

SPECIFICATION

TITLE OF THE INVENTION: LOWER LIMB MASSAGE MACHINE

TECHNICAL FIELD

[0001]

The present invention relates to a lower limb massage machine.

BACKGROUND ART

[0002]

Patent Literature 1 discloses a lower limb massage machine capable of massaging a lower limb of a user, specifically, a range from a region under a knee to a region near an ankle. The lower limb massage machine includes a massage mechanism configured to apply an acupuncture massage to the calf in the lower limb with the calf held by the massage mechanism. The massage mechanism includes a treatment member configured to push the calf, and a movement mechanism configured to move the treatment member up and down along the calf. The massage mechanism thus enables an acupuncture massage to be applied to a wide range of the calf in the up-down direction.

CITATION LIST

[PATENT LITERATURE]

[0003]

PATENT LITERATURE 1: Japanese Laid-Open Patent Publication No. 2014-018616

SUMMARY OF THE INVENTION

[TECHNICAL PROBLEM]

[0004]

The lower limb massage machine disclosed in Patent Literature 1 also includes a movement mechanism including a perpendicularly movable slider to which the treatment member is mounted, a feed screw shaft screwed into the perpendicularly movable slider and disposed in the up-down direction, and a motor configured to rotate the feed screw shaft in both forward and reverse directions. When the movement mechanism drives the motor, the motor rotates the feed screw shaft in the forward direction to raise the treatment member and rotates the feed screw shaft in the reverse direction to lower the treatment member. The movement mechanism repeatedly rotates the feed screw shaft in the forward and reverse directions to reciprocate the treatment member upward and downward. It is consequently necessary for the lower limb massage machine disclosed in Patent Literature 1 to frequently rotate the motor in the forward and reverse directions while monitoring a position of the treatment member in the up-down direction with a sensor or the like, which may make the structure and control complicated.

[0005]

An object of the present disclosure is to provide a lower limb massage machine capable of moving a treatment member by simple control.

[SOLUTION TO PROBLEM]

[0006]

(1) A lower limb massage machine of the present disclosure includes: a treatment member configured to massage a lower limb; and a movement mechanism coupled to the treatment member and configured to move the treatment member in a longitudinal direction of the lower limb.

The movement mechanism includes: a rotation shaft; a driver configured to rotate the rotation shaft; a support frame supporting the rotation shaft with the rotation shaft movable in the longitudinal direction of the lower limb; and a linkage mechanism coupling the rotation shaft and the support frame together, and expandable and contractible by rotation of the rotation shaft.

[0007]

(2) In (1) described above, preferably, the linkage mechanism includes: a first linkage member fixed to the rotation shaft and configured to rotate together with the rotation shaft; and a second linkage member having a first end swingably coupled to the first linkage member, and a second end swingably coupled to the support frame.

[0008]

(3) In (1) or (2) described above, preferably, the treatment member is mounted to the rotation shaft.

[0009]

(4) In (3) described above, preferably, the lower limb massage machine further includes a position adjustment mechanism disposed between the treatment member and the rotation shaft and configured to adjust a position of the treatment member in an axial direction of the rotation shaft by rotation of the rotation shaft in forward and reverse directions.

[0010]

(5) In any one of (1) to (4) described above, preferably, the movement mechanism includes a movable frame supported by the support frame so as to be movable in the longitudinal direction of the lower limb, and the rotation shaft is supported by the movable frame.

[0011]

(6) In (5) described above, preferably, the driver is mounted to the movable frame.

[0012]

(7) In (6) described above, preferably, the rotation shaft, the movable frame, and

the driver are located so as to overlap with each other in the longitudinal direction of the lower limb.

[0013]

(8) In any one of (1) to (7) described above, preferably, the lower limb massage machine includes a plurality of the treatment members for respective left and right lower limbs, and the driver is disposed between the left and right treatment members.

[0014]

(9) In any one of (1) to (8) described above, preferably, the lower limb massage machine includes a plurality of the treatment members for respective left and right lower limbs, and the rotation shaft extends across the left and right treatment members in a left-right direction.

[0015]

(10) In any one of (1) to (9) described above, preferably, the linkage mechanism is disposed on an end of the movement mechanism in a left-right direction.

[0016]

(11) In (2) described above, preferably, the first and second linkage members each have a plate shape and are disposed with main surfaces of the first and second linkage members oriented in a left-right direction.

[0017]

(12) In any one of (1) to (11) described above, preferably, the lower limb massage machine further includes a biasing member biasing the treatment member so as to bring the treatment member close to the lower limb.

[0018]

(13) In any one of (1) to (12) described above, preferably, the treatment member includes: a first treatment member disposed sideward of the lower limb in a left-right direction; and a second treatment member disposed rearward of the lower limb.

