(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 062 983 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.09.2022 Bulletin 2022/39

(21) Application number: **22164456.0**

(22) Date of filing: **25.03.2022**

(51) International Patent Classification (IPC):
A63B 71/00 *(2006.01)* *A63B 22/06* *(2006.01)*
A63B 22/00 *(2006.01)* *A63B 23/12* *(2006.01)*
A63B 21/062 *(2006.01)* *A63B 21/00* *(2006.01)*
A63B 71/06 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A63B 71/0622; A63B 21/0059; A63B 21/062; A63B 21/154; A63B 22/025; A63B 22/0605; A63B 23/1254; A63B 2022/0079; A63B 2071/0625; A63B 2071/065; A63B 2220/18; A63B 2220/30; A63B 2220/50; A63B 2225/12; A63B 2225/50;

(Cont.)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **25.03.2021 IT 202100007334**

(71) Applicant: **Technogym S.p.A.**
47521 Cesena, Forli'-Cesena (IT)

(72) Inventors:
- **ALESSANDRI, Nerio**
  47521 Cesena, FORLI'-CESENA (IT)
- **PASINI, Alessandro**
  47521 Cesena, FORLI'-CESENA (IT)
- **ZANUSO, Silvano**
  47521 Cesena, FORLI'-CESENA (IT)
- **BISCARINI, Andrea**
  06125 PERUGIA (IT)

(74) Representative: **Mozzi, Matteo**
Jacobacci & Partners S.p.A.
Via Senato, 8
20121 Milano (IT)

(54) **METHOD FOR CONTROLLING A USER'S BREATHING DURING A WORKOUT WITH AN EXERCISE MACHINE AND EXERCISE MACHINE THEREOF**

(57) A method (300) for controlling a user's breathing during a workout with an exercise machine, comprising steps of:
- acquiring (301), by a data processing unit of an exercise machine, at least one parameter representative of a physical exercise being performed by the user with the exercise machine;
- determining (302), by the data processing unit of the exercise machine, an indication of the breathing to be followed by the user while performing the physical exercise based on the acquired at least one parameter representative of the physical exercise;
- providing (303) the user, by the data processing unit of the exercise machine, with the determined indication of the breathing.

EP 4 062 983 A1

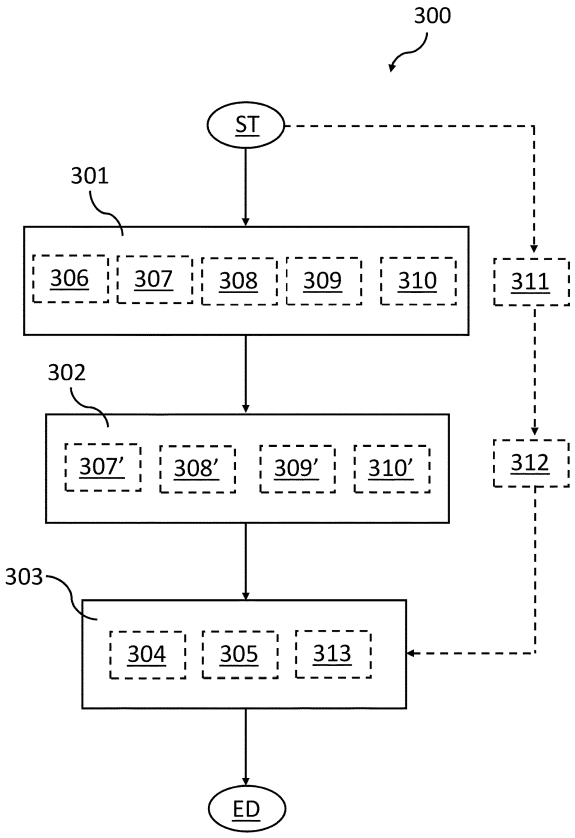

Fig. 3

(52) Cooperative Patent Classification (CPC): (Cont.)
A63B 2230/04; A63B 2230/40; A63B 2230/42

Description

Field of the invention

[0001] The present invention relates to the fitness sector and, in particular, to a method for controlling a user's breathing during a workout with an exercise machine and an exercise machine thereof.

Technological background of the invention

[0002] Correct breathing is a very important aspect during a user's physical activity for optimal performance of a workout with an exercise machine during not only the warm-up and/or the performance but also during the recovery phase.

[0003] Furthermore, correct breathing guarantees better oxygenation of the brain, lowers the heartbeats with consequent activation of the parasympathetic nervous system, reduces anxiety and stress states, and improves the posture (in particular at cervical and lumbar level).

[0004] While performing a physical exercise, personal trainers often highlight the importance of associating the various phases of breathing to the movement, especially during overload workouts.

[0005] Indeed, during overload workouts, the lifting of supramaximal loads while holding one's breath should be avoided because this would lead to an excessive and dangerous increase in intra-abdominal pressure.

[0006] Furthermore, breathing acts on blood pressure, regulating it.

[0007] Additionally, it is important to control a set breathing rate and/or the air exhaling and inhaling phases according to the type of workout and/or the exercise machine used.

[0008] Indeed, the respiratory system is linked to the cardiovascular system, and the frequency of both increases while performing a physical exercise.

[0009] Therefore, when a workout becomes more intense, the need is felt to breathe through one's mouth as well because the body needs more oxygen and, at the same time, must expel carbon dioxide.

[0010] However, this manner of oxygenating the body is not always correct and can sometimes lead to increased fatigue.

[0011] In light of this, the need is strongly felt to be able to provide users with timely and reliable indications on how to control their breathing while working out on an exercise machine.

Summary

[0012] It is an object of the present invention to devise and make available a method of controlling a user's breathing during a workout on an exercise machine which will make it possible to obviate at least partially the drawbacks described above with reference to the prior art, in particular, that it allows to make possible to provide users with timely and reliable indications of how to control their breathing during a workout on an exercise machine.

[0013] Such an object is achieved by a method according to claim 1.

[0014] Preferred embodiments of said method are defined in the dependent claims.

[0015] The present invention also relates to an exercise machine implementing such a method.

Brief description of the drawings

[0016] Further features and advantages of the method and the exercise machine according to the invention will be apparent from the following description which illustrates preferred embodiments, given by way of indicative, non-limiting examples, with reference to the accompanying figures, in which:

- figures 1a, 1b, 1c, 1d, 1e, and 1f illustrate examples of an exercise machine usable by a user to perform a physical activity;
- figure 2a illustrates, by means of a block diagram, an exercise machine implementing a method of controlling a user's breathing during a workout with an exercise machine, according to an embodiment of the present invention;
- figure 2b illustrates, by means of a block diagram, an exercise machine implementing a method of controlling a user's breathing during a workout with an exercise machine, according to a further embodiment of the present invention;
- figure 3 illustrates, by means of a block diagram, an exercise machine implementing a method of controlling a user's breathing during a workout with an exercise machine, according to an embodiment of the present invention, and
- figures 4a, 4b, and 5a-5b show graphic representations usable to indicate the breathing control manners.

[0017] It is worth noting that, in the aforesaid figures, equivalent or similar elements are indicated by the same numeric and/or alphanumeric references.

Detailed description

[0018] An exercise machine 1 adapted to implement a method for controlling a user's breathing during a workout with an exercise machine according to the present invention will now be described with reference to the aforesaid figures.

[0019] The exercise machine 1 may be any exercise machine usable by a user to perform a physical activity remotely (e.g., from home) or in a gym, either alone or in a workout class.

[0020] Examples of exercise machines 1 are shown in figure 1a-1f.

[0021] Figure 1a shows an example of a treadmill.

[0022] Figure 1b shows an example of a bike or an exercise bike (cyclette).

[0023] Figure 1c shows an example of a rowing machine.

[0024] Figures 1d, 1e, and 1f show examples of strength exercise machines.

[0025] Each strength exercise machine in figures 1d, 1e, and 1f has movable elements (shown in the figures) actuatable by a user for performing a strength exercise by moving a respective exercise load. In particular, the movable elements are actuated by the user in a first direction of motion (so-called concentric motion), which simulates the lifting of a gravitational load (exercise load), and in a second direction of motion (so-called eccentric motion), in the direction opposite to the first direction of motion, which simulates the return of the gravitational load (exercise load) to the starting position.

[0026] In the examples of figures 1d and 1f, the strength exercise machine comprises a motor (not shown in the figures) operatively connected, e.g., by mechanical kinematic mechanisms, to the movable elements. The motor is configured to apply on the movable elements a resistive force representative of the exercise load which the user can move during the execution of the exercise by actuating the movable elements.

[0027] Instead, in the example of figure 1e, the strength exercise machine comprises a weight pack (partially shown in the figure) operatively connected, e.g., by mechanical kinematic mechanisms, to the movable elements. The weight stack represents the exercise load that the user can move while performing the exercise by operating the movable elements.

[0028] The following description, with reference in particular to figure 2a and 2b, is valid for any of the exercise machines 1 listed above.

[0029] The exercise machine 1 comprises a user interface 2 configured to allow a user to interact with the exercise machine 1.

[0030] The exercise machine 1 comprises a data processing unit 3, e.g. a microprocessor or a microcontroller.

[0031] The user interface 2 is operatively connected to the data processing unit 3 of the exercise machine 1.

