an example embodiment.

[0016] FIG. 5 is an enlarged, elevational view of the exercise apparatus of FIG. 4 in accordance with an example embodiment.

[0017] FIG. 6 shows a plurality of user interfaces that may be used with shrouded spring assemblies in accordance with further example embodiments.

[0018] FIG. 7 is a perspective view of an exercise apparatus that includes a pair of shrouded spring assemblies in a second use scenario in accordance with an example embodiment.

[0019] FIG. 8 is a perspective view of an exercise machine that includes a plurality of shrouded spring assemblies in accordance with an example embodiment.

[0020] FIG. 9 is a side elevational view of the exercise machine of FIG. 8 in a third use scenario in accordance with an example embodiment.

DETAILED DESCRIPTION

A. Overview

[0021] Some of the various embodiments of the present disclosure relate to shrouded spring assemblies for use in exercising, and for use in exercise machines. Embodiments in accordance with the present disclosure may be easily transportable to other locations, and may advantageously enable a user's ability to perform exercises wherever they desire to do so in a safe and convenient manner.

[0022] In some example embodiments, a shrouded spring assembly comprises a coil spring, and a shroud that substantially encapsulates the coil spring. The shroud is expandable and retractable to accommodate stretching and retracting of the coil spring along its longitudinal axis. In some embodiments, a first attachment member is coupled to a first end of the coil spring and a second attachment member is coupled to a second end of the coil spring. In use, a user may secure one end of the shrouded spring assembly to a fixed object (e.g. a wall, door, heavy furniture, etc.), and a handle to other end of the shrouded spring assembly, and may then apply an exercising force to the handle. The coil spring is stretchable along the longitudinal axis responsive to the exercising force applied along the longitudinal axis, and retractable to a resting length in response to removal of the exercising force. The shrouded spring assembly is easily transportable to any desired location, and the shroud prevents foreign objects from becoming pinched or caught in the coil spring as it expands and contracts.

[0023] Various embodiments of shrouded spring assemblies, and exercise apparatus and exercise machines that include such shrouded spring assemblies, are described herein. Many specific details of certain embodiments are set forth in the following description and in FIGS. 1-9 to provide a thorough understanding of such embodiments. One skilled in the art will understand, however, that the invention may have additional embodiments, or that alternate embodiments may be practiced without several of the details described in the following description.

B. Shrouded Spring Assemblies

[0024] FIG. 1 is an elevational view of a shrouded spring assembly 10 in accordance with an example embodiment. FIG. 2 is a partially exploded, perspective view of the shrouded spring assembly 10 of FIG. 1. In the embodiment shown in FIGS. 1-2, the shrouded spring assembly 10 includes a coil spring 20 having a cylindrical body 22 that extends along a longitudinal axis 25. The cylindrical body 22 has a first end 26 and a second end 28 opposite from the first end 26. In some embodiments, the coil spring 20 includes a first attachment member 24 coupled to the first end 26 of the cylindrical body 22, and a second attachment member 30 coupled to the second end 28 of the cylindrical body 22.

[0025] The shrouded spring assembly 10 further includes a shroud 40 having a sleeve portion 42 that encapsulates the cylindrical body 22 of the coil spring 20. It will be appreciated that, in some

embodiments, the sleeve portion **42** is configured to expand in a lengthwise direction along the longitudinal axis **25** as the coil spring **20** is stretched by an exercising force, and further configured to contract again as the exercising force is relieved and the coil spring **20** returns to its relaxed length **L1** (FIG. 2), as described more fully below.

C. Coil Spring

[0026] As noted above, the shrouded spring assembly **10** includes a coil spring **20** that includes a cylindrical body **22** that extends along a longitudinal axis **25** having a first end **26** and a second end **28** opposite from the first end **26**. The cylindrical body **22** of the coil spring **20** extends along a longitudinal axis **25**. As shown in FIGS. 1-2, in some embodiments, the coil spring **20** includes a first attachment member **24** coupled to the first end **26** of the cylindrical body **22**, and a second attachment member **30** coupled to the second end **28** of the cylindrical body **22**.

[0027] In use, the cylindrical body **22** of the coil spring **20** is stretchable and retractable along the longitudinal axis **25** responsive to opposing forces applied to the first and second attachment members **24**, **30** along the longitudinal axis **25**. For example, with the first attachment member **24** coupled to a fixed structure (e.g. a door), and the second attachment member **30** coupled to a user interface (e.g. a handle, ankle strap, etc.), the user may apply an exercise force along the longitudinal axis, stretching the coil spring **20** to a stretched length **L2**, and then may release the exercise force, allowing the coil spring **20** to return to the relaxed length **L1**.

