

DESCRIPTION

Title of Invention: SOLE MASSAGING MECHANISM

Technical field

5 [0001] The present invention relates to a sole massaging mechanism which is suitably used for sole massage.

Background Art

[0002] To date the developments of massagers capable of massaging the sole of the human body have been worked on.

10 An example of such a massager is disclosed in Patent Literature 1.

The sole massager disclosed in Patent Literature 1 has a plurality of finger-pressure rods for performing finger-pressure massage on user's sole. These finger-pressure rods are arranged side by side across the sole, and operate independently of each other.

Prior Art Reference

Citation List

[0003] Patent Literature 1: Japanese Unexamined Patent Publication JP-A 2007-54169

Summary of Invention

Technical Problem

[0004] In present day sole massager requirements, however, there are user's requests asking an increasingly wider variety of massaging actions for their soles

throughout the toe-heel range.

For example, in the sole massager disclosed in Patent Literature 1, the finger-pressure rods are designed to jut upward, and thus operate simply to press the sole in a vertical direction. After all, various massaging actions, such as a sole kneading action and a push-pull action against the sole in the direction of its length, cannot be achieved.

[0005] That is, the sole massager disclosed in Patent Literature 1 fails to satisfy various user's requests.

Furthermore, in the sole massager disclosed in Patent Literature 1, the finger-pressure rods operate independently of each other. This creates complications in the control of the finger-pressure rods in respect of jutting amounts and so forth, thus causing much expense in time and effort in the design of control programs. In addition, the finger-pressure rods are allowed to move only in an upward direction, wherefore it is not always possible to achieve massaging actions in accordance with user's desire.

[0006] The present invention has been devised in view of the problems as discussed supra, and accordingly an object of the present invention is to provide a sole massaging mechanism which is constructed of fewer constituent components than ever and is yet capable of concurrently

performing various types of massage on user's sole throughout the toe-heel range.

Solution to Problem

[0007] The following technical means is adopted in order
5 that the present invention may be carried into effect for the attainment of the above object.

That is, a sole massaging mechanism pursuant to the present invention comprises: at least more than one of a first massaging member for massaging a central area of
10 user's sole, a second massaging member for massaging a rear part of said user's sole, and a third massaging member for massaging a front part of said user's sole; and a driving section for driving at least more than one of said first massaging member, said second massaging member, and said
15 third massaging member in cooperation to produce massaging actions.

[0008] Moreover, a sole massaging mechanism pursuant to the present invention comprises: a first massaging member for massaging a central area of user's sole; at least one
20 of a second massaging member for massaging a rear part of said user's sole and a third massaging member for massaging a front part of said user's sole; and a driving section for driving said first massaging member and said second massaging member in cooperation to produce massaging
25 actions, and/or driving said first massaging member and

said third massaging member in cooperation to produce massaging actions.

[0009] In the present invention, it is preferable that said driving section has a horizontally-directed rotation shaft for transmission of a rotational driving force, and that said first massaging member comprises a rotary roller which engages said rotation shaft, and performs, at its outer peripheral surface, massage on said central area of user's sole.

In the present invention, it is preferable that there is provided an arm-like first coupling piece formed so as to extend rearward from said first massaging member, that said first coupling piece has its basal end rotatably mounted in eccentric relation to said rotation shaft, and is fitted to said second massaging member at its tip, and that said second massaging member coupled to said first coupling piece is designed to undergo a rocking movement in response to a rotational movement of said rotation shaft.

[0010] In the present invention, it is preferable that there is provided an arm-like second coupling piece formed so as to extend forward from said first massaging member, that said second coupling piece has its basal end rotatably mounted in eccentric relation to said rotation shaft, and is fitted to said third massaging member at its tip, and that said third massaging member coupled to said second

coupling piece is designed to undergo a slidingly rocking movement in a front-rear direction in response to a rotational movement of said rotation shaft.

[0011] In the present invention, it is preferable that the third massaging member has a massager element free to slide in the front-rear direction, and that a tip of the second coupling piece is coupled relatively to said massager element for free rotation about a horizontally-directed axis.

In the present invention, it is preferable that, in an arrangement of said second massaging member and said third massaging member, said first coupling piece and said second coupling piece are formed in one-piece structure, with their basal ends brought into coincidence with each other.

Advantageous Effects of Invention

[0012] According to the present invention, the sole massaging mechanism is constructed of fewer constituent components than ever and is yet capable of concurrently performing various types of massage on user's sole throughout the toe-heel range.

Brief Description of Drawings

[0013] [FIG. 1] FIG. 1 is a front perspective view of a leg massager incorporating a sole massaging mechanism pursuant to the present invention.

[FIG. 2] FIG. 2 is a front perspective view showing

the internal structure of the leg massager incorporating the sole massaging mechanism of the present invention.

[FIG. 3] FIG. 3 is a front perspective view showing the general structure of the sole massaging mechanism of the present invention.

[FIG. 4] FIG. 4 is a front perspective view showing the internal structure of the sole massaging mechanism of the present invention.

[FIG. 5] FIG. 5 is a developed view showing the internal structure of the sole massaging mechanism of the present invention.