[0032] The exercise machine 1 further comprises a memory unit 4, operatively connected to the data processing unit 3.

[0033] The memory unit 4 can be either internal or external (as shown in figures 2a and 2b, for example) to the data processing unit 3.

[0034] It is worth noting that the memory unit 4 is configured to store one or more program codes which can be executed by the data processing unit 3 and data generated and processed following the execution of said one or more program codes.

[0035] The data processing unit 3 is configured to control the operation of the exercise machine 1.

[0036] Furthermore, the data processing unit 3 is configured to execute steps of the method for controlling a user's breathing during a workout with an exercise machine, according to the present invention, as will be described below.

[0037] In greater detail, the data processing unit 3 is configured to acquire at least one parameter representative of a physical exercise being performed by the user with the exercise machine 1.

[0038] "Parameter representative of a physical exercise being performed by the user with the exercise machine" means any parameter relating to the exercise machine and/or the user and/or the workout program which can be acquired during the performance of the physical exercise by the data processing unit 3 because it can be detected by the data processing unit 3 (either directly or indirectly, as will be discussed below) or can be determined based on other parameters either acquired or known thereto or in that it is set automatically or manually by the user during the physical exercise according to a set workout program.

[0039] Examples of a "parameter representative of a physical exercise being performed by the user with the exercise machine", as a function of the exercise machine 1 and, if applicable, the physical exercise being performed with said exercise machine 1, are provided below.

[0040] If the exercise machine 1 is a treadmill and the physical exercise is running/walking on the treadmill, such at least one parameter representative of a physical exercise comprises, either alternatively or in combination (and/or) with each other:

- the speed of the treadmill;
- the running/walking cadence of the user on the treadmill;
- the inclination of the running/walking surface of the treadmill.

[0041] If the exercise machine 1 is a bike or an exercise bike, such at least one parameter representative of the physical exercise comprises, either alternatively or in combination with each other:

- the resistance of the bike or the exercise bike in opposition to the pedaling of the user;
- the pedaling frequency of the user on the bike or the exercise bike.

[0042] If the exercise machine 1 is a rowing machine, such at least one parameter representative of the physical exercise comprises, either alternatively or in combination with each other:

- the resistance of the rowing machine as opposed to the rowing of the user;
- the rowing frequency of the user on the rowing machine.

[0043] If the exercise machine 1 is a strength exercise machine (strength machine) such at least one parameter

representative of the physical exercise comprises, either alternatively or in combination with each other:

- the load of the strength exercise machine;
- the percentage of the load relative to the user's maximum (1 RM), for a set exercise;
- the eccentric phase of the movement of the user;
- the concentric phase of the movement of the user;
- the position along the range of motion during the eccentric phase;
- the position along the range of motion during the concentric phase;
- the repetition execution cadence of a series within the physical exercise;
- the recovery time;
- the progressive number of the series during the physical exercise.

[0044] Additionally, more in general, regardless of the type of exercise machine 1 (which can be any type), said at least one parameter representative of the physical exercise can comprise a set time period of the workout program, e.g. the cool-down period at the end of a physical exercise (running, walking, cycling or rowing) or the pre-workout (or warm-up) period needed to prepare the body better for the workout.

[0045] In an embodiment, the data processing unit 3 is configured to directly acquire the at least one parameter representative of the physical exercise (e.g., if such a parameter is a parameter set either automatically or manually by the user and/or automatically provided by the workout program).

[0046] In an embodiment, in combination with any of those described above and shown in figures 2a and 2b, the exercise machine 1 further comprises a sensor unit 5 operatively connected to the data processing unit 3.

[0047] It is worth noting that the sensor unit 5 (shown symbolically in figures 2a and 2b) comprises a plurality of sensors with which the exercise machine 1 is equipped to detect and provide the data processing unit 3 with information for managing and controlling the operation of the exercise machine 1 while performing a physical exercise by a user.

[0048] Additionally, the data processing unit 3 has a set configuration from a hardware/software point of view adapted to detect information for managing and controlling the operation of the exercise machine 1 while performing a physical exercise by a user.

[0049] By way of example, if the exercise machine 1 is a treadmill and the physical exercise is a running/walking on the treadmill:

- the speed of the treadmill can be detected by an encoder (or other equivalent devices) or by a set configuration of the data processing unit 3 which is aware of the speed of the treadmill;
- in order to determine the speed of the treadmill, a change in the electric current drawn by an electric motor adapted to move the running/walking surface can be detected either explicitly by an electric current sensor or implicitly by a set configuration of the data processing unit 3 which is aware of the change in the electric current drawn by said electric motor;
- in order to determine the running/walking cadence of the user on the treadmill by the data processing unit 3, an impact of the user's feet on the running/walking surface is detected by appropriate sensors, such as accelerometers placed underneath the running/walking surface.

[0050] If the exercise machine 1 is a bike or an exercise bike:

- the resistance in opposition to the pedaling of the user can be detected, e.g., by a torque transducer or an encoder.

[0051] If the exercise machine 1 is a rowing machine:

- the resistance in opposition to the rowing of the user can be detected, for example, by means of a torque meter or an encoder.

[0052] If the exercise machine 1 is a strength exercise machine (strength machine):

- the load can be detected, e.g. by a strain gage, a torque meter, a magnetic sensor, or a tag identifying the magnitude of the load selected for the physical exercise;
- the position along the range of motion during the eccentric phase and/or during the concentric phase can be detected, e.g., by a position sensor;
- the repetition execution cadence of a series within the physical exercise, the eccentric phase and the concentric phase can be detected e.g. by an optical sensor or an accelerometer.

[0053] In an embodiment, in combination with any one of the embodiments described above, the data processing unit 3 is configured to acquire the at least one parameter representative of the physical exercise from the sensor unit 5 configured to detect said parameter (e.g., if said parameter is a parameter to be detected while performing the workout).

[0054] In general, the data processing unit 3 is further configured to determine an indication of the breathing to be followed by the user while performing the physical exercise based on the acquired at least one parameter representative of the physical exercise.

[0055] In an embodiment, the data processing unit 3 of the exercise machine 1 is configured to directly determine the indication of the breathing to be followed by the user while performing the physical exercise.

[0056] Therefore, in this embodiment, the "intelligent" part of the processing resides entirely in the exercise

machine 1.

[0057] According to a further embodiment, alternative to the preceding one, the data processing unit 3 of the exercise machine 1 is configured to delegate the determination of the indication of the breathing to be followed by the user while performing the physical exercise to a remote electronic processor (e.g., a cloud server, not shown in the figures) operatively connected to the exercise machine 1 through a data communication network (also not shown in the figures).

[0058] The remote electronic processor is configured to determine and provide the exercise machine 1 with an indication of the breathing to be followed by the user while performing the physical exercise based on the acquired at least one parameter representative of the physical exercise and provided to the remote electronic processor by the exercise machine 1.

[0059] Therefore, in this embodiment, the "intelligent" part of the processing resides in the remote electronic processor which, in addition to providing the workout program, can also determine the indication of the breathing to be followed within the workout program.

[0060] The following is worth noting with regard to the indication of the breathing to be followed by the user during physical exercise.

[0061] Where a workout program is provided, an indication of the breathing to be followed by the user while performing the physical exercise is provided in the form of instructions comprised in the operating instructions of the workout program algorithm, e.g., instructions stored in the pre-workout step and/or in the cool-down step.

[0062] In this case, such instructions (such as the duration of the phase, the breathing rate, the duration of the breathing phases) may depend on the type of workout which will be performed or which has been performed (therefore also on the type of exercise machine), the level of intensity of the workout, the duration of the workout and so on.

[0063] During the physical exercise, the indications of the breathing are related to the acquired at least one parameter representative of the physical exercise in a manner which depends on the type of physical exercise (thus also on the type of exercise machine).

[0064] The aforesaid correlation can be represented, for example, in the form of a table or the form of a mathematical function.

[0065] Examples of breathing techniques include pre-workout breathing techniques, breathing techniques for cardiovascular type workouts (running or walking, bike or exercise bike), and breathing techniques for strength workouts.

[0066] Pre-workout breathing techniques prepare the breathing before starting a physical exercise session, preparing the body for the workout by maintaining a set level of relaxation.

[0067] An example of a pre-workout breathing technique comprises the following operational phases:

- performing a set number of deep breaths;
- inhaling through the nose;
- inflating the belly and diaphragm;
- exhaling slowly through the mouth.

[0068] On the other hand, examples of breathing techniques for cardiovascular workouts are diaphragmatic breathing and thoracic breathing.

[0069] Diaphragmatic, or abdominal, breathing allows the maximum amount of oxygen to be introduced into the body.

[0070] Conversely, thoracic breathing uses only the upper part of the lungs and the air which is inhaled remains in the lungs for only a short time, preventing the total turnover and reducing oxygen supply.

[0071] Another aspect of breathing for which an indication can be provided while performing a physical exercise during a cardiovascular workout is the breathing rate, as shown below.

[0072] In the case of a low-intensity run, a correct rate might be 3:3, meaning inhaling every 3 steps, exhaling every 3 steps, and so on.

[0073] In the case of a medium-intensity run, a correct rate might be 2:2, meaning inhaling every 2 steps, exhaling every 2 steps, and so on.

[0074] In the case of a high-intensity run, a correct rate may be 1:1, meaning 1 inhaling step, 1 exhaling step, and so on.