[0019]

(14) In any one of (1) to (13) described above, preferably, the lower limb massage machine further includes: an airbag disposed opposite the treatment member with the lower limb interposed between the airbag and the treatment member, and configured to expand by air supplied to the airbag; and a second driver configured to drive the airbag.

[0020]

(15) In (14) described above, preferably, the lower limb massage machine further includes a controller configured to control the driver and the second driver, the driver includes: an electric motor configured to generate rotational power for the rotation shaft; and a current sensor configured to detect a current value of the electric motor, and the controller discharges the air from the airbag when the current value of the electric motor is more than a predetermined threshold value.

[ADVANTAGEOUS EFFECTS OF THE INVENTION]

[0021]

According to the lower limb massage machine of the present disclosure, it is possible to move the treatment member by the simple control.

BRIEF DESCRIPTION OF DRAWINGS

[0022]

FIG. 1 is a perspective view illustrating a lower limb massage machine according to an embodiment.

FIG. 2 is a perspective view illustrating an upper massage apparatus of the lower limb massage machine.

FIG. 3 is a perspective view illustrating the upper massage apparatus from which a

front cover is removed.

FIG. 4 is a plan view illustrating an interior of the upper massage apparatus.

FIG. 5 is a perspective view illustrating outer treatment members, rear treatment members, and a part of a movement mechanism.

FIG. 6 is a perspective view illustrating one of the outer treatment members.

FIG. 7 is a plan view illustrating one of the outer treatment members and one of the rear treatment members.

FIG. 8 is a sectional view taken along line A-A in FIG. 7.

FIG. 9A is a side view illustrating one of the outer treatment members at an upper limit position.

FIG. 9B is a side view illustrating one of the outer treatment members at a middle position in an up-down direction.

FIG. 9C is a side view illustrating one of the outer treatment members at a lower limit position.

FIG. 10 is a block diagram illustrating a control configuration of the upper massage apparatus.

DETAILED DESCRIPTION

[0023]

An embodiment of the present disclosure will be described below with reference to the drawings.

FIG. 1 is a perspective view illustrating a lower limb massage machine according to an embodiment.

As illustrated in FIG. 1, a lower limb massage machine 10 is an apparatus configured to massage the left and right lower limbs of a user. The lower limb massage

machine 10 includes an upper massage apparatus 11 configured to massage the calves L in the lower limbs, and a lower massage apparatus 12 configured to massage the feet F in the lower limbs. The lower limb massage machine 10 of the present embodiment massages the calves L with the calves L oriented in an up-down direction.

[0024]

As used herein, the term “calf L” refers to a portion of a human lower limb ranging from a region below a knee to a region above an ankle. The term “foot F” refers to a region below an ankle. In the present embodiment, directions indicated by double-headed arrow X, double-headed arrow Y, and double-headed arrow Z in FIG. 1 are referred to as a left-right direction (width direction), a front-rear direction, and an up-down direction, respectively. These directions correspond with the directions seen from a user who has inserted his/her lower limbs into the lower limb massage machine 10. The lower limb massage machine 10 of the present embodiment massages the calves L with the calves L oriented in approximately the up-down direction.

[0025]

As illustrated in FIG. 1, the lower limb massage machine 10 includes a casing 13. The casing 13 has an approximately rectangular shape or an approximately square shape as seen from the front or the rear. The casing 13 has an approximately “L” shape so that a lower side of the casing 13 is long in the front-rear direction as seen in the left-right direction and an upper side of the casing 13 is long in the up-down direction. The casing 13 has in its front surface a pair of left and right upper recesses 14 open forward and upward and located on an upper side of the front surface. The casing 13 also has in its front surface a pair of left and right lower recesses 15 open upward and located on a lower side of the front surface. The left upper recess 14 and the left lower recess 15 communicate with each other. The right upper recess 14 and the right lower recess 15 communicate with each other. The left upper recess 14, the right upper

recess 14, the left lower recess 15, and the right lower recess 15 each have a liner 16 formed therein. The left and right upper recesses 14 are configured to receive the left and right calves L of the user, respectively. The left and right lower recesses 15 are configured to receive the left and right feet F of the user, respectively.

[0026]

In the casing 13, the upper massage apparatus 11 is disposed near the upper recesses 14, and the lower massage apparatus 12 is disposed near the lower recesses 15. The lower massage apparatus 12 adopts a publicly-known configuration capable of massaging the lateral sides or the sole of each foot F. The lower massage apparatus is omissible.

[0027]

(Configuration of upper massage apparatus)

FIG. 2 is a perspective view illustrating the upper massage apparatus of the lower limb massage machine.