[FIG. 6] FIG. 6 is a side view of the sole massaging mechanism of the present invention, illustrating an operating condition where the third massaging member is moving rearward.

[FIG. 7] FIG. 7 is a side view of the sole massaging mechanism of the present invention, illustrating an operating condition where the third massaging member is moving forward.

Embodiments

[0014] Hereinafter, an embodiment of a sole massaging mechanism pursuant to the present invention will be described with reference to drawings.

Prior to the description of the sole massaging mechanism of the present invention, a leg massager

which incorporates the sole massaging mechanism 10 will be described.

It is noted that a left-hand tubular member 4 and a right-hand tubular member 4 of the leg massager 1 are identical in configuration and contour, and also a left-hand sole massaging mechanism 10 and a right-hand sole massaging mechanism 10 are identical in structure, wherefore the following description deals mainly with the left-hand sole massaging mechanism 10 and the left-hand tubular member 4 for insertion of the left sole U of user's foot. Thus, the configuration and contour of the right-hand tubular member 4 and the structure of the right-hand sole massaging mechanism 10 will be omitted from the following description. Moreover, for the sake of a clear view of the sole massaging mechanism 10 of the present invention, part of the constituent components is not shown in the drawings illustrating the embodiment.

[0015] In FIGs. 1 and 2, there is shown the structure of the leg massager 1.

As employed in this description, the term "foot F" refers to that part of the human leg L located below the ankle, and the term "sole U" refers to the surface of the foot that is brought into contact with a floor. Moreover, the term "heel H" refers to the rear part of the foot F located substantially immediately below the ankle, and, the

term "toe T" refers to the front end of the foot F in its lengthwise direction. The term "arch (of the foot) A" refers to a lengthwise intermediate part of the sole U of the foot F.

5 [0016] Moreover, in the following description, a slanting rightward direction in FIG. 1 corresponds to a direction of from front to rear, or a front-rear direction, of the apparatus in actual use, and, a slanting leftward direction in FIG. 1 corresponds to a direction of from
10 right to left, or a horizontal or width direction, of the apparatus in actual use. Moreover, a vertical direction in FIG. 1 corresponds to a direction of from top to bottom of the apparatus in actual use. These directions are indicated by arrows in each drawing, and coincide with the
15 corresponding directions based on the view of the user whose legs L are set in the leg massager 1.

As shown in FIGs. 1 and 2, the leg massager 1 of this embodiment is an apparatus capable of massaging the legs L of the user sitting in, for example, a chair.

20 [0017] The leg massager 1 comprises: a pair of tubular members 4, each in the form of the letter of "L" as seen in side view, opened at its top for receiving user's legs L; air bags 6a to 6c disposed in the tubular members 4, for performing pressing massage on the inserted user's legs L;
25 and a pump 8 for feeding pressurized air to the air bags 6a

to 6c. Moreover, the leg massager 1 includes a case body 2 (casing) which is substantially triangular-shaped as seen in side view. The paired tubular members 4 (massaging sections) are arranged side by side in the horizontal direction within the case body 2.

[0018] The case body 2 is made large enough to support the tubular member 4 pair in an upstanding condition while covering the front surfaces of the upstanding tubular members 4, and serves as an enclosure for accommodating the pump 8 and so forth (the details will hereafter be described). The case body 2 has a horizontally or vertically oriented rectangular shape or a square shape when viewed from in front, and has, nearly like the tubular member 4, the "L" (boot-like) shape as seen in side view.

Moreover, the back side of the case body 2 is formed with a pair of horizontally spaced apart insertion recesses 3, each in the form of a continuous opening extending from the lower part to the upper end of the case body 2. The tubular members 4 are fitted in their respective insertion recesses 3.

[0019] The tubular members 4 are each a bottomed member made of a flexible cloth or the like material having a predetermined thickness, which are adapted to insertion of legs of different shapes. The tubular member 4 is designed so that its part maintained in a horizontal position covers

the foot F in the range of the lengthwise intermediate part (the arch A) to the front part (the toe T), and its part maintained in a vertical position covers the foot F in the range of the rear part (the heel H) to the calf C.

5 The tubular member 4 is situated at the back side of the case body 2, wherefore the user inserts his/her leg L into the tubular member 4 in a direction from the upper rear of the tubular member 4 to the lower front thereof.

[0020] The tubular member 4 has a long cut 5 formed at
10 its back side so as to extend from the upper end to the lower end along a direction to insert the leg L (vertical direction) for easy insertion and withdrawal of the leg L.

 The outer periphery of the tubular member 4 is provided with a plurality of air bags 6a to 6c for
15 performing pressing massage on the legs L (leg massaging system). The air bags 6a to 6c are each a highly inflatable bag body designed for free inflation and deflation, which is capable of retaining pressurized air fed from the pump 8 via an air supply hose 7. The air bags
20 6a to 6c may be given any form which is capable of performing pressing massage on the legs L without limitation.