[0075] With reference instead to strength workouts, examples of breathing techniques are based on the anatomical principle and the performance principle.

[0076] In the case of a strength workout, according to the anatomical principle, the breathing technique follows the natural rate of expansion and closure of the rib cage.

[0077] In this case:

- in pushing exercises, exhaling in the concentric phase and inhaling in the eccentric phase;
- in pulling exercises, inhaling in the concentric phase, and exhaling in the eccentric phase.

[0078] It is worth noting that, in pushing exercises, the rib cage tends to close in the concentric phase while it tends to open in the eccentric phase.

[0079] Instead, in pulling exercises, the rib cage tends to open in the concentric phase while it tends to close in the eccentric phase.

[0080] Always in the case of strength workouts, according to the performance principle, the breathing technique involves breathing in such a manner as to lift the greatest load.

[0081] In all strength exercises (pushing and pulling), the performance principle implies exhaling in the concentric phase and inhaling in the eccentric phase.

[0082] It is worth noting that more load is moved when exhaling, so one is put in the best condition in the most unfavorable phase, i.e., the concentric phase (there is about 50% more strength in the eccentric phase).

[0083] Comparing the anatomical principle and the performance principle:

- it is natural to apply the anatomical principle if the load is relatively low and not close to yielding (easy load management);
- the performance principle is used if the load is close to the maximum or close to yielding (problematic repetitions) (this comes naturally; otherwise the repetitions cannot be repeated).

[0084] Referring back to figures 2a and 2b, according to an embodiment, in combination with any one of those described above, the data processing unit 3, if the exercise machine 1 is a treadmill, is configured to detect a speed of the treadmill and/or a running/walking cadence of the user on the treadmill and/or an inclination of the running/walking surface of the treadmill.

[0085] In this embodiment, the data processing unit 3 is configured to determine the indication of the breathing to be followed by the user while performing the physical exercise according to the detected speed of the treadmill and/or the detected running/walking cadence of the user on the treadmill and/or the detected inclination of the running/walking surface of the treadmill.

[0086] According to a further embodiment, alternative to the preceding embodiments, the data processing unit 3, if the exercise machine 1 is a bike or an exercise bike, is configured to detect a resistance in opposition to the pedaling of the user and/or a pedaling frequency of the user.

[0087] In this embodiment, the data processing unit 3 is configured to determine the indication of the breathing to be followed by the user while performing the physical exercise as a function of the detected resistance in opposition to the pedaling of the user and/or the detected pedaling frequency of the user.

[0088] According to a further embodiment, alternative to the preceding ones, the data processing unit 3, if the exercise machine 1 is a rowing machine, is configured to detect a resistance in opposition to the rowing of the user and/or a rowing frequency of the user.

[0089] In this embodiment, the data processing unit 3 is configured to determine the indication of the breathing to be followed by the user while performing the physical exercise as a function of the detected resistance in opposition to the rowing of the user and/or the detected rowing frequency of the user.

[0090] According to a further embodiment, as an alternative to the preceding embodiments, the data processing unit 3, if the exercise machine 1 is a strength exercise machine, is configured to detect an eccentric phase and/or a concentric phase of a movement of the user and/or the repetition execution cadence of a series within the physical exercise and/or the load of the exercise machine 1 and/or a position along the range of motion during the eccentric phase and/or a position along the range of motion during the concentric phase and/or to determine a percentage of the load relative to the user's maximum (1RM), for a set physical exercise.

[0091] In this embodiment, the data processing unit 3 is configured to determine the indication of the breathing to be followed by the user while performing the physical exercise as a function of the detected eccentric phase and/or concentric phase of the movement of the user and/or the detected repetition execution cadence of a series within the physical exercise, and/or the detected load of the exercise machine 1.

[0092] According to an embodiment, in combination with any one of those described above, regardless of the type of the exercise machine 1, the data processing unit 3 is configured to acquire a heart rate of the user.

[0093] The heart rate of the user is detectable through a heart rate monitor, or other equivalent devices, worn by the user and connected to the data processing unit 3 (e.g., through a wireless data connection type) or comprised in the sensor unit 5 of the exercise machine 1 or through a set configuration of the data processing unit 3 which is aware of the heart rate of the user.

[0094] It is worth noting that the detected heart rate represents information to further refine the indication of the breathing to be followed by the user during the physical exercise to be provided to the user.

[0095] In particular, the detected heart rate is comparable to a set value representative of the user's maximum heart rate to determine what percentage of the set value representative of the user's maximum heart rate is being worked by the user to determine the subjective effort the user is under and the respective workout zone (e.g., near the anaerobic threshold).

[0096] Indeed, the same physical exercise could induce mutually different heart rate responses in two users with different physical characteristics, and thus with set values representative of the maximum heart rate.

[0097] Therefore, a user who is more fatigued than another may need a modification of the indication of the breathing to be followed, such as a different correlation between physical exercise mode and breathing to be followed.

[0098] In this embodiment, the data processing unit 3 is configured to provide the user with a modified indication of the breathing to be followed by the user while performing the physical exercise according to the detected heart rate of the user (e.g., a different correlation between physical exercise mode and the breathing to be followed).

[0099] Referring back in general to the invention and figures 2a and 2b, the data processing unit 3 is further configured to provide the user with the determined indication of the breathing.

[0100] In an embodiment, in combination with the preceding one and shown in figures 2a and 2b, the exercise machine 1 comprises an audio speaker 6 operatively connected to the data processing unit 3.

[0101] In an embodiment, the determined indication of the breathing comprises an audio message (e.g., a voice of a personal trainer) which can be used by the user

through the audio speaker 6 of the exercise machine 1.

[0102] In this embodiment, the data processing unit 3 is configured to broadcast the determined indication of the breathing in the form of an audio message through the audio speaker 6 of the exercise machine 1.

[0103] In an embodiment, in combination with the preceding, the audio speaker 6 comprises a speaker.

[0104] According to a further embodiment, as an alternative to the preceding ones, the audio speaker 6 is a hardware component configured to be operatively connected, e.g., wirelessly or wired, to a headset with which a user is provided.

[0105] According to an embodiment, either alternatively or in combination with the preceding one, shown in figures 2a and 2b, the exercise machine 1 further comprises a display module 7, e.g., a display, operatively connected to the data processing unit 3.

[0106] In an embodiment, either alternatively or in combination with the preceding one, the determined indication of the breathing comprises a graphic representation viewable through the display module 7 of the exercise machine 1.

[0107] In this embodiment, the data processing unit 3 is configured to display the determined indication of the breathing in the form of a graphic representation through the display module 7 of the exercise machine 1.

[0108] According to an embodiment, shown in figure 2a, the user interface 2 is distinct from the data processing unit 3, the memory unit 4, the sensor unit 5, the audio speaker 6, and the display module 7 which are therefore external to the user interface 2, e.g., integrated into other parts of the exercise machine 1.

[0109] According to a further embodiment shown in figure 2b, the data processing unit 3, the memory unit 4, the sensor unit 5, the audio speaker 6, and the display module 7 are comprised and integrated within the user interface 2.

[0110] The graphic representation is preferably animated because it shows to the user an indicator I-D (figures 4a and 4b) or an indicator E-G (figures 5a and 5b), the animation of which helps the user follow the breathing phases more immediately and intuitively.

[0111] According to an embodiment, shown in figures 4a and 4b, the graphic representation comprises a time pattern S-T (e.g., a sine curve) of the I-S (inhaling) and E-S (exhaling) breathing phases to be followed while performing the physical exercise.

[0112] With reference to the embodiment in figure 4a, if the physical exercise performed by the user is running on a treadmill, the time pattern S-T is a sine curve, the ascending phase of which is an inhaling phase I-S and the descending phase is an exhaling phase E-S.

[0113] In this embodiment, every two steps P-S of a user, between two successive foot impacts I-P, the sine curve S-T comprises a breathing phase (inhaling I-S or exhaling E-S).

[0114] In the case of a medium-intensity run, a correct breathing rate may be 2:2, meaning inhaling every 2 steps, exhaling every 2 steps, and so on.

[0115] During the physical exercise, an indicator I-D appears on the time pattern S-T, adapted to move in the direction indicated by the arrows represented within the time pattern S-T, the position of which along the time pattern S-T indicates to the user the breathing phase to be followed, so that the detected cadence while running is correlated to the breathing rate, as in the example just illustrated.

[0116] It is worth noting that different correlations with the rate of the breathing phases can be set up according to the detected speed of the treadmill or the detected cadence, thus obtaining time patterns (e.g. sinusoidal curves) with different shapes.

[0117] With reference to the embodiment in figure 4b, if the physical exercise performed by the user is a strength exercise on a strength exercise machine, the time pattern S-T is again a sine curve, the ascending phase of which is an inhaling phase I-S and the descending phase of which is an exhaling phase E-S.

[0118] In this embodiment, each eccentric movement M-E of the user corresponds to an inhaling phase I-S of the sine curve S-T while each concentric movement M-C of the user corresponds to an exhaling phase E-S.

[0119] During the physical exercise, an indicator I-D appears on the S-T time course, the position of which along the time pattern S-T tells the user which breathing phase to be followed.