As illustrated in FIG. 2, the upper massage apparatus 11 includes a case 21 and a plurality of treatment members 37, 38, and 39.

[0028]

The case 21 includes a base 26 and a plurality of walls 27 and 28. The base 26 corresponds to the rear of the case 21 and has an approximately rectangular shape as seen in rear view. The walls 27 and 28 protrude forward from the base 26. The walls 27 and 28 are left and right walls 27 corresponding to opposite sides of a front portion of the case 21 in the left-right direction and a central wall 28 corresponding to a center of the front portion of the case 21 in the left-right direction. The base 26 protrudes downward beyond the left and right walls 27 and the central wall 28.

[0029]

The case 21 has recesses 29 open forward, upward, and downward and located

between the left wall 27 and the central wall 28 and between the right wall 27 and the central wall 28, respectively. These recesses 29 are located in correspondence with the left and right upper recesses 14 in the casing 13 of the lower limb massage machine 10. The recesses 29 in the case 21 are also configured to receive the calves L fit in the upper recesses 14. The plurality of treatment members 37, 38, and 39 are disposed in the recesses 29.

[0030]

The case 21 includes a rear cover 21a corresponding to a rear surface of the base 26, and a front cover 21b corresponding to a front surface of the base 26 and the plurality of walls 27 and 28. The rear cover 21a and the front cover 21b are coupled together by a coupling tool such as a screw.

[0031]

FIG. 3 is a perspective view illustrating the upper massage apparatus from which the front cover is removed. FIG. 4 is a plan view illustrating an interior of the upper massage apparatus. FIG. 5 is a perspective view illustrating outer treatment members, rear treatment members, and a part of a movement mechanism.

[0032]

(Configuration of movement mechanism)

As illustrated in FIGs. 3 and 4, a movement mechanism 23 is disposed in the case 21. The movement mechanism 23 moves some of the treatment members 37 and 38 up and down along the longitudinal direction of the calves L. The movement mechanism 23 includes support frames 22, a movable frame 34, a rotation shaft 35, a first driver 36, and linkage mechanisms 66.

[0033]

The support frames 22 are fixed to the interior of the case 21. The support frames 22 are fixed to the rear cover 21a of the case 21. The support frames 22 are mounted to

opposite ends of the rear cover 21a in the left-right direction. The support frames 22 each include a support plate 31 formed of a plate bent in an approximately “L” shape as seen from above, and a guide rail 32 mounted to the support plate 31. The guide rail 32 is formed of a rod, such as a round rod or an angular rod, extending in the up-down direction.

[0034]

As illustrated in FIGs. 4 and 5, the movable frame 34 is a long member elongated in the left-right direction. The movable frame 34 has a length extending over approximately the entire interior of the case 21 in the left-right direction. The movable frame 34 is movably supported at its opposite ends in the left-right direction by the guide rails 32 of the support frames 22. Specifically, the movable frame 34 has in its opposite ends insertion holes 34a corresponding to through holes extending in the up-down direction, and the guide rails 32 are slidably inserted through the insertion holes 34a. Therefore, the movable frame 34 is movable in the up-down direction along the guide rails 32, i.e., in the longitudinal direction of the calves L fit in the recesses 29.

[0035]

The rotation shaft 35 is disposed forward of the movable frame 34. The rotation shaft 35 is disposed at a position (a height) where the rotation shaft 35 overlaps with the movable frame 34 in the up-down direction. The rotation shaft 35 is disposed with its axis extending horizontally. Specifically, the rotation shaft 35 is disposed with its axis oriented in the left-right direction. The rotation shaft 35 is supported at its opposite ends in the left-right direction by the movable frame 34. The movable frame 34 is provided with bearings 42 disposed on the opposite ends of the movable frame 34 in the left-right direction and protruding forward. The opposite ends of the rotation shaft 35 in the left-right direction are rotatably supported by the bearings 42. Therefore, the rotation shaft 35 is supported by the movable frame 34 and the guide rails 32 so as to be movable in the up-down direction.

[0036]

The first driver 36 rotates the rotation shaft 35. As illustrated in FIG. 4, the first driver 36 is accommodated in an accommodation member 43 of the movable frame 34. The accommodation member 43 protrudes forward from a center of the movable frame 34 in the left-right direction. The accommodation member 43 is disposed within the central wall 28 of the case 21.

[0037]

As illustrated in FIG. 5, the first driver 36 includes an electric motor 45 and a transmitter 46 configured to transmit an output from the electric motor 45 to the rotation shaft 35. The electric motor 45 outputs rotational power from an output shaft 45a. The electric motor 45 rotates the output shaft 45a in both forward and reverse directions. The electric motor 45 is disposed with the output shaft 45a oriented in the left-right direction. The electric motor 45 is disposed forward of the rotation shaft 35. The electric motor 45 is disposed at a position (a height) where the electric motor 45 overlaps with the movable frame 34 and the rotation shaft 35 in the up-down direction. Therefore, the arrangement of the movable frame 34, rotation shaft 35, and electric motor 45 in the up-down direction is made compact, which enables an increase in moving range in the up-down direction.