[0021] More specifically, the first air bag 6a is disposed on the upper side of that part of the tubular
25 member 4 maintained in a horizontal position, for

accomplishing pressing massage by pressing the instep and nearby area (such as the toe T) of the foot set in that part. Moreover, a pair of the second air bags 6b is disposed on the lower side of that part of the tubular member 4 maintained in a vertical position, for accomplishing pressing massage by pressing the inward and outward sides of the heel H of the foot set in that part from the outside in the width direction. In addition, a pair of the third air bags 6c is disposed on the upper side of that part of the tubular member 4 maintained in a vertical position, for accomplishing pressing massage by pressing the inward and outward sides of the calf C set in that part from the outside in the width direction. The first to third air bags 6a to 6c can be inflated and deflated on an individual basis.

[0022] The inflation and deflation of the first to third air bags 6a to 6c are effected by the pump 8 and so forth.

More specifically, inside the case body 2, there are arranged the pump 8 (compressor) for feeding pressurized air to each air bag 6a to 6c for inflation, a solenoid valve 9 for allowing switching between an air admission mode and an air ejection mode for the air bags 6a to 6c, and a control unit to control the solenoid valve 9.

[0023] The pump 8 is situated centrally of the tubular member 4 pair in the horizontal direction so as to be

connected to the solenoid valve 9 via the air supply hose 7.
By the action of the pump 8, pressurized air is fed to the
solenoid valve 9 and from there to each air bag 6a to 6c.
The control unit (not shown in the drawings) is installed
5 with a plurality of pressing massage programs to effect
control of the solenoid valve 9 in a manner so as to
inflate each air bag 6a to 6c on a program-by-program basis.
Thus constructed, the mechanism permits user's selection of
pressing massage operations by the individual air bags 6a
10 to 6c for the legs L.

[0024] The sole massaging mechanism 10 of this
embodiment is mounted on a bottom portion 2a of the case
body 2 constructed of a platy material in pan form.

As shown in FIGs. 3 to 5, the sole massaging mechanism
15 10 comprises: a first massaging member for massaging the
lengthwise midportion of user's sole U (the arch A); a
second massaging member 33 for massaging the rear part of
the sole U (the heel H); a third massaging member 41 for
massaging the front part of the sole U (the toe T); and a
20 driving section 11 for driving the first massaging member,
the second massaging member 33, and the third massaging
member 41 to produce massaging actions.

[0025] The driving section 11 comprises: a rotation
shaft 12 mounted with its axis directed in the horizontal
25 direction; a gear box 16 for gear-connection with the

rotation shaft 12; a drive motor for driving the rotation shaft 12; and a conversion section for converting a rotational force of the rotation shaft 12 into rocking motion.

5 As shown in FIGs. 3 and 4, a single rotation shaft 12 is mounted across the width of the mechanism, with its axis lying on a horizontal plane, so as to be located centrally of the bottom portion 2a of the case body 2 in the front-rear direction.

10 [0026] The rotation shaft 12 is rotatably supported on support members 13 disposed in an upstanding condition at the opposite ends and the center, respectively, of the bottom portion 2a. The support member 13 is constructed of a platy material having a predetermined thickness, which is
15 fitted at its upper part with a shaft bearing 14 (bearing) for rotatably supporting the rotation shaft 12. That is, the support member 13 supports each of the lengthwise ends and the lengthwise intermediate part of the rotation shaft 12 via the shaft bearing 14 for free rotation of the
20 rotation shaft 12.

[0027] Moreover, a pair of the first massaging members is attached to each side of the rotation shaft 12 in the horizontal direction in a fixed state so as not to be rotatable relative to the rotation shaft 12. That is, the
25 rotation shaft 12 is provided with the paired left-hand and

right-hand first massaging members for massaging the soles
U, each located in a below-tubular member 4 region between
the centrally-located support member 13 and corresponding
one of the support members 13 disposed at the opposite ends,
5 respectively.

The gear box 16 is situated axially centrally of the
rotation shaft 12 so as to lie above the support member 13
disposed in an upstanding condition at the center of the
bottom portion 2a.

10 [0028] Inside the gear box 16, two worm wheels 18 and 19
are arranged side by side in the vertical direction. The
upper worm wheel 18 has a meshing engagement with a worm
gear 17 disposed at an output shaft 15a of the drive motor.
The lower worm wheel 19 is attached, in meshing engagement
15 with the upper worm wheel 18, to the piercingly mounted
rotation shaft 12.

The electric motor 15 is mounted at the rear of the
gear box 16, with its output shaft 15a maintained in a
horizontal position while being directed in the front-rear
20 direction. A driving force produced by the drive motor,
being subjected to deceleration to a predetermined level in
the gear box 16, acts to rotatably drive the rotation shaft
12.

[0029] A pair of the left-hand and right-hand first
25 massaging members is disposed on each side of the gear box

16 in the horizontal direction so as to have sandwiched therebetween the gear box 16.

The first massaging member 20 comprises a rotary roller having formed on its outer peripheral surface projections 21a and 21b (first massager elements 21), which engages the horizontally-directed rotation shaft 12 mounted with its axis lying on a horizontal plane. The roller 20 is a cylindrical member made of, for example, a hard resin.

[0030] As shown in FIGs. 4 and 5, the first massaging member 20 receives therein the long rotation shaft 12 passing therethrough in an impaled fashion, so that the first massaging member 20 and the rotary shaft 12 can be rotated together about the same axis.