[0028] It will be appreciated that the first and second attachment members **24**, **30** may be configured in a variety of suitable ways. For example, in some embodiments, the first attachment member **24** may be configured as a hook member **23** that is coupled to the first end **26** of the cylindrical body **22**, wherein the hook member **23** projects outwardly from the first end **26** at least partially along the longitudinal axis **25**. The hook member **23** may be a partially oval or partially circular member (e.g. semi-circular) that is configured to be coupled to an external device or structure. For example, in some embodiments, the hook member **23** may simply be a portion of the wire that forms the coil spring **20** bent at an angle (e.g. 90 degree angle) with respect to the first end **26** so that it projects at least partially along the longitudinal axis **25**.

[0029] Similarly, in some embodiments, the second attachment member **30** may be configured as an eye member **31** that is coupled to the second end **28** of the cylindrical body **22** opposite the first end **26**. More specifically, in some embodiments, the eye member **31** may be configured as an eye bolt that is attached to the second end **28**. For example, FIG. 3 is an enlarged perspective view of the second end **28** of the coil spring **20** in accordance with an example embodiment. In some embodiments, the second end **28** includes a conical end portion **29** that converges to a smaller diameter than the cylindrical body **22**. A threaded shaft **32** of the eye member **31** is inserted through the conical end portion **29**, and through a washer **34**, and is threadedly engaged with a nut **36**, securing the eye member **31** to the second end **28** of the coil spring **22**.

[0030] It will be appreciated that the coil spring **20** is not necessarily limited to the particular embodiments shown in FIGS. 1-3. For example, in some embodiments, both the first and second attachment members **24**, **30** may be configured to be substantially similar or identical attachment members. More specifically, in some embodiments, both the first and second attachment members **24**, **30** may be configured as hook members (e.g. hook member **23**). In other embodiments, both the first and second attachment members **24**, **30** may be configured as eye members (e.g. eye member **31**). And in some embodiments, the end portions may be reversed, so that the eye member **31** is proximate the first end **26** of the coil spring **20**, and the hook member **23** is proximate the second end **28** of the coil spring **20**. And in further embodiments, both the first and second attachment members **24**, **30** may be configured as other suitable types of attachment members. Therefore, a variety of alternate embodiments of the coil spring **20** may be readily conceived and are within the scope of the present disclosure.

D. Shroud

[0031] Referring again to FIGS. 1 and 2, the shrouded spring assembly **10** further includes a shroud

40. In some embodiments, the shroud **40** includes a sleeve portion **42** that encapsulates the cylindrical body **22** of the coil spring **20**. In some embodiments, the sleeve portion **42** is configured to expand in a lengthwise direction along the longitudinal axis **25** as the coil spring **20** is stretched by an exercising force, and further configured to contract again as the exercising force is relieved and the coil spring **20** returns to its relaxed length **L1**.

[0032] More specifically, in some embodiments, the sleeve portion **42** may be an expandable portion that is made from a suitably flexible or stretchable material that enables the sleeve portion **42** to expand in a lengthwise direction along the longitudinal axis **25** as the coil spring **20** is stretched by an exercising force, and then to contract again as the exercising force is relieved and the coil spring **20** returns to its relaxed length **L1** (FIG. 2). In some embodiments, the sleeve portion **42** of the shroud **40** may be formed of a flexible or stretchable material that includes a durable polymeric or other synthetic material. As shown in FIGS. 1-2, in some embodiments, the sleeve portion **42** may be fashioned to include a plurality of pleats (or folds) **44** that enables the sleeve portion **42** to expand and contract in a lengthwise direction along the longitudinal axis **25** with the expansion and contraction of the cylindrical body **22** of the coil spring **20**. Accordingly, in some embodiments, the sleeve portion **42** is expandable and retractable along the longitudinal axis **25** to accommodate stretching and retracting of the cylindrical body **22** responsive to opposing forces applied to the first and second attachment members **24**, **30** of the coil spring **20** along the longitudinal axis **25**.