[0120] According to a further embodiment, either alternatively or in combination with the preceding ones and shown in figures 5a-5b, the graphic representation comprises an animated graphic element E-G, the animation of which represents the breathing phases to be followed while performing the physical exercise.

[0121] The animated graphic element E-G is a geometric shape (such as a circle or sphere), the size of which varies with the breathing phases.

[0122] According to the embodiment in figures 5a-5b, the animated graphic element E-G is a circle (or a sphere).

[0123] In the inhaling phase I-S (figure 5a), the radius of the animated graphic element E-G (circle) increases from a first value R1, corresponding to a first circle S-1 (represented with dashed line) to a second value R2, corresponding to a second circle S-2 (represented with solid line).

[0124] The second value R2 is greater than the first value R1.

[0125] In the exhaling phase E-S (figure 5b), the radius of the animated graphic element E-G (circle) decreases from the second value R2, corresponding to the second circle S-2 (represented with dashed line) to the first value R1, corresponding to the first circle S-1 (represented with solid line).

[0126] With reference now also to figure 3, a method 300 for controlling a user's breathing during a workout with an exercise machine hereinafter also control method or simply method is now described.

[0127] The method 300 comprises a symbolic step of starting ST.

[0128] The method 300 comprises a step of acquiring 301, by a data processing unit 3 with a user interface 2 of an exercise machine 1, at least one parameter representative of a physical exercise being performed by the user with the exercise machine 1.

[0129] The exercise machine 1, the user interface 2 and the data processing unit 3 have been described above.

[0130] The definition and examples of "parameter representative of a physical exercise being performed by the user with the exercise machine" have been provided above.

[0131] The method 300 further comprises a step of determining 302, by the data processing unit 3 of the exercise machine 1, an indication of the breathing to be followed by the user while performing the physical exercise based on the acquired at least one parameter representative of the physical exercise.

[0132] In such regard, technical breathing examples were provided above.

[0133] In an embodiment, the step of determining 302 is performed directly by the data processing unit 3 of the exercise machine 1.

[0134] Therefore, in this embodiment, the "intelligent" step of the method 300 resides entirely in the exercise machine 1.

[0135] According to a further embodiment, alternative to the previous one, the step of determining 302 is delegated, by the data processing unit 3 of the exercise machine 1, to a remote electronic processor (e.g., a cloud server, not shown in the figures) operatively connected to the exercise machine 1 through a data communication network (also not shown in the figures) which determines and provides the exercise machine 1 with an indication of the breathing to be followed by the user while performing the physical exercise based on the acquired at least one parameter representative of the physical exercise and provided to the remote electronic processor by the exercise machine 1.

[0136] Therefore, in this embodiment, the "intelligent" step of the method 300 resides in the remote electronic processor which, in addition to providing the workout program, can also determine and provide the indication of the breathing to be followed within the workout program.

[0137] Referring back to the embodiment shown in figure 3, the method 300 further comprises a step of providing 303 the user, by the data processing unit 3 of the exercise machine 1, with the determined indication of the breathing.

[0138] The method 300 comprises a symbolic step of ending ED.

[0139] In an embodiment, in combination with the preceding embodiment, the determined indication of the breathing comprises an audio message (e.g., a voice of a personal trainer) usable by the user through an audio speaker 6 of the exercise machine 1 operatively connected to the data processing unit 3.

[0140] In this embodiment, shown with dashed lines in figure 3, the step of providing 303 comprises a step of broadcasting 304, by the data processing unit 3 of the exercise machine 1, the determined indication of the breathing in the form of an audio message through the audio speaker 6 of the exercise machine 1 operatively connected to the data processing unit 3.

[0141] In a further embodiment, either alternatively or in combination with the preceding one, the determined indication of the breathing comprises a graphic representation usable by the user through a display module 7 of the exercise machine 1 operatively connected to the data processing unit 3.

[0142] In this embodiment, shown with dashed lines in figure 3, the step of providing 303 comprises a step of displaying 305, by the data processing unit 3 of the exercise machine 1, the determined indication of the breathing in the form of a graphic representation by the display module 7 of the exercise machine 1 operatively connected to the data processing unit 3.

[0143] As mentioned above, the graphic representation is preferably animated because it shows to the user an indicator I-D (figures 4a and 4b) or an indicator E-G (figures 5a and 5b), the animation of which helps the user follow the breathing phases more immediately and intuitively.

[0144] Embodiments of the graphic representation have been provided previously with particular reference to figures 4a, 4b, 5a, and 5b.

[0145] According to an embodiment, in combination with any one of those described above, the step of acquiring 301 is performed directly by the data processing unit 3 of the exercise machine 1.

[0146] According to an embodiment, either in combination or as an alternative to the preceding one and shown with a dashed line in figure 3, the step of acquiring 301 comprises a step of detecting 306, by a sensor unit 5 operatively connected to the data processing unit 3 of the exercise machine 1, the at least one parameter representative of a physical exercise being performed by the user with the exercise machine 1.

[0147] According to an embodiment, in combination with any one described above and shown with dashed lines in figure 3, the step of acquiring 301, if the exercise machine 1 is a treadmill, comprises a step of detecting 307, by the data processing unit 3, a speed of the treadmill and/or a running/walking cadence of the user on the treadmill and/or an inclination of the running/walking surface of the treadmill.

[0148] In this embodiment, the step of determining 302 comprises a step of determining 307', by the data processing unit 3, the indication of the breathing to be followed by the user while performing the physical exercise as a function of the detected speed of the treadmill and/or the detected running/walking cadence of the user on the treadmill and/or the detected inclination of the running/walking surface of the treadmill.

[0149] According to a further embodiment, alternative to the preceding ones and shown with dashed lines in figure 3, the step of acquiring 301, if the exercise machine 1 is a bike or an exercise bike, comprises a step of detecting 308, by the data processing unit 3, a resistance of the bike or the exercise bike in opposition to the pedaling of the user and/or a pedaling frequency of the user.

[0150] In this embodiment, the step of determining 302 comprises a step of determining 308', by the data processing unit 3, the breathing indication to be followed by the user while performing the physical exercise as a function of the detected resistance of the bike or the exercise bike in opposition to the pedaling of the user and/or the detected pedaling frequency of the user.

[0151] According to a further embodiment, alternative to the preceding ones and shown with dashed lines in figure 3, the step of acquiring 301, if the exercise machine 1 is a rowing machine, comprises a step of detecting 309, by the data processing unit 3, a resistance of the rowing machine in opposition to the rowing of the user and/or a rowing frequency of the user.

[0152] In this embodiment, the step of determining 302 comprises a step of determining 309', by the data processing unit 3, the indication of the breathing to be followed by the user while performing the physical exercise as a function of the detected resistance of the rowing machine in opposition to the rowing of the user and/or the detected rowing frequency of the user.

[0153] According to a further embodiment, as an alternative to the preceding ones and shown with dashed lines in figure 3, the step of acquiring 301, if the exercise machine 1 is a strength exercise machine, comprises a step of detecting 310, by the data processing unit 3, an eccentric phase and/or a concentric phase of a movement of the user and/or a load of the strength exercise machine.

[0154] In this embodiment, the step of determining 302 comprises a step of determining 310', by the data processing unit 3, the indication of the breathing to be followed by the user while performing the physical exercise according to the detected eccentric phase and/or concentric phase of the movement of the user and/or the detected load of the strength exercise machine.

[0155] According to an embodiment, in combination with any one of those described above and shown with dashed lines in figure 3, regardless of the type of the exercise machine 1, the method 300 further comprises a step of acquiring 311, by the data processing unit 3, a heart rate of the user.

[0156] In this embodiment, the method 300 further comprises a step of determining 312, by the data processing unit 3, a modification of the indication of the breathing to be followed by the user while performing the physical exercise according to the acquired heart rate of the user (e.g., a different correlation between physical exercise mode and the breathing to be followed).

[0157] In this embodiment, the step of providing 303 further comprises a step of providing 313 the user, by the data processing unit 3, with the determined modified indication of the breathing to be followed.

[0158] With reference to an embodiment and the aforesaid figures, an example of implementation, by the exercise machine 1, of a method for controlling a user's breathing during a workout with an exercise machine is now described.

[0159] A user climbs onto an exercise machine 1, e.g., a treadmill like the one shown in figure 1a, to perform a workout.

[0160] While performing the physical exercise, e.g., running, a data processing unit 3 of a user interface 2 of the exercise machine 1 acquires at least one parameter representative of a physical exercise being performed by the user with the exercise machine 1, e.g. the speed of the treadmill.

[0161] The data processing unit 3 of the exercise machine 1 determines an indication of the breathing to be followed by the user while performing the physical exercise based on the acquired at least one parameter representative of the acquired physical exercise, i.e. based on the speed of the treadmill.

[0162] The data processing unit 3 of the exercise machine 1 provides the determined indication of the breathing.

[0163] In particular, the data processing unit 3 of the exercise machine 1 displays the determined indication of the breathing in the form of a graphic representation (e.g., a sine curve representing the breathing phases to be followed while performing the physical exercise) through a display module 7 of the exercise machine 1.

[0164] It is worth noting that the scope of the invention is fully achieved.

[0165] Indeed, the user can promptly and reliably receive an indication of the breathing to be followed while performing a physical exercise with an exercise machine, ensuring as much as possible a correct and optimal performance of the physical exercise with the achievement of the required performance.