More specifically, the first massaging member 20 has an outside diameter large enough to support the arch A of the sole U in surface-to-surface contacting relation, and has an outer peripheral surface which is concentric or eccentric with respect to the rotation shaft 12. The outer peripheral surface is formed with a plurality of projections 21a and 21b (first massager elements 21) of different shapes spaced apart in a circumferential direction, as well as in the axial direction of the rotation shaft 12.

[0031] For example, the first projection 21a is constructed of a pair of greatly radially-outwardly

protruding members having semi-arcuate ends capable of performing pressing massage such as strong finger-pressure massage at predetermined time-spaced intervals. On the other hand, the second projection 21b is a slightly
5 radially-outwardly protruding member capable of performing pressing massage such as weak finger-pressure massage.

That is, various types of pressing massage can be performed on the arch of the foot A by rotating the first massaging member 20 having a plurality of the projections
10 21a and 21b of different shapes secured to the rotation shaft 12 concurrently with a rotational movement of the rotation shaft 12. Moreover, the first massaging member 20 is rotatable in sync with the described repeated inflation and deflation of the first to third air bags 6a to 6c. The
15 shape and the number of the first massager elements 21 may be determined with alterations depending on which type of massaging action is to be produced without limitation.

[0032] A pair of conversion sections 22 is disposed at each end face of the described first massaging member 20 in
20 the horizontal direction.

As shown in FIGs. 5 and 6, the conversion section 22 converts a rotational force of the rotation shaft 12 into rocking motion for allowing a second massager element 35 of the second massaging member 33 to move close to and away
25 from the first massager element 21 of the first massaging

member 20 in the vertical direction, as well as in the front-rear direction. Moreover, the conversion section 22 converts the rotational force of the rotation shaft 12 into sliding motion for allowing a third massager element 42 of the third massaging member 41 to move close to and away from the first massager element 21 of the first massaging member 20 in the front-rear direction.

[0033] The conversion section 22 comprises: an eccentric boss portion 23 mounted in eccentric relation to the rotation shaft 12; an annular fit portion 29 formed at a basal end 28 of a first coupling piece 27, for receiving the eccentric boss portion 23; and a restraint portion 43 for restraining the first coupling piece 27 from rotating in response to the rotation of the rotation shaft 12. That is, the conversion section 22 is composed of the eccentric boss portion 23 disposed at the end face of the first massaging member 20 in the horizontal direction, and a coupling member 40 comprising the first coupling piece 27 and a second coupling piece 36 for coupling the second massaging member 33 and the third massaging member 41.

[0034] A pair of the eccentric boss portions 23 is disposed at each end face of the first massaging member 20 in the horizontal direction in a fixed state so as not to be rotatable relative to the rotation shaft 12. The eccentric boss portions 23 in the form of a set of

horizontally-arranged separate members are placed so as to have sandwiched therebetween the first coupling piece 27.

The eccentric boss portion 23 has an eccentric face 24 formed on its side facing toward the first coupling piece 27, and this eccentric face 24 is disposed in contact with the outer peripheral surface of the first massaging member 20. Thus, the eccentric boss portion 23 is mounted in eccentric relation to the rotation shaft 12.

[0035] Moreover, the eccentric boss portion 23 is formed with a horizontally-directed through hole 25 lying on a horizontal plane for insertion of the rotation shaft 12. The axis of the through hole 25 is offset from the center axis of a circle defining the shape of the eccentric boss portion 23. Accordingly, the eccentric boss portion 23 and the rotation shaft 12 rotate in different orbital paths.

The eccentric face 24, which is oriented in the same direction as the axis of the rotation shaft 12, is situated inside of the outer peripheral surface of the eccentric boss portion 23. Moreover, the eccentric face 24 is opposed to the through hole 25. The eccentric boss portion 23 is slidably fitted, at its side opposite the side thereof formed with the eccentric face 24, to the annular fit portion 29 (the first coupling piece 27), so that the second massaging member 33 can be rocked in the vertical direction, as well as in the front-rear direction. That is,

the eccentric boss portion 23 rotates about the rotation shaft 12 while moving around the outer periphery of the first massaging member 20.

[0036] The annular fit portion 29 formed at the basal ends 28 of the first coupling piece 27 and the second coupling piece 36 is fitted onto the eccentric boss portion 23 for converting the rotation of the eccentric boss portion 23 into vertical rocking motion and rocking motion in the front-rear direction. The annular fit portion 29 is substantially ring-shaped as seen in side view, and has a substantially centrally-located opening 26 whose diameter is substantially equal to the outer diameter of the eccentric boss portion 23. Accordingly, the eccentric boss portion 23 and the annular fit portion 29 are rotatable relative to each other.

[0037] Moreover, a pair of the first coupling pieces 27 is disposed at each end face of the first massaging member 20 in the horizontal direction for the engagement of the conversion section 22.

20 The first coupling piece 27, which is a member for the coupling of the second massaging member 33 as will hereafter be described, is constructed of an arm-like (curved) platy material formed so as to extend rearward from the first massaging member 20 as seen in side view.

25 [0038] The first coupling piece 27 has its basal end 28

rotatably mounted in eccentric relation to the rotation shaft 12, and is coupled, at its tip 31, to the second massaging member 33.