[0033] In addition, in some embodiments, the shroud **40** further includes a first end portion **46** proximate the first end **26** of the cylindrical body **22**, and a second end portion **54** proximate the second end **28** of the cylindrical body **22**. The first and second end portions **46**, **54** are coupled to the sleeve portion **42** and are configured to substantially encapsulate first and second ends **26**, **28** of the cylindrical body **22** while permitting engagement of the first and second attachment members **24**, **30** with other external structures or devices, as described more fully below.

[0034] More specifically, in some embodiments, the first end portion **46** of the shroud **40** may be configured as a guard end **47** that is coupled to the sleeve portion **42** and that is configured to substantially encapsulate the first attachment member **24** projecting from the first end **26** of the cylindrical body **22**. As best shown in FIG. 2, in some embodiments, wherein the first attachment member **24** of the coil spring **20** is configured as a hook member **23**, the guard end **47** of the shroud **40** may include a compartment **48** that substantially surrounds the hook member **23**. In some embodiments, the compartment **48** of the guard end **47** may be a flattened compartment that surrounds and substantially encapsulates the hook member **23** on four sides. A pair of apertures **50** may be formed through opposing sides of the guard end **47** (e.g. opposing sides of the compartment **48**) proximate the hook member **23** to enable an external device, such as a coupling ring **52** or other suitable coupling device (e.g. a carabiner, an openable chain link, etc.), to be engaged through the apertures **50** and into engagement with the hook member **23**.

[0035] Similarly, in some embodiments, the second end portion **54** of the shroud **40** may be configured as a closeable end **55** that is coupled to the sleeve portion **42** and that is configured to be selectively opened and closed over the second end **28** of the coil spring **20** while leaving the second attachment member **30** exposed outside the shroud **40**. For example, in some embodiments, the closeable end **55** may include one or more flaps **56** extending outwardly from the sleeve portion **42**, the one or more flaps **56** being configured to be extended through the second attachment member **30** and secured in position by a securing device **58**. For example, in some embodiments, the closeable end **55** includes at least one flap **56** proximate to the eye member **31** that may be folded through the eye member **31** and secured in position by the securing device **58**. In the embodiment shown in FIG. 1, the securing device **58** is a snap assembly (having a stud mounted on the flap **56** and a socket mounted on the sleeve portion **42** or on another flap **56** in an overlapping fashion), however, in other embodiments, any other suitable types of securing devices may be used, including hook and loop fasteners (e.g. Velcro™), hook and eye fasteners, cinches, or any other

suitable securing devices. Because the closeable end **55** of the shroud **40** is selectively openable and closeable, the shroud **40** may be easily removed from the coil spring **20** for cleaning or replacement.

[0036] It will be appreciated that the shroud **40** is not necessarily limited to the particular embodiments shown in FIGS. **1-2**. For example, in some embodiments, both the first and second end portions **46, 54** may be configured to be substantially similar or identical attachment members. More specifically, in some embodiments, both the first and second end portions **46, 54** may be closeable end portions (e.g. closeable end **55**) (see FIG. **1**), while in other embodiments, both the first and second end portions **46, 54** may be guard end portions (e.g. guard end **47**). In some embodiments, the first end portion **46** may be a guard end **47** and the second end portion **54** may be a closeable end **55** (e.g. FIG. **2**). And in some embodiments, the end portions may be reversed, so that the closeable end **55** is proximate the first end **26** of the coil spring **20**, and the guard end **47** is proximate the second end **28** of the coil spring **20** (e.g. such that the compartment **48** of the guard end **47** substantially encapsulates the eye member **31**). And in further embodiments, both the first and second end portions **46, 54** may be configured as other suitable types of end portions. Therefore, a variety of alternate embodiments of the shroud **40** may be readily conceived and are within the scope of the present disclosure.

[0037] Accordingly, in some embodiments, a shrouded spring assembly **10** includes a coil spring **20** having a cylindrical body **22** that extends along a longitudinal axis **25**, the coil spring **20** including a first attachment member **24** (e.g. hook member **23**) coupled to a first end **26** of the cylindrical body **22** and projecting outwardly from the first end **26** at least partially along the longitudinal axis **25**, and a second attachment member **30** (e.g. eye member **31**) coupled to a second end **28** of the cylindrical body **22** opposite the first end **26** and projecting outwardly from the second end **28** at least partially along the longitudinal axis **25**; and a shroud **40** having a sleeve portion **42** that encapsulates at least the cylindrical body **22** of the coil spring **20**, the sleeve portion **42** including first and second end portions **46, 54** (e.g. guard end **47** and closeable end **55**) proximate the first and second attachment members **24, 30**, respectively, each of the first and second end portions **46, 54** being configured to enable the first and second attachment members **24, 30** to be operatively couplable to one or more external devices (e.g. coupling ring **52**), the sleeve portion **42** being expandable and retractable along the longitudinal axis **25** to accommodate stretching and retracting of the cylindrical body **22** responsive to opposing forces applied to the first and second attachment members **24, 30** along the longitudinal axis **25**.