[0166] The person skilled in the art may make changes and adaptations to the embodiments of the method and exercise machine described above or can replace elements with other, functionally equivalent ones to meet contingent needs without departing from the scope of the following claims. All the features described above as belonging to a possible embodiment may be implemented independently of the other described embodiments.

Claims

1. A method (300) for controlling a user's breathing during a workout with an exercise machine (1), comprising steps of:

   - acquiring (301), by a data processing unit (3) of an exercise machine (1), at least one parameter representative of a physical exercise being

performed by the user with the exercise machine (1);
- determining (302), by the data processing unit (3) of the exercise machine (1), an indication of the breathing to be followed by the user while performing the physical exercise based on the acquired at least one parameter representative of the physical exercise;
- providing (303) the user, by the data processing unit (3) of the exercise machine (1), with the determined indication of the breathing.

2. The method (300) according to claim 1, wherein the determined indication of the breathing comprises an audio message usable by the user through an audio speaker (6) of the exercise machine (1), the step of providing (303) comprising a step of broadcasting (304), by the data processing unit (3) of the exercise machine (1), the determined indication of the breathing in the form of an audio message through the audio speaker (6) of the exercise machine (1).

3. The method (300) according to any one of the preceding claims, wherein the determined indication of the breathing comprises a graphic representation usable by the user through a display module (7) of the exercise machine (1), the step of providing (303) comprising a step of displaying (305), by the data processing unit (3) of the exercise machine (1), the determined indication of the breathing in the form of a graphic representation through the display module (7) of the exercise machine (1).

4. The method (300) according to any one of the preceding claims, wherein the step of acquiring (301) is performed directly by the data processing unit (3) of the exercise machine (1).

5. The method (300) according to any one of the preceding claims, wherein the step of acquiring (301) comprises a step of detecting (306), by a sensor unit (5) operatively connected to the data processing unit (3) of the exercise machine (1), the at least one parameter representative of a physical exercise being performed by the user with the exercise machine (1).

6. The method (300) according to any one of the preceding claims, wherein the step of acquiring (301), if the exercise machine (1) is a treadmill, comprising a step of detecting (307), by the data processing unit (3), a speed of the treadmill and/or a running/walking cadence of the user on the treadmill and/or the inclination of the running/walking surface of the treadmill, the step of determining (302) comprising a step of determining (307'), by the data processing unit (3), the indication of the breathing to be followed by the user while performing the physical exercise as a function of the detected speed of the treadmill and/or the detected running/walking cadence of the user on the treadmill and/or the detected inclination of the running/walking surface of the treadmill.

7. The method (300) according to any one of the preceding claims 1 to 5, wherein the step of acquiring (301), if the exercise machine (1) is a bike or an exercise bike, comprises a step of detecting (308), by the data processing unit (3), a resistance of the bike or the exercise bike in opposition to the pedaling of the user and/or a pedaling frequency of the user, the step of determining (302) comprising a step of determining (308'), by the data processing unit (3), the breathing indication to be followed by the user while performing the physical exercise as a function of the detected resistance of the bike or the exercise bike in opposition to the pedaling of the user and/or the detected pedaling frequency of the user.

8. The method (300) according to any one of the preceding claims 1 to 5, wherein the step of acquiring (301), if the exercise machine (1) is a rowing machine, comprising a step of detecting (309), by the data processing unit (3), a resistance of the rowing machine in opposition to the rowing of the user and/or a rowing frequency of the user on the rowing machine, the step of determining (302) comprising a step of determining (309'), by the data processing unit (3), the indication of the breathing to be followed by the user while performing the physical exercise as a function of the detected resistance of the rowing machine in opposition to the rowing of the user and/or the detected rowing frequency of the user.

9. The method (300) according to any one of the preceding claims 1 to 5, wherein the step of acquiring (301), if the exercise machine (1) is a strength exercise machine, comprises a step of detecting (310), by the data processing unit (3), an eccentric phase and/or a concentric phase of a movement of the user and/or a load of the strength exercise machine, the step of determining (302) comprising a step of determining (310'), by the data processing unit (3), the indication of the breathing to be followed by the user while performing the physical exercise as a function of the detected eccentric phase and/or concentric phase of the movement of the user and/or the detected load of the strength exercise machine.

10. An exercise machine (1) comprising:

- a user interface (2) configured to allow a user to interact with the exercise machine (1);
- a data processing unit (3), the user interface (2) being operatively connected to the data processing unit (3);
- a memory unit (4) operatively connected to the data processing unit (3);

the data processing unit (3) of the exercise machine (1) being configured to:

- acquire at least one parameter representative of a physical exercise being performed by the user with the exercise machine (1);
- determine an indication of the breathing to be followed by the user while performing the physical exercise based on the acquired at least one parameter representative of the physical exercise;
- providing the user with a determined indication of the breathing.

11. The exercise machine (1) according to claim 10, further comprising an audio speaker (6) operatively connected to the data processing unit (3), the determined indication of the breathing comprising an audio message usable by the user through the audio speaker (6) of the exercise machine (1), the data processing unit (3) being configured to broadcast the determined indication of the breathing in the form of an audio message through the audio speaker (6) of the exercise machine (1).

12. The exercise machine (1) according to claim 11, wherein the audio speaker (6) comprises a speaker or hardware component configured to be operatively connected to a headset with which the user is provided.

13. The exercise machine (1) according to any one of the preceding claims 10 to 12, further comprising a display module (7) operatively connected to the data processing unit (3), the determined indication of the breathing comprising a graphic representation viewable through the display module (7) of the exercise machine (1), the data processing unit (3) being configured to display the determined indication of the breathing in the form of a graphic representation through the display module (7) of the exercise machine (1).

14. The exercise machine (1) according to any one of the preceding claims from 10 to 13, wherein the data processing unit (3) is configured to directly acquire the at least one parameter representative of the physical exercise.

15. The exercise machine (1) according to any one of the preceding claims 10 to 14, further comprising a sensor unit (5) operatively connected to the data processing unit (3), the data processing unit (3) being configured to acquire the at least one parameter representative of the physical exercise from the sensor unit (5) configured to detect said at least one parameter representative of the physical exercise.

16. The exercise machine (1) according to any one of the preceding claims from 10 to 15, wherein the data processing unit (3) is configured to perform steps of the method according to any one of the preceding claims from 6 to 9.