In response to a rotational movement of the rotation shaft 12, the second massaging member 33 coupled to the first coupling piece 27 undergoes a rocking movement.

More specifically, in the first coupling piece 27, its basal end 28 is formed with the annular fit portion 29 which engages the eccentric boss portion 23, and, a first support portion 30 (arm) is formed so as to extend rearward at an upward incline from the annular fit portion 29. The annular fit portion 29 is a thin cylindrical member whose inner diameter is substantially equal to the outer diameter of the eccentric boss portion 23.

[0039] The first support portion 30 is formed so as to extend rearward at an upward incline from the top of a vertical plane including the axis of the annular fit portion 29 (the axis of the rotation shaft 12). The first support portion 30 has formed at its tip 31 a through hole 32 having a horizontally-directed axis lying on a horizontal plane. The through hole 32 receives a rod 34 (shaft) constituting the second massaging member 33, thus achieving the coupling of the second massaging member 33 having the second massager element 35.

[0040] The second massaging member 33 comprises the rod

34 having a horizontally-directed axis maintained in a horizontal position, and the second massager element 35 for performing rock-based massage on the heel H.

The second massager element 35, which is attached to
5 the outer peripheral surface of the rod 34, lies in a position behind and above the top of a horizontal plane including the axis of the annular fit portion 29 (the axis of the rotation shaft 12). The second massager element 35 is constructed of a ring-like member having a predetermined
10 width and a predetermined outer diameter. The second massager element 35 may be made of resin, hard rubber, or the like material shaped in various forms, including the form of a thick-walled circular plate and a spherical form. Moreover, the shape and the number of the second massager
15 elements 35 may be determined with alterations depending on which type of massaging action is to be produced without limitation.

[0041] Moreover, a pair of the second coupling pieces 36 is disposed at each end face of the first massaging member
20 20 in the horizontal direction for the engagement of the conversion section 22.

The second coupling piece 36, which is a member for the coupling of the third massaging member 41 as will hereafter be described, is constructed of an arm-like
25 (curved) platy material formed so as to extend forward from

the first massaging member 20 as seen in side view.

[0042] The second coupling piece 36 has its basal end 28 rotatably mounted in eccentric relation to the rotation shaft 12, and is coupled, at its tip 37, to the third
5 massaging member 41.

In response to a rotational movement of the rotation shaft 12, the third massaging member 41 coupled to the second coupling piece 36 undergoes a slidingly rocking movement in the front-rear direction.

10 More specifically, in the second coupling piece 36, its basal end 28 is formed with the annular fit portion 29 which engages the eccentric boss portion 23, and, a second support portion 39 (arm) is formed so as to extend forward at an upward incline from the annular fit portion 29.

15 [0043] The second support portion 39, which is longer than the first support portion 30, is formed so as to extend rearward at an upward incline from the top of a vertical plane including the axis of the annular fit portion 29 (the axis of the rotation shaft 12). The second
20 coupling piece 36 has formed at its tip 37 a through hole 38 having a horizontally-directed axis lying on a horizontal plane. The through hole 38 receives a pin (shaft) constituting the third massaging member 41, thus achieving the coupling of the third massaging member 41
25 having the third massager element 42. The through hole 38

has its axis located on a horizontal plane including the axis of the rotation shaft 12.

[0044] In this embodiment, the first coupling piece 27 and the second coupling piece 36 are formed in one-piece structure, with their basal ends 28 brought into coincidence with each other. That is, this embodiment incorporates the curved, arm-like (comma-shaped) coupling member 40 composed of the rearwardly-extending first coupling piece 27 whose basal end 28 is attached to its respective end face of the first massaging member 20 in the horizontal direction, and the forwardly-extending second coupling piece 36 whose basal end 28 is attached to its respective end face of the first massaging member 20 in the horizontal direction.

[0045] The third massaging member 41 has a massager element (the third massager element 42) free to slide in the front-rear direction. The tip 37 of the second coupling piece 36 is coupled relatively to the third massager element 42 for free rotation about a horizontally-directed axis.

That is, the third massaging member 41 is constructed by forming, on the upper surface of a flat plate material, a plurality of projections (the third massager elements 42) for performing massage on the toe T (the sole U). Moreover, a restraint pin 44 constituting the restraint portion 43 is

disposed at each side face of the plate material in the horizontal direction.

[0046] In the flat plate material, the length of its side extending in the front-rear direction is shorter than the length of its side extending in the horizontal direction, and, the length of the horizontally-extending side (width) is substantially equal to the width of the foot F. Moreover, the third massager element 42 is an upwardly-curved convex member having a domical tip.

Although, in this embodiment, the individual third massager elements 42 have the same height, they may be given different heights. That is, the shape and the number of the third massager elements 42 may be determined with alterations depending on which type of massaging action is to be produced without limitation.

[0047] The restraint portion 43 comprises: the second coupling piece 36 for imparting a sliding movement to the third massaging member 41; the restraint pin 44 formed in the third massaging member 41; and a guide rail 45 (restraint slot) formed in an upstanding condition at the bottom portion 2a, for guiding the restraint pin 44.