[0038] In some embodiments, the cylindrical body **22** of the coil spring **20** is stretchable along the longitudinal axis **25** responsive to opposing forces applied to the first attachment member **24** and the second attachment member **30** along the longitudinal axis **25**, and retractable to a resting length **L1** in response to removal of the opposing forces. In some embodiments, the sleeve portion **42** is made from a suitably flexible or stretchable material that enables the sleeve portion **42** to expand in a lengthwise direction along the longitudinal axis **25** as the coil spring **20** is stretched by an exercising force, and then to contract again as the exercising force is relieved. And in some embodiments, the sleeve portion **42** includes a plurality of pleats **44** that enables the sleeve portion **42** to expand and contract in a lengthwise direction along the longitudinal axis **25** with the expansion and contraction of the cylindrical body **22** of the coil spring **20**.

[0039] In some embodiments, at least one of the first or second attachment members **24, 30** of the coil spring **20** comprises a hook member **23** that projects at least partially along the longitudinal axis **25**. Similarly, in some embodiments, at least one of the first or second attachment members **24, 30** comprises an eye member **31** that projects at least partially along the longitudinal axis **25**. And in some embodiments, at least one of the first or second end portions **46, 54** of the shroud **40** comprises a guard end **47** including a substantially enclosed compartment **48** having a pair of apertures **50** disposed through opposing sidewalls thereof. In some embodiments, at least one of the first or second end portions **46, 54** of the shroud **40** comprises a closeable end **55** including at least

one flap **56** configured to be extended through at least one of the first or second attachment members and secured in position by a securing device **58**.

[0040] In some embodiments, the first attachment member **24** of the coil spring **20** comprises a hook member **23** that projects at least partially along the longitudinal axis **25**, and wherein the first end portion **46** of the shroud **40** comprises a guard end **47** including a compartment **48** that substantially encapsulates the hook member **23**, the compartment **48** having a pair of apertures **50** disposed through opposing sidewalls thereof to enable operative engagement of the hook member **23** with an external device **52**. Similarly, in some embodiments, the shrouded spring assembly **10** further comprises a coupling ring **52** operatively engaged through the pair of apertures **50** of the guard end **47** and operatively engaged with the hook member **23**.

[0041] Embodiments of shrouded spring assemblies in accordance with the present disclosure may provide considerable advantages over the prior art. For example, in some embodiments, shrouded spring assemblies are easily transportable to any desired location. Moreover, in some embodiments, the shroud may advantageously prevent foreign objects from becoming pinched or caught in the coil spring as it expands and contracts. And in some embodiments, because the shroud may be easily removed from the coil spring, the shroud may be easily cleaned or replaced as it becomes worn due to extended use.

E. Operation Example Embodiments

[0042] It will be appreciated that shrouded spring assemblies in accordance with the present disclosure may be used as a stand-alone exercise device, or may be incorporated as a component into a larger, more complex exercise machine. In this section, techniques for using shrouded spring assemblies as stand-alone exercise devices will be described. Exercise machines that incorporate shrouded spring assemblies will then be described in the following sections below.

[0043] In use, shrouded spring assemblies in accordance with the present disclosure may be coupled to a wide variety of interface devices and may be used in a wide variety of use scenarios. For example, FIG. **4** is a perspective view of an exercise apparatus **60** in a first use scenario **65** in accordance with an example embodiment. FIG. **5** is an enlarged, elevational view of the exercise apparatus **60** of FIG. **4**. In some embodiments, the exercise apparatus **60** includes a shrouded spring assembly **61** having a coil spring **20** substantially encapsulated by a shroud **40** as described above with respect to FIGS. **1-3**. More specifically, in some embodiments, the shroud **40** of the shrouded spring assembly **61** includes closeable ends **55** (e.g. see FIG. **1**) at each end of the sleeve portion **42**. In some embodiments, as shown in FIGS. **4-5**, the exercise apparatus **60** further includes a first user interface **62** coupled by a first coupling device **64** to the first attachment member **24** of the coil spring **20**, and a second user interface **66** coupled by a second coupling device **68** to the second attachment member **30** of the coil spring **20**. The first and second coupling devices **64**, **68** may, for example, be carabiners, openable links, or any other suitable coupling devices.