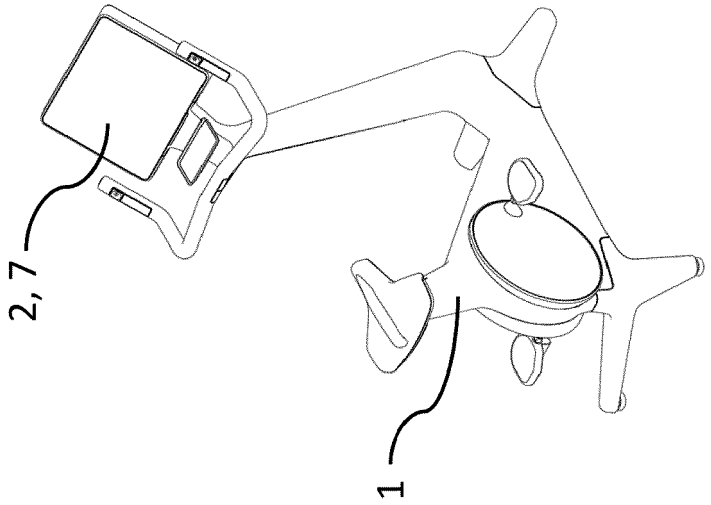

Fig. 1b

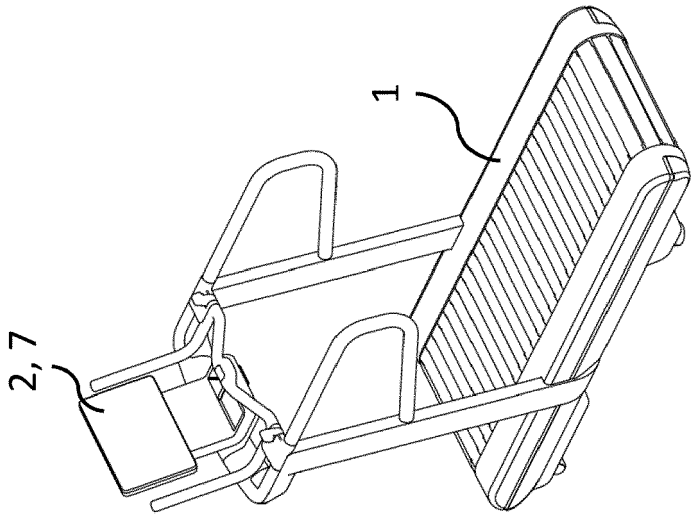

Fig. 1a

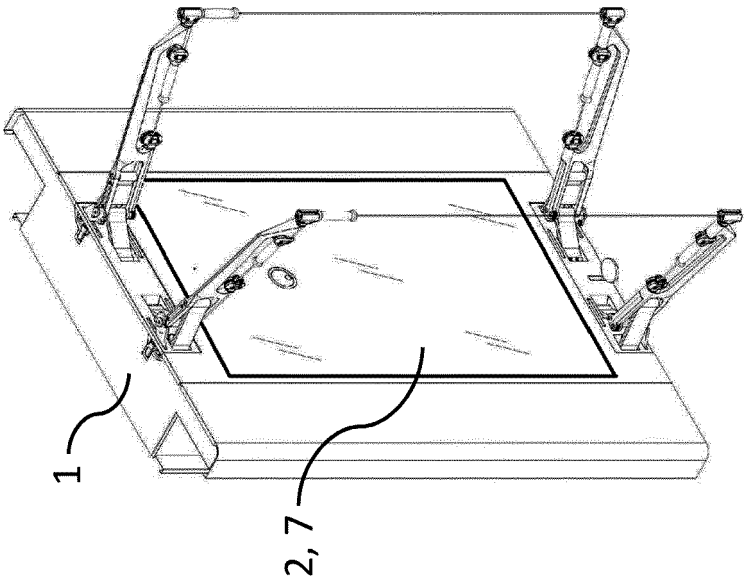

Fig. 1d

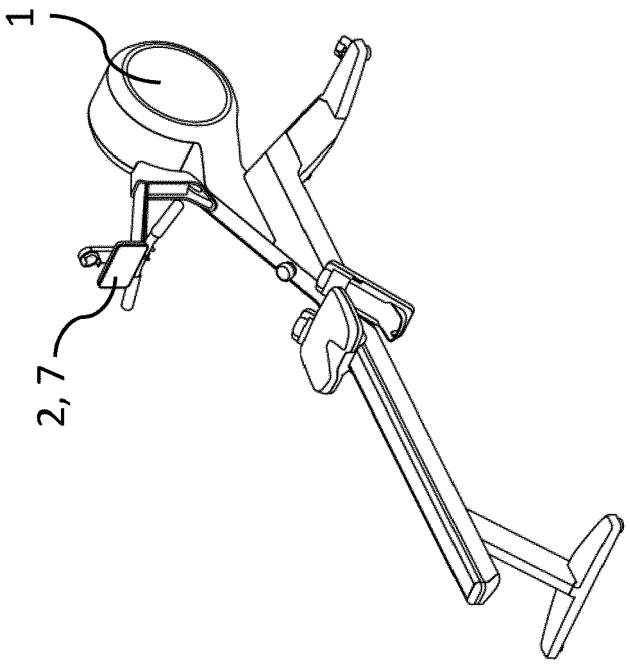

Fig. 1c

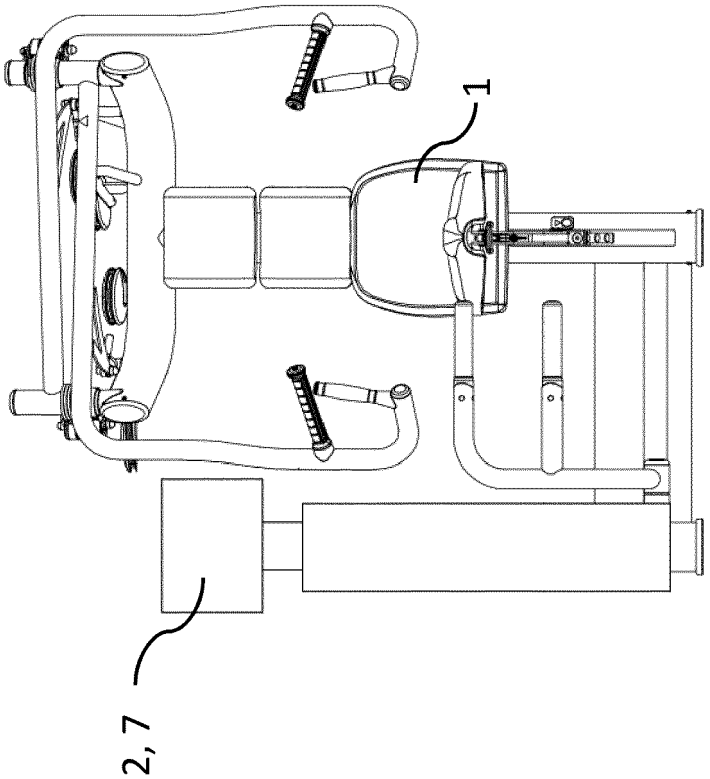

Fig. 1f