The restraint pin 44 is a substantially cylindrical short rodlike piece having a horizontally-directed axis maintained in a horizontal position. More specifically, a single restraint pin 44 is formed so as to extend outwardly

from the lengthwise midpoint of each side face of the plate material in the horizontal direction. The restraint pin 44 is rotatably fitted in the through hole 38 of the second coupling piece 36, while being slidably inserted in the guide rail 45.

[0048] The guide rail 45, which is elongated in the front-rear direction, is placed at the upper part of the plate material disposed in an upstanding condition on the bottom portion 2a. The guide rail 45 is mounted with its upper side wall 45a and lower side wall 45b arranged in face-to-face relation in the vertical direction. The distance between the upper side wall 45a and the lower side wall 45b is equal to the outside diameter of the restraint pin 44. The restraint pin 44 is inserted into the space between the upper side wall 45a and the lower side wall 45b of the guide rail 45 for free sliding movement in the front-rear direction.

[0049] In the restraint portion 43, the now eccentrically rotating second coupling piece 36 imparts a sliding movement to the third massaging member 41 via the restraint pin 44 slidably fitted in the guide rail 45, thus restraining the second massaging member 33 coupled to the integrally-formed first coupling piece 27 from rotating about the rotation shaft 12.

To sum up, the sole massaging mechanism 10 of this

embodiment is characterized in that the third massaging member 41 (the third massager element 42) is provided in the restraint portion 43 for restraining the second massaging member 33 from rotating about the rotation shaft 12 in response to a rocking movement of the first coupling piece 27. With this structure, the third massaging member 41 undergoes a sliding movement concurrently with a rocking movement of the second massaging member 33.

[0050] More specifically, in the sole massaging mechanism 10 of this embodiment, as the rotation shaft 12 is rotated, a pair of the first coupling pieces 27 is eccentrically rotated about the rotation shaft 12 to impart a rocking movement to the second massaging member 33, and also a pair of the second coupling pieces 36 is eccentrically rotated about the rotation shaft 12 to impart a sliding movement to the third massaging member 41. At this time, that part of the sole massaging mechanism 10 which corresponds to the paired second coupling pieces 36 and the third massaging member 41, namely the part which becomes involved in the sliding movement, serves as the restraint portion 43. The guide rail 45 constituting the restraint portion 43, while allowing the restraint pin 44 to move only in the front-rear direction (reciprocating movement), restrains the restraint pin 44 against a vertical movement, thus restraining the second massaging

member 33 coupled to the first coupling piece 27 from rotating about the rotation shaft 12.

[0051] That is, the second coupling piece 36 is rotated eccentrically with respect to the rotation shaft 12 to allow the third massaging member 41 to slide in the front-rear direction, and, the restraint pin 44 is moved in the front-rear direction within the guide rail 45. This structure constitutes a reciprocatory slider-crank system for converting crank rotation into slider reciprocation.

10 [Workings]

The following describes the workings of the sole massaging mechanism 10 of this embodiment.

[0052] In FIGs. 6 and 7, there is shown how the sole massaging mechanism 10 of this embodiment produces massaging actions.

To begin with, the user inserts his/her legs L in the left-hand and right-hand tubular members 4, respectively, of the leg massager 1 at rest. Then, the arch of the foot A (the lengthwise midportion of the sole U) abuts on the first massaging member 20 (roller), and, part of the sole U located toward the heel H abuts on the second massaging member 33. In addition, part of the sole U located toward the toe T abuts on the third massaging member 41.

[0053] With user's legs L set in the tubular members 4, the electric motor 15 of the driving section 11 is put in

motion. Then, the output shaft 15a fitted with the worm gear 17 is rotatably driven. As the worm gear 17 is rotated, the worm wheel 18 situated, in meshing engagement with the worm gear 17, at the upper part of the gear box 16 is rotated correspondingly. As the lower worm wheel 19 having a meshing engagement with the worm wheel 18 is rotated, the rotation shaft 12 attached to the lower worm wheel 19 is rotatably driven correspondingly.

[0054] This causes the first massaging member 20 attached to the rotation shaft 12 to rotate about the rotation shaft 12, with consequent rotation of a pair of the eccentric boss portions 23 situated at each horizontal side of the first massaging member 20.

At this time, since the eccentric boss portion 23 is slidably fitted to the annular fit portion 29, it follows that a pair of the left-hand and right-hand first coupling pieces 27 seeks to rotate together about the rotation shaft 12. That is, the second massaging member 33 seeks to rotate together about the rotation shaft 12.

[0055] However, the second massaging member 33 is restrained against unitary rotation about the rotation shaft 12 by the third massaging member 41 pivotally supported on the paired left-hand and right-hand second coupling pieces 36 and the guide rail 45 (restraint slot) for guiding the restraint pin 44 in movement in the front-

rear direction, namely the restraint portion 43, via the restraint pin 44.

Meanwhile, each of the paired left-hand and right-hand second coupling pieces 36 has its basal end 28 made
5 eccentrically rotatable about the rotation shaft 12, and has its tip 37 controlled so as to move in the front-rear direction while being maintained in a horizontal position by the restraint portion 43. Thus, a crank movement of the first coupling piece 27 is converted into a sliding
10 movement.