[0044] In operation, the user **70** engages a first body portion **72** (e.g. a foot) with the first user interface **62** and a second body portion **74** (e.g. a hand) with the second user interface **66**. The user **70** may then apply first and second exercising forces **76**, **78** (e.g. downward and upward) in an opposing fashion on the user interfaces **62**, **66** along the longitudinal axis **25** of the coil spring **20**, stretching the coil spring **20** (and the shroud **40**) into a stretched length **L2** and thereby exercising the desired muscles against the tension force of the coil spring **20**. The user **70** may then relax or remove the first and second exercising forces **76**, **78**, allowing the coil spring **20** (and the shroud **40**) to become less stretched and return at least partially toward the fully relaxed length **L1**. The user **70** may then re-apply the first and second exercising forces **76**, **78**, re-stretching the coil spring **20** (and the shroud **40**) to the stretched length **L2**. These operations may then be repeated to achieve a desired exercising effect on the user's body. In some embodiments, the user **70** may only partially reduce the first and second exercising forces **76**, **78**, allowing the coil spring **20** (and the shroud **40**) to return to a less stretched length, but may not return entirely to the relaxed length **L1** until a desired number of exercising repetitions have been completed. These operations may be repeated

indefinitely until the user **70** has achieved a desired level of exercise.

[0045] It will be appreciated, however, that a variety of suitable user interfaces may be employed in combination with shrouded spring assemblies in accordance with the present disclosure. In the embodiment shown in FIGS. **4** and **5**, the first user interface **62** is configured as a foot harness, and the second user interface **66** is configured as a handle. FIG. **6**, however, shows a plurality of user interfaces **80** that may be used with shrouded spring assemblies in accordance with further example embodiments. In some embodiments, the shrouded spring assembly **60** may include an ankle cuff **82** for coupling with an ankle of the user **70**, or a rope handle **84** to be grasped by the user **70**, or a bar handle **86** that may be held by the hands of the user **70**. Of course, the plurality of user interfaces **80** shown in FIG. **6** is merely representative of a wide variety of user interfaces that may be used with shrouded spring assemblies in accordance with the present disclosure.

[0046] FIG. **7** is a perspective view of an exercise apparatus **90** in a second use scenario **95** in accordance with another example embodiment. As shown in FIG. **7**, in some embodiments, the exercise apparatus **90** includes two shrouded spring assemblies **92**. Each shrouded spring assembly **92** includes a coil spring **20** substantially encapsulated by a shroud **40** as described above with respect to FIGS. **1-3**. In some embodiments, the first attachment member **24** of each shrouded spring assembly **92** is coupled to a mounting structure **96** that couples to a door **98**, while the second attachment member **30** is coupled to a user interface **94** (e.g. handle) (one visible). For example, in some embodiments, the mounting structure **96** may be coupled to a bottom portion of the door **98** (FIG. **7**), however, in further embodiments, the mounting structure **96** may be coupled to a top portion, side portion, or any other portion of the door **98**. More specifically, in some particular embodiments, the mounting structure **96** may be of the type disclosed in U.S. Pat. No. 11,452,904 B1 issued to Lagree et al.

[0047] In operation, the user **70** grasps the user interfaces **94** (one visible) with her hands and applies an exercising force along the longitudinal axis **25** of each coil spring **20** of the shrouded spring assemblies **92**, stretching each coil spring **20** (and shroud **40**) into a stretched length **L2** (e.g. FIG. **4**) and thereby exercising the desired muscles against the tension forces of the coil springs **20**. The user **70** may then relax or remove the exercising forces, allowing the coil spring **20** (and the shroud **40**) of each shrouded spring assembly **92** to become less stretched and return at least partially toward the fully relaxed length **L1**. The user **70** may then re-apply the exercising forces, re-stretching the coil springs **20** (and the shrouds **40**) to the stretched length **L2**. These operations may then be repeated to achieve a desired exercising effect on the user's body. In some embodiments, the user **70** may only partially reduce the exercising forces, allowing the coil springs **20** (and the shrouds **40**) of the shrouded spring assemblies **92** to return to a less stretched length, but may not return entirely to the relaxed length **L1** until a desired number of exercising repetitions have been completed. These operations may be repeated indefinitely until the user **70** has achieved a desired level of exercise.