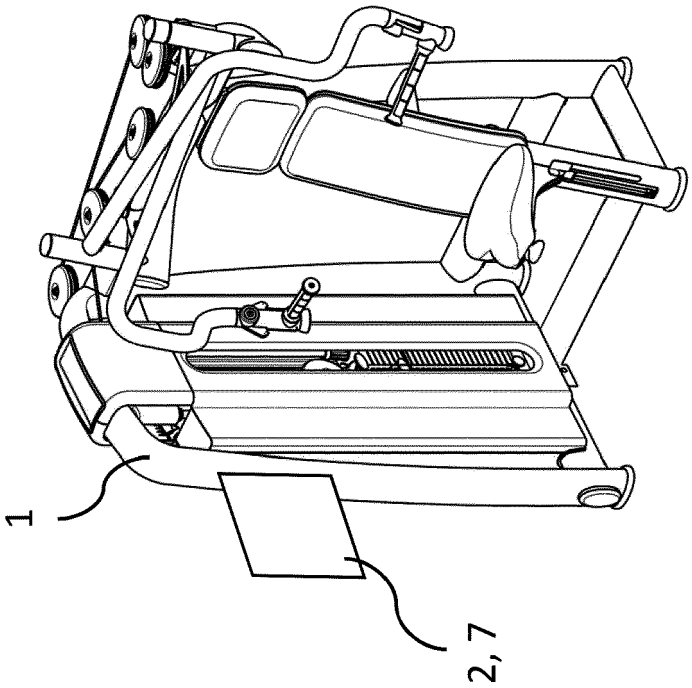

Fig. 1e

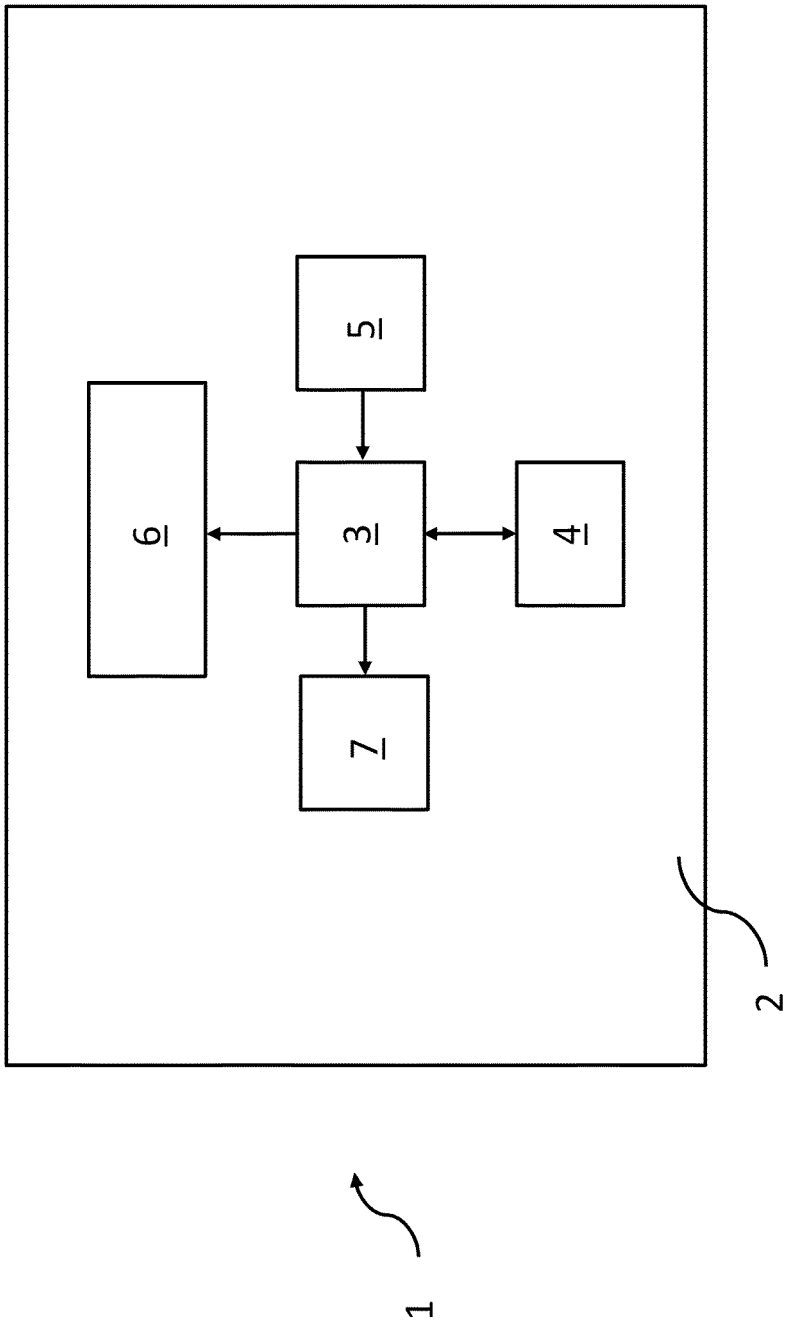

Fig. 2a

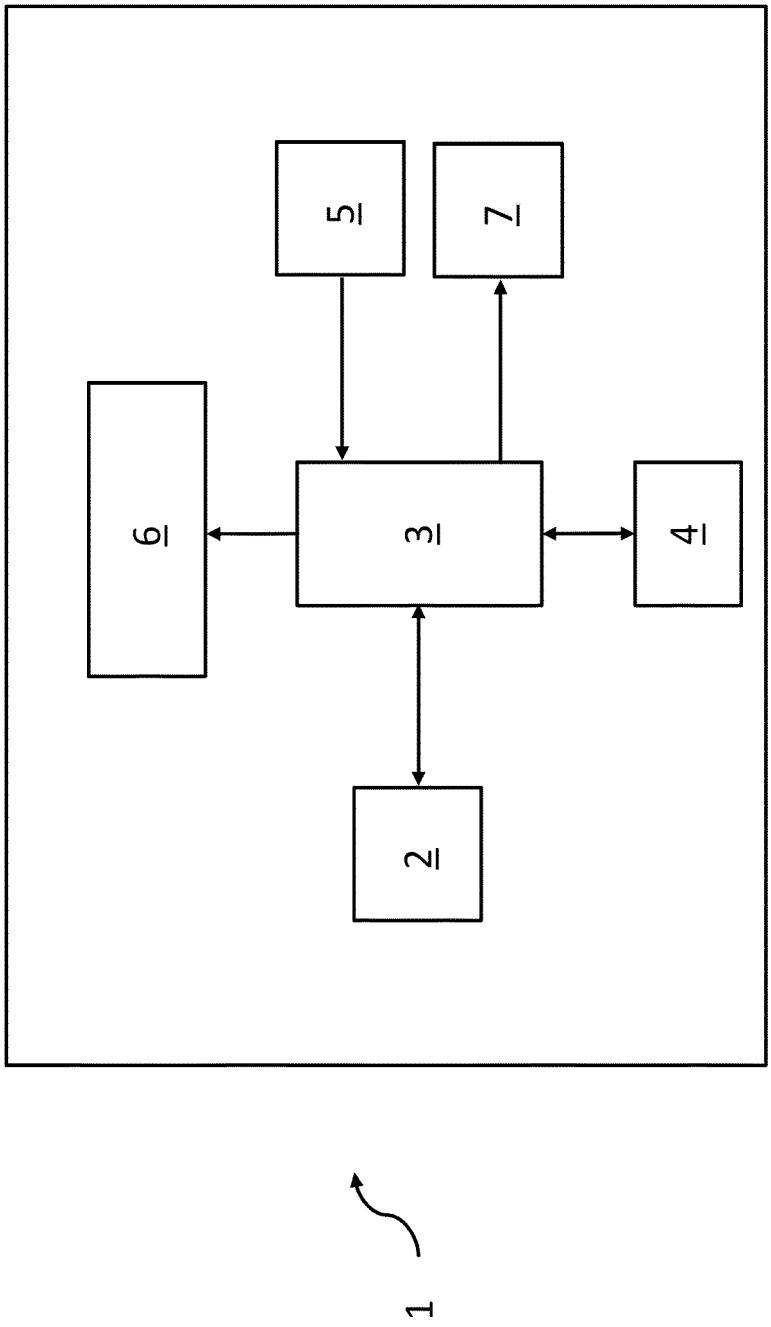

Fig. 2b

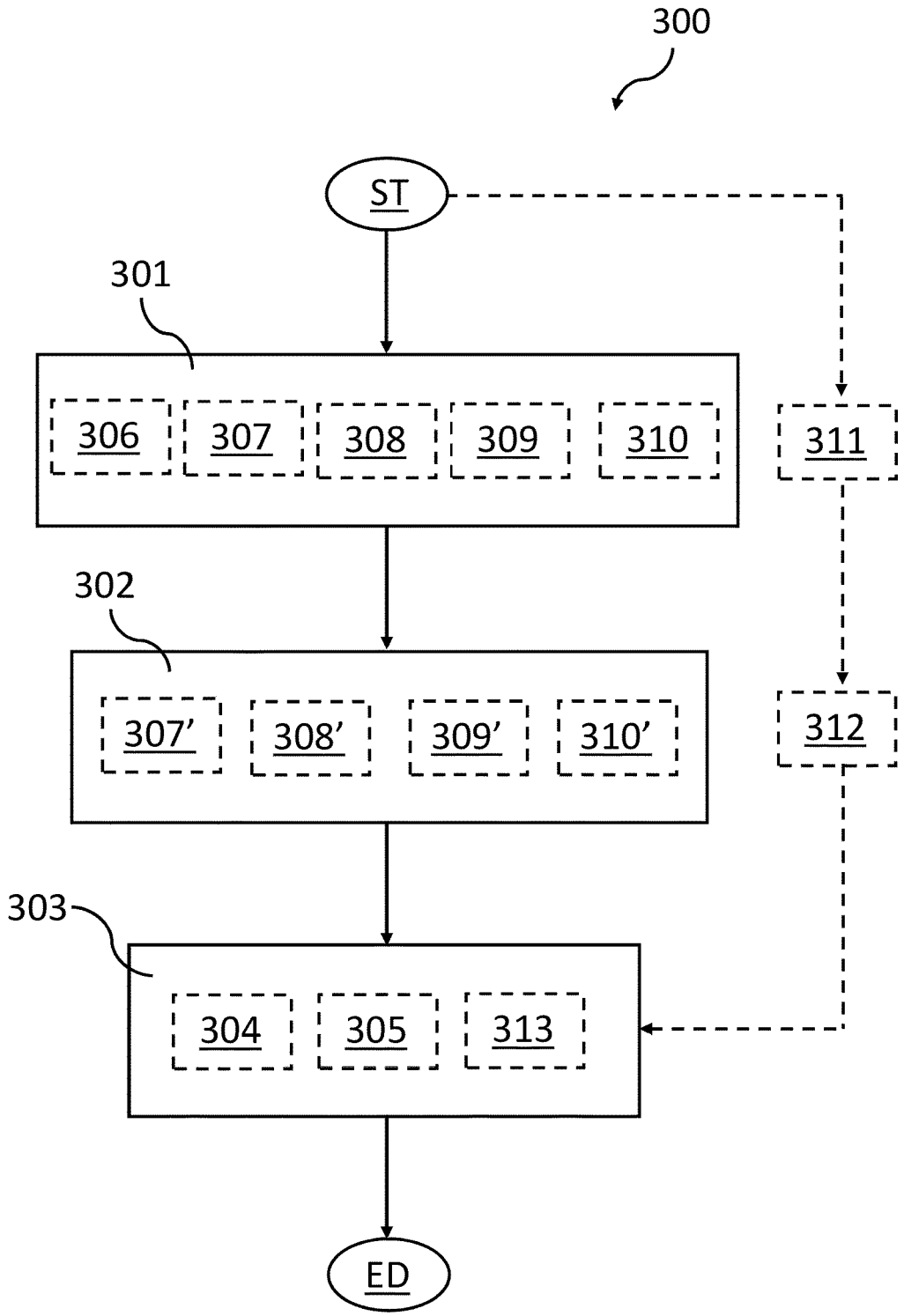
300
ST
301
306
307
308
309
310
311
302
307'
308'
309'
310'
312
303
304
305
313
ED