[0056] That is, the third massaging member 41, being designed so that the paired restraint pins 44 are each slidably inserted in the guide rail 45 while being rotatably supported in the through hole 38 of the second
15 coupling piece 36, slides in the front-rear direction along the guide rail 45.

As shown in FIG. 6, as the first support portion 30 of the first coupling piece 27 is moved obliquely downwardly toward the rear, the first massaging member 20 is rocked
20 obliquely downwardly toward the rear correspondingly. Moreover, the second support portion 39 of the second coupling piece 36 formed integral with the first coupling piece 27 is moved rearward while being maintained in a horizontal position, wherefore the third massaging member
25 41 is moved rearward correspondingly. At this time, the

second massaging member 33 is positioned away from the axis of the rotation shaft 12, whereas the third massaging member 41 is positioned close to the axis of the rotation shaft 12.

5 [0057] As shown in FIG. 7, as the first support portion 30 of the first coupling piece 27 is moved obliquely upwardly toward the front, the first massaging member 20 is rocked obliquely upwardly toward the front correspondingly. Moreover, the second support portion 39 of the second
10 coupling piece 36 formed integral with the first coupling piece 27 is moved forward while being maintained in a horizontal position, wherefore the third massaging member 41 is moved forward correspondingly. At this time, the second massaging member 33 is positioned close to the axis
15 of the rotation shaft 12, whereas the third massaging member 41 is positioned away from the axis of the rotation shaft 12.

[0058] It will thus be seen that the first massaging member 20 performs pressing massaging on the arch A of the
20 foot F by exploiting the rotation of a plurality of the first massager elements 21 (the projections 21a and 21b) about the rotation shaft 12.

In the second massaging member 33, the second massager element 35 is rocked in the vertical direction, as well as
25 in the front-rear direction, relative to the first massager

element 21 rotating about the rotation shaft 12. Expressed differently, in response to the eccentric rotation of the first coupling piece 27 about the rotation shaft 12, the second massager element 35 undergoes an approaching-separating rocking movement in the vertical direction and the front-rear direction. Thus, the second massaging member 33 performs kneading massage on that part of the sole U located toward the heel H by squeezing the part in a direction from the front to the rear.

[0059] On the other hand, in the third massaging member 41, on a horizontal plane including the axis of the rotation shaft 12, the third massager element 42 undergoes a reciprocating movement so as to move close to and away from the first massager element 21 rotating about the rotation shaft 12 in the front-rear direction while being maintained in a horizontal position. Expressed differently, in response to the eccentric rotation of the second coupling piece 36 about the rotation shaft 12, the third massager element 42 undergoes a sliding movement in the front-rear direction. Thus, the third massaging member 41 performs massage on that part of the sole U located toward the toe T by pressing the part while moving reciprocally in the front-rear direction.

[0060] To sum up, the sole massaging mechanism 10 of the present invention is not designed merely to have simple

rocking movement, but designed so that, during the rotation of the first massaging member 20 about the rotation shaft 12, when the second massaging member 33 is rocked obliquely downwardly toward the rear under the movement of the first
5 coupling piece 27, the third massaging member 41 slides rearward under the movement of the second coupling piece 36, whereas, when the second massaging member 33 is rocked obliquely upwardly toward the front under the movement of the first coupling piece 27, the third massaging member 41
10 slides forward under the movement of the second coupling piece 36. That is, in the sole massaging mechanism 10, the three massaging members produce massaging actions simultaneously and repeatedly for their respective target areas of massage. This structure makes it possible to
15 perform various types of massage on user's sole U.

[0061] It is worthy of note that, by inflating the first air bag 6a during activation of the sole massaging mechanism 10, user's instep is pressed downward by the first air bag 6a, thus bringing user's sole into intimate
20 contact with the sole massaging mechanism 10. This allows the sole massaging mechanism 10 to perform efficacious massage on the sole.

It should be understood that the embodiment as disclosed hereinabove is considered in all respects as
25 illustrative only and not restrictive. The scope of the

present invention is indicated by the appended claims rather than the foregoing description, and all changes that come within the meaning of and the range of equivalency of the claims are intended to be embraced therein.

5 [0062] For example, this embodiment has been described with respect to the case where the first coupling piece 27 and the second coupling piece 36 are formed in one-piece design, with their basal ends 28 brought into coincidence with each other, to constitute the monolithic coupling
10 member 40. In the alternative, the first coupling piece 27 and the second coupling piece 36 may be separately disposed at a side (each end face in the horizontal direction) of the second massaging member 33, with their basal ends 28 arranged in overlapping relation to each other.

15 Moreover, instead of, for example, the first air bag 6a, massaging members (for example, platy massaging members) may be disposed one at each side of user's foot so as to have sandwiched therebetween the foot in the horizontal direction. Also in this case, by holding user's
20 foot with the massaging members during activation of the sole massaging mechanism 10, the instep is pressed downward by the massaging members, thus bringing the sole into intimate contact with the sole massaging mechanism 10. This allows the sole massaging mechanism 10 to perform
25 efficacious massage on the sole.

[0063] Moreover, the mechanism pursuant to the present invention is a technology applicable to various massaging systems adapted to different target areas of user's body.