[0048] Accordingly, in some embodiments, an exercise apparatus **60**, **90** may comprise a shrouded spring assembly **61**, **92** that includes a coil spring **20** having a cylindrical body **22** that extends along a longitudinal axis **25**, the coil spring **20** including a first attachment member **24** coupled to a first end **26** of the cylindrical body **22** and projecting outwardly from the first end **26** at least partially along the longitudinal axis **25**, and a second attachment member **30** coupled to a second end **28** of the cylindrical body **22** opposite the first end **26** and projecting outwardly from the second end **28** at least partially along the longitudinal axis **25**; and a shroud **40** having a sleeve portion **42** that encapsulates at least the cylindrical body **22** of the coil spring **20**, the sleeve portion **42** including first and second end portions **46**, **54** proximate the first and second attachment members **24**, **30**, respectively, at least one of the first and second end portions **46**, **54** being configured to enable a corresponding at least one of the first and second attachment members **24**, **30** to be operatively coupled to a corresponding at least one user interface **62**, **66**, the sleeve portion **42** being expandable and retractable along the longitudinal axis **25** to accommodate stretching and

retracting of the cylindrical body **22** responsive to at least one exercising force applied to at least one of the first and second attachment members **24**, **30** along the longitudinal axis **25**; and at least one user interface **62**, **66** operatively coupled to at least one of the first and second attachment members **24**, **30**, the at least one user interface **62**, **66** configured to engage with a user **70** for applying the at least one exercising force to the at least one of the first and second attachment members **24**, **30** along the longitudinal axis **25**.

[0049] In some embodiments, the sleeve portion **42** is made from a material that is at least one of flexible or stretchable that enables the sleeve portion **42** to expand in a lengthwise direction along the longitudinal axis **25** as the cylindrical body **22** is stretched by the at least one exercising force, and then to contract again as the at least one exercising force is relieved. Moreover, in some embodiments, the sleeve portion **42** includes a plurality of pleats **44** that enables the sleeve portion **42** to expand and contract in a lengthwise direction along the longitudinal axis **25** with the expansion and contraction of the cylindrical body **22**. In further embodiments, the at least one user interface **62**, **66** comprises at least one of a handle, a foot harness, an ankle cuff, a rope handle, or a bar handle. And in some embodiments, the at least one user interface **62**, **66** comprises a handle coupled to the second attachment member **30**, the exercise apparatus further comprising a mounting structure **96** coupled to the first attachment member **24**, the mounting structure **96** configured to attach to an external structure **98**.

F. Exercise Machine Embodiments That Include Shrouded Spring Assemblies

[0050] Shrouded spring assemblies in accordance with the present disclosure may also be incorporated into a wide variety of exercise machines and may be used in a wide variety of use scenarios. For example, FIG. **8** is a perspective view of an exercise machine **100** that includes a plurality of shrouded spring assemblies **120** in accordance with an example embodiment. More specifically, in some embodiments, the exercise machine **100** may include a support frame **102** having a plurality of supports **104** that support a pair of rails **106**. In some embodiments, the rails **106** may be parallel and may extend lengthwise along a longitudinal axis **105** of the exercise machine **100**. A slidable carriage **108** may slide along the rails **106** in response to a user's movements. For example, a user may perform exercises by moving the slidable carriage **108** along the rails **106** in forward and rearward directions **116**, **118** substantially along the longitudinal axis **105** of the exercise machine **100**. In some embodiments, the support frame **102** of the exercise machine **100** further includes a fixed end **110** having a pair of raised uprights **112** that support a push handle **114**.

[0051] A resistance force may be generated by attaching or adjusting one or more shrouded spring assemblies **120** between the slidable carriage **108** and the fixed end **110** of the lower structure **102**. In some embodiments, each of the shrouded spring assemblies **120** includes a coil spring **20** substantially encapsulated by a shroud **40** as described above with respect to FIGS. **1-3**. In some embodiments, the first attachment member **24** of each shrouded spring assembly **120** may be coupled to the fixed end **110** of the lower support structure **102**, while the second attachment member **30** of each shrouded spring assembly **120** is coupled to the slidable carriage **108**. Of course, in alternate embodiments, the orientations of one or more of the shrouded spring assemblies **120** may be reversed such that the second attachment member **30** is coupled to the fixed end **110** and the first attachment member **24** is coupled to the slidable carriage **108**.