[0038]

As illustrated in FIG. 5, the transmitter 46 includes a plurality of transmission gears 46a. The transmitter 46 reduces the output from the electric motor 45, and transmits the reduced output to the rotation shaft 35. Since the electric motor 45 and the transmitter 46 are accommodated in and supported by the accommodation member 43 as illustrated in FIG. 4, the electric motor 45 and the transmitter 46 are disposed within the central wall 28 of the case 21 as with the accommodation member 43.

[0039]

The linkage mechanisms 66 constitute a raising and lowering mechanism configured to raise and lower the movable frame 34, the rotation shaft 35, and the first driver 36. The linkage mechanisms 66 couple the rotation shaft 35 and the support frames 22 together, and are expandable and contractible between the rotation shaft 35 and the support frames 22. The details of the linkage mechanisms 66 will be described below.

[0040]

(Configuration of treatment member)

As illustrated in FIG. 2, the plurality of treatment members 37, 38, and 39 are configured to massage the two calves L fit in the two recesses 29 in the case 21. The plurality of treatment members 37, 38, and 39 include: outer treatment members 37 each disposed outward of the corresponding calf L in the left-right direction; rear treatment members 38 each disposed rearward of the corresponding calf L; and inner treatment members 39 each disposed inward of the corresponding calf L in the left-right direction.

[0041]

(Configuration of outer treatment member)

As illustrated in FIGS. 3 and 4, the outer treatment members 37 are mounted to the opposite ends of the rotation shaft 35 in the left-right direction. The outer treatment members 37 are disposed inward in the left-right direction with respect to the support frames 22. The outer treatment members 37 each include an arm 51 mounted to the rotation shaft 35, and treatment elements 52 mounted to the arm 51. The arm 51 is mounted to the rotation shaft 35 so as to be swingable in the left-right direction on a mount shaft 53 oriented in the up-down direction. The treatment elements 52 are arranged vertically. The upper and lower treatment elements 52 are disposed on a front end of the arm 51 at positions forward of the mount shaft 53.

[0042]

FIG. 6 is a perspective view illustrating one of the outer treatment members.

As illustrated in FIGs. 5 and 6, the upper and lower treatment elements 52 each include a shaft 52a and a plurality of rollers 52b rotatably mounted to the shaft 52a. The shaft 52a is disposed approximately horizontally and extends forward from the front end of the arm 51. As illustrated in FIG. 4, more specifically, the shaft 52a extends forward while slightly tilting with respect to the front-rear direction such that a front side of the shaft 52a is located inward in the left-right direction (i.e., located near the corresponding calf L). The shafts 52a of the upper and lower treatment elements 52 are arranged in approximately parallel to each other.

[0043]

The plurality of rollers 52b (three rollers 52b in the illustrative example) are arranged in the axial direction of each shaft 52a. The rollers 52b each have an outer peripheral surface in the form of an arc disk or a flat sphere. The rollers 52b come into contact with the corresponding calf L to apply an acupressure massage to the calf L. In the present embodiment, the rollers 52b come into contact with the calf L with the liner 16 (see FIG. 1) interposed between the rollers 52b and the calf L. Since the shaft 52a tilts with the front side located inward in the left-right direction, the treatment elements 52 apply an acupressure massage obliquely rearward to the slightly front side of the calf L (i.e., a shin region of the leg). Alternatively, the treatment elements 52 may be configured to apply an acupressure massage to lateral sides of the calf L from the side.

[0044]

FIG. 7 is a plan view illustrating one of the outer treatment members and one of the rear treatment members.

As illustrated in FIGs. 4 and 7, each arm 51 has a rear end 51a biased outward in the left-right direction by a biasing member 55. Specifically, the movable frame 34 has an opening 34b corresponding to a through hole extending in the up-down direction, and the rear end 51a of the arm 51 is inserted in the opening 34b. The biasing member 55 is accommodated

in the opening 34b. The biasing member 55 includes a compression coil spring expandable and contractible in the left-right direction. By the biasing member 55, the rear end 51a of the arm 51 is biased outward in the left-right direction. The arm 51 has a middle portion in the front-rear direction. The middle portion of the arm 51 is mounted to the rotation shaft 35 so as to be swingable on the mount shaft 53 extending in the up-down direction. The front end of the arm 51 is thus biased inward in the left-right direction by the biasing member 55. As illustrated