Moreover, in the description of the embodiment, the leg massager 1 is cited merely by way of exemplification, wherefore the sole massaging mechanism 10 of the present invention can be mounted in various leg massagers. Note that the illustrated leg massager 1 serves also as a footrest when installed at the front of a seat of a chair massager.

[0064] The sole massaging mechanism 1 of this embodiment has been described as having a structure in which the first massaging member 20, the second massaging member 33, and the third massaging member 41 are actuated in cooperation.

However, the present application invention is not limited to the described embodiment. For example, the invention may be carried into effect in a sole massaging mechanism comprising the first massaging member 20 and the second massaging member 33 (devoid of the third massaging member 41) that are driven in cooperation to produce massaging actions, or in a sole massaging mechanism comprising the first massaging member 20 and the third massaging member 41 (devoid of the second massaging member 33) that are driven in cooperation to produce massaging actions.

[0065] The present invention is also applicable to a sole massaging mechanism comprising only the second massaging member 33 and the third massaging member 41 that are driven in cooperation to produce massaging actions.

5 That is, the present invention is applicable to any of sole massaging mechanisms each having at least two out of the three massaging members 20, 33, and 41.

Explanation of reference symbols

[0066]

- 10 1 Leg massager
- 2 Case body
- 2a Bottom portion
- 3 Insertion recess
- 4 Tubular member
- 15 5 Cut
- 6a First air bag
- 6b Second air bag
- 6c Third air bag
- 7 Air supply hose
- 20 8 Pump
- 9 Solenoid valve
- 10 Sole massaging mechanism
- 11 Driving section
- 12 Rotation shaft
- 25 13 Support member

	14	Shaft bearing
	15	Electric motor
	15a	Output shaft
	16	Gear box
5	17	Worm gear
	18	Worm wheel
	19	Worm wheel
	20	First massaging member (Roller)
	21	First massager element
10	21a	First projection
	21b	Second projection
	22	Conversion section
	23	Eccentric boss portion
	24	Eccentric face
15	25	Through hole
	26	Opening
	27	First coupling piece
	28	Basal end
	29	Annular fit portion
20	30	First support portion
	31	Tip
	32	Through hole
	33	Second massaging member
	34	Rod
25	35	Second massager element

	36	Second coupling piece
	37	Tip
	38	Through hole
	39	Second support portion
5	40	Coupling member
	41	Third massaging member
	42	Third massager element
	43	Restraint portion
	44	Restraint pin
10	45	Guide rail
	45a	Upper side wall
	45b	Lower side wall
	L	Leg
	C	Calf
15	F	Foot
	U	Sole
	H	Heel
	A	Arch of the foot
	T	Toe

20

CLAIMS

1. A sole massaging mechanism comprising:

5 at least more than one of a first massaging member for massaging a central area of user's sole, a second massaging member for massaging a rear part of said user's sole, and a third massaging member for massaging a front part of said user's sole; and

10 a driving section for driving at least more than one of said first massaging member, said second massaging member, and said third massaging member in cooperation to produce massaging actions.

15 2. A sole massaging mechanism comprising:

a first massaging member for massaging a central area of user's sole;

at least one of a second massaging member for massaging a rear part of said user's sole and a third
20 massaging member for massaging a front part of said user's sole; and

a driving section for driving said first massaging member and said second massaging member in cooperation to produce massaging actions, and/or driving said first
25 massaging member and said third massaging member in

cooperation to produce massaging actions.

3. The sole massaging mechanism according to claim 1 or claim 2,

5 wherein said driving section has a horizontally-directed rotation shaft for transmission of a rotational driving force,

 and wherein said first massaging member comprises a rotary roller which engages said rotation shaft, and
10 performs, at its outer peripheral surface, massage on said central area of user's sole.

4. The sole massaging mechanism according to claim 3, further comprising:

15 an arm-like first coupling piece formed so as to extend rearward from said first massaging member,

 wherein said first coupling piece has its basal end rotatably mounted in eccentric relation to said rotation shaft, and is fitted to said second massaging member at its
20 tip,

 and wherein said second massaging member coupled to said first coupling piece is designed to undergo a rocking movement in response to a rotational movement of said rotation shaft.

25

5. The sole massaging mechanism according to claim 3,
further comprising:

an arm-like second coupling piece formed so as to
extend forward from said first massaging member,

5 wherein said second coupling piece has its basal end
rotatably mounted in eccentric relation to said rotation
shaft, and is fitted to said third massaging member at its
tip,

and wherein said third massaging member coupled to
10 said second coupling piece is designed to undergo a
slidingly rocking movement in a front-rear direction in
response to a rotational movement of said rotation shaft.

6. The sole massaging mechanism according to claim 5,

15 wherein the third massaging member has a massager
element free to slide in the front-rear direction,

and wherein a tip of the second coupling piece is
coupled relatively to said massager element for free
rotation about a horizontally-directed axis.

20

7. The sole massaging mechanism according to any one of
claims 4 to 6,

wherein, in an arrangement of said second massaging
member and said third massaging member, said first coupling
25 piece and said second coupling piece are formed in one-

piece structure, with their basal ends brought into coincidence with each other.