[0052] As shown in FIG. **8**, in some embodiments, there may be four shrouded spring assemblies **120** coupled between the between the slidable carriage **108** and the fixed end **110**, however, in other embodiments, any suitable number of shrouded spring assemblies **120** may be employed. For example, in some alternate embodiments, an exercise machine may include a fewer number of shrouded spring assemblies **120** (e.g. 1, 2, 3) or a greater number of shrouded spring assemblies **120** (e.g. 5, 6, etc.).

[0053] FIG. **9** is a side elevational view of the exercise machine **100** of FIG. **8** in a third use scenario **125** in accordance with an example embodiment. In operation, the user **70** may work

against the resistance of the shrouded spring assemblies **120** by applying a workload force that exceeds the spring resistance force. The workload force may be applied in the rearward direction **118** to the slidable carriage **108**, such that the slidable carriage **108** slides along the rails **106** away from the fixed end **110**, stretching the coil springs **20** and the shrouds **40** of the shrouded spring assemblies **120**.

[0054] More specifically, the user **70** assumes an exercising position on the slidable carriage **108**, grasps the push handle **114** with her hands, and applies an exercising force to the slidable carriage **108** in the rearward direction **118** and along the longitudinal axis **25** of each coil spring **20** of the shrouded spring assemblies **120**, moving the slidable carriage **108** in the rearward direction **118** and stretching each coil spring **20** (and shroud **40**) into a stretched length **L2**, thereby exercising the desired muscles against the tension forces of the coil springs **20**. The user **70** may then relax or remove the exercising force, allowing the slidable carriage **108** to move in the forward direction **116** and allowing each coil spring **20** (and shroud **40**) of each shrouded spring assembly **120** to become less stretched and return as least partially toward the relaxed length **L1**. The user **70** may then re-apply the exercising forces, moving the slidable carriage **108** in the rearward direction **118** and re-stretching the coil springs **20** (and the shrouds **40**) to the stretched length **L2**. These operations may then be repeated to achieve a desired exercising effect on the user's body. In some embodiments, the user **70** may only partially reduce the exercising forces, allowing the coil springs **20** (and the shrouds **40**) of the shrouded spring assemblies **120** to return to a less stretched length, but may not return entirely to the relaxed length **L1** until a desired number of exercising repetitions have been completed. These operations may be repeated indefinitely until the user **70** has achieved a desired level of exercise.

[0055] Accordingly, in some embodiments, an exercise machine **100** includes: a support frame **102** having a fixed portion (e.g. fixed end **110**) and at least one rail **106**; a slidable member (e.g. slidable carriage **108**) slidably coupled to the at least one rail **106**; and at least one shrouded spring assembly **120** coupled between the fixed portion **110** of the support frame **102** and the slidable member **108**. In some embodiments, the at least one shrouded spring assembly **120** includes: a coil spring **20** having a cylindrical body **22** including a first attachment member **24** coupled to a first end **26** of the cylindrical body **22** and projecting outwardly from the first end **26**, and a second attachment member **30** coupled to a second end **28** of the cylindrical body **22** opposite the first end **26** and projecting outwardly from the second end **28**; and a shroud **40** having a sleeve portion **42** that substantially encapsulates at least the cylindrical body **22** of the coil spring **20**, the sleeve portion **42** including first and second end portions **46**, **54** proximate the first and second attachment members **24**, **30**, respectively, each of the first and second end portions **46**, **54** being configured to enable the first and second attachment members **24**, **30** to be operatively couplable to one or more external devices (e.g. fixed end **110**, slidable carriage **108**), the sleeve portion **42** being expandable and retractable along a longitudinal axis **25** of the coil spring **20** to accommodate stretching and retracting of the cylindrical body **22** responsive to opposing forces applied to the first and second attachment members **24**, **30** along the longitudinal axis **25** as the slidable member **108** is moved on the at least one rail **106**.