Fig. 3

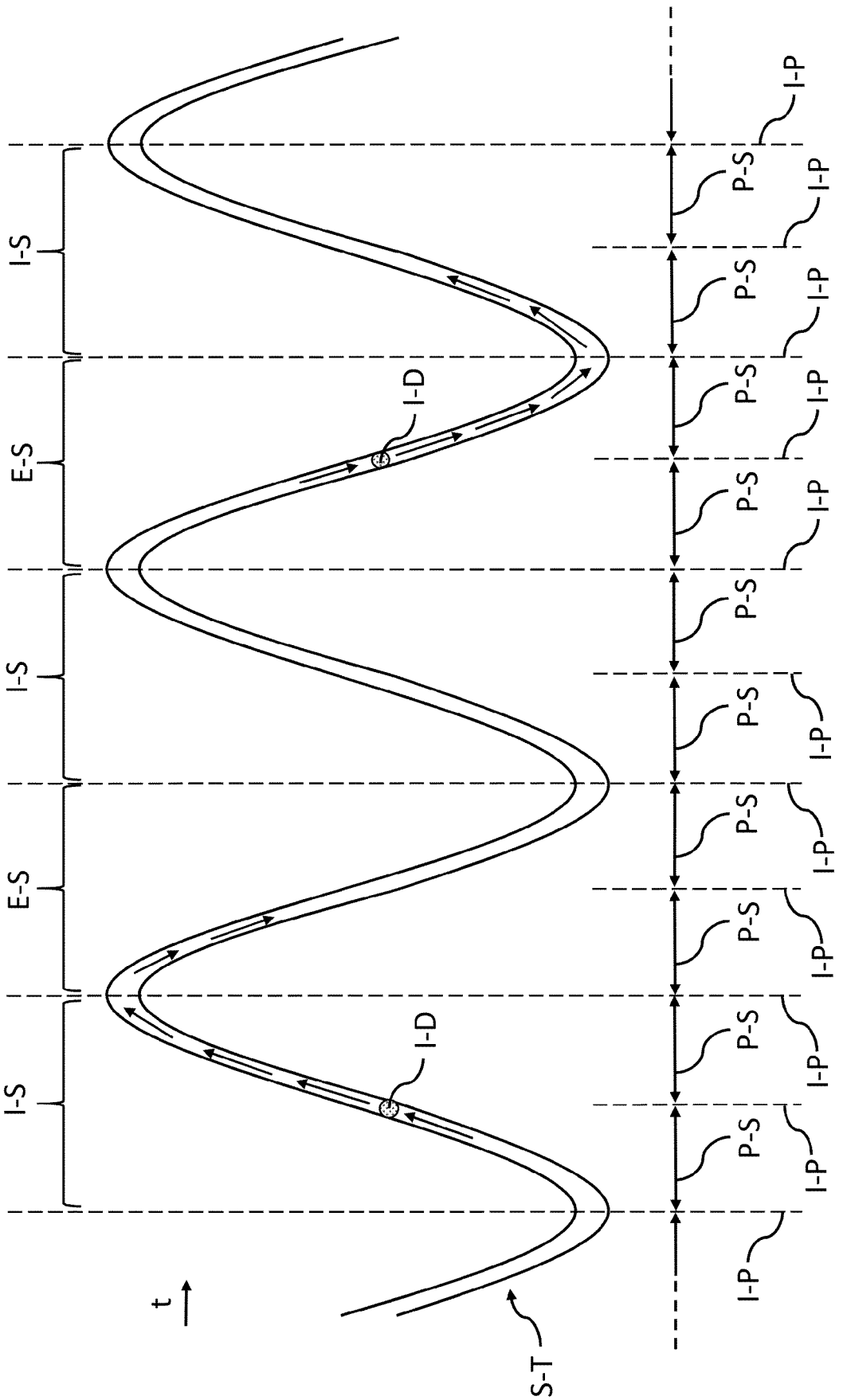

Fig. 4a

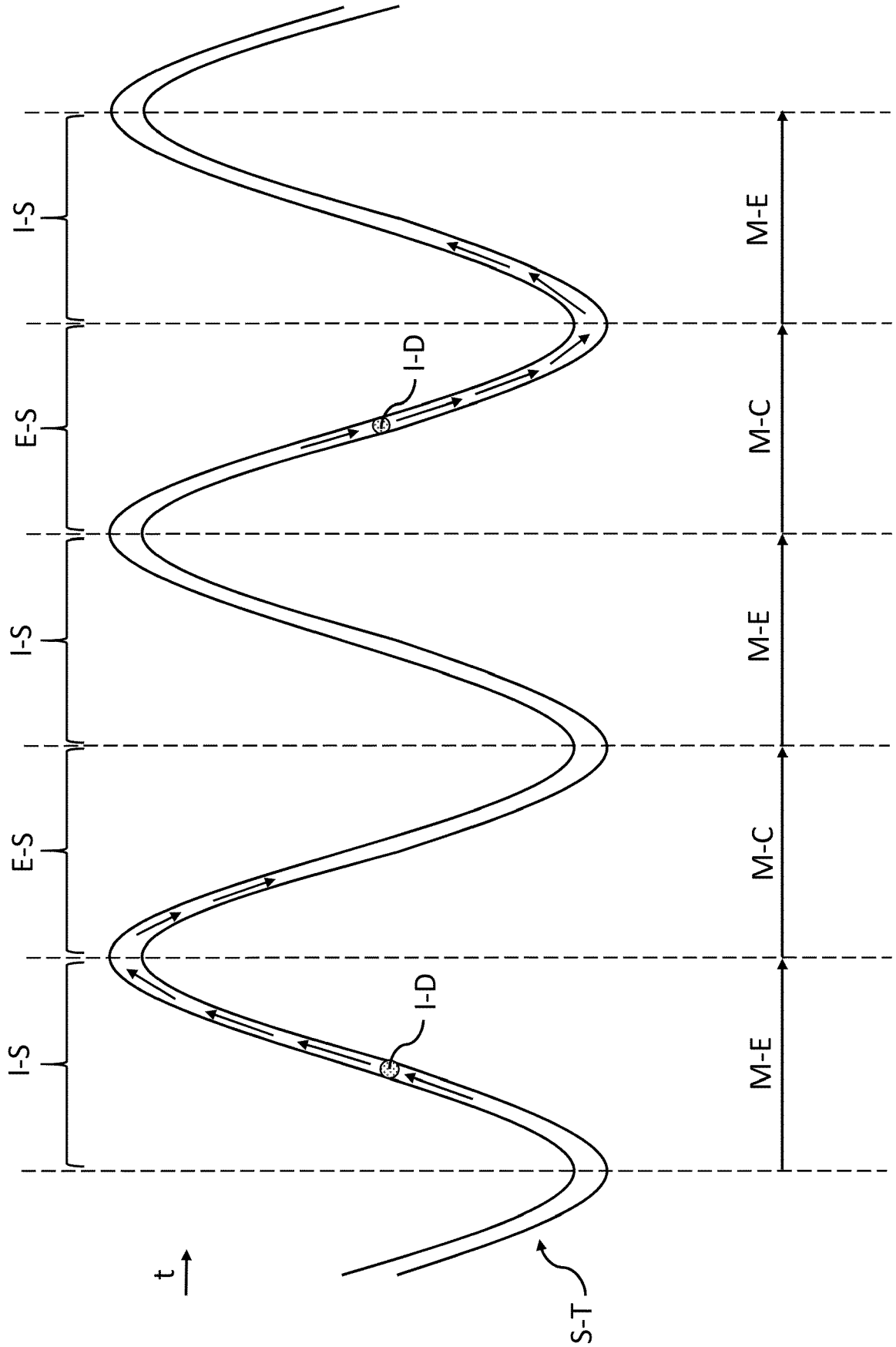

Fig. 4b

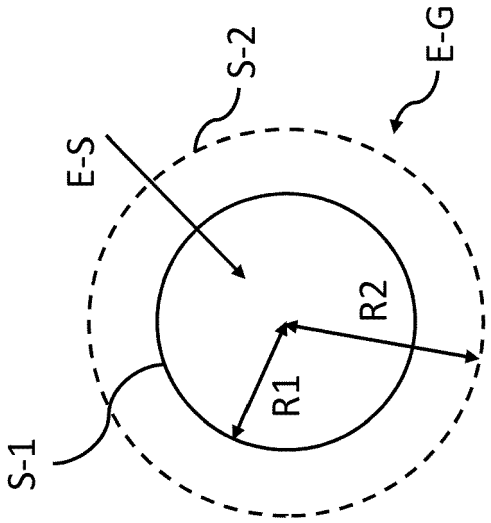

Fig. 5b

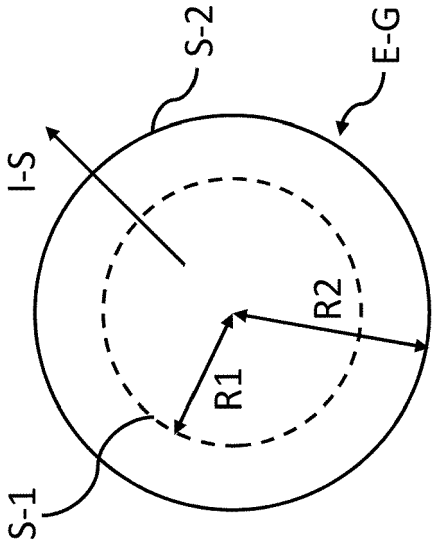

Fig. 5a

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 22 16 4456

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2013/028581 A1 (PULSON INC [US]; BLEICH JEFFERY LEE [US] ET AL.) 28 February 2013 (2013-02-28) * paragraphs [54], [125], [139], [144], [182], [198], [206], [234], [237], [263], [267]; figures 5, 34A-D, 48A-F, 49-50 *	1-16	INV. A63B71/00 ADD. A63B22/06 A63B22/00 A63B23/12 A63B21/062 A63B21/00 A63B71/06
X	US 2007/219059 A1 (SCHWARTZ MARK H [US] ET AL) 20 September 2007 (2007-09-20) * paragraphs [2], [42], [48], [69], [74]-[75], [82], [86], [93], [101], [103]-[104], [163]-[164], [174]-[176]; claim 21; figures 4-5, 8-9 *	1-16	
X	KR 2013 0007812 A (BAEK HYO JEONG [KR]) 21 January 2013 (2013-01-21) * paragraphs [0003], [0009], [0011], [0012], [0019], [0025]; figures *	1-16	
X	US 2018/296157 A1 (BLEICH JEFFERY LEE [US] ET AL) 18 October 2018 (2018-10-18) * paragraphs [0019], [0064], [0081], [0193], [0194] *	1-16	TECHNICAL FIELDS SEARCHED (IPC) A63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 August 2022	Vesin, Stéphane

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 16 4456

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-08-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2013028581 A1	28-02-2013	EP 2744403 A1	25-06-2014
		EP 3202320 A1	09-08-2017
		US 2013171599 A1	04-07-2013
		WO 2013028581 A1	28-02-2013
US 2007219059 A1	20-09-2007	NONE	
KR 20130007812 A	21-01-2013	NONE	
US 2018296157 A1	18-10-2018	US 2018296157 A1	18-10-2018
		US 2020289051 A1	17-09-2020

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82