[0056] In some embodiments, the sleeve portion **42** is made from a material that is at least one of flexible or stretchable that enables the sleeve portion **42** to expand in a lengthwise direction along the longitudinal axis **25** as the cylindrical body **22** is stretched by the at least one exercising force, and then to contract again as the at least one exercising force is relieved. In further embodiments, the sleeve portion **42** includes a plurality of pleats **44** that enables the sleeve portion **42** to expand and contract in a lengthwise direction along the longitudinal axis **25** with the expansion and contraction of the cylindrical body **22**. And in some embodiments, at least one of the first or second end portions **46**, **55** of the shroud **40** comprises a closeable end **55** including at least one flap **56** configured to be extended through at least one of the first or second attachment members **24**, **30** and secured in position by a securing device **58**.

[0057] Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Although methods and materials similar to or equivalent to those described herein can be used in the practice or testing of the various embodiments of the present disclosure, suitable methods and materials are described above. All patent applications, patents, and printed publications cited herein are incorporated herein by reference in their entireties, except for any definitions, subject matter disclaimers or disavowals, and except to the extent that the incorporated material is inconsistent with the express disclosure herein, in which case the language in this disclosure controls. The various embodiments of the present disclosure may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the various embodiments in the present disclosure be considered in all respects as illustrative and not restrictive. Any headings utilized within the description are for convenience only and have no legal or limiting effect.

Claims

1. An exercise machine, comprising: a support frame having at least one rail; a slidable carriage slidably positioned on the at least one rail; a coil spring connected to the support frame and connectable to the slidable carriage to apply a biasing force to the slidable carriage; and a shroud that substantially surrounds a cylindrical body of the coil spring, the shroud being expandable and retractable along a longitudinal axis of the coil spring to accommodate stretching and retracting of the cylindrical body of the coil spring along the longitudinal axis as the slidable carriage is moved along the at least one rail.
2. The exercise machine of claim 1, wherein the shroud is made from a material that is at least one of flexible or stretchable that enables the shroud to expand and contract in a lengthwise direction along the longitudinal axis of the coil spring.
3. The exercise machine of claim 1, wherein the shroud includes a plurality of pleats that enables the shroud to expand and contract in a lengthwise direction along the longitudinal axis of the coil spring.
4. The exercise machine of claim 1, including a fixed end attached to an end of the support frame.
5. The exercise machine of claim 1, wherein the at least one rail is comprised of a first rail and a second rail that are parallel to one another.
6. An exercise machine, comprising: a support frame having at least one rail; a slidable carriage slidably positioned on the at least one rail; and a plurality of shrouded spring assemblies each connected to the support frame and connectable to the slidable carriage to apply a biasing force to the slidable carriage; wherein each of the plurality of shrouded spring assemblies comprises a coil spring and a shroud, wherein the shroud substantially surrounds a cylindrical body of the coil spring, the shroud being expandable and retractable along a longitudinal axis of the coil spring to accommodate stretching and retracting of the cylindrical body of the coil spring along the longitudinal axis as the slidable carriage is moved along the at least one rail.
7. The exercise machine of claim 6, wherein the shroud is made from a material that is at least one of flexible or stretchable that enables the shroud to expand and contract in a lengthwise direction along the longitudinal axis of the coil spring.
8. The exercise machine of claim 6, wherein the shroud includes a plurality of pleats that enables the shroud to expand and contract in a lengthwise direction along the longitudinal axis of the coil spring.
9. The exercise machine of claim 6, including a fixed end attached to an end of the support frame.
10. The exercise machine of claim 6, wherein the at least one rail is comprised of a first rail and a second rail that are parallel to one another.
11. An exercise machine, comprising: a support frame having at least one rail; a slidable carriage

slidably positioned on the at least one rail; and a plurality of shrouded spring assemblies each connected to the support frame and connectable to the slidable carriage to apply a biasing force to the slidable carriage; wherein each of the plurality of shrouded spring assemblies comprises a coil spring and a shroud, wherein the shroud substantially surrounds a cylindrical body of the coil spring, the shroud being expandable and retractable along a longitudinal axis of the coil spring to accommodate stretching and retracting of the cylindrical body of the coil spring along the longitudinal axis as the slidable carriage is moved along the at least one rail; wherein the shroud is made from a material that is at least one of flexible or stretchable that enables the shroud to expand and contract in a lengthwise direction along the longitudinal axis of the coil spring; wherein the shroud includes a plurality of pleats that enables the shroud to expand and contract in a lengthwise direction along the longitudinal axis of the coil spring.

12. The exercise machine of claim 11, including a fixed end attached to an end of the support frame.

13. The exercise machine of claim 11, wherein the at least one rail is comprised of a first rail and a second rail that are parallel to one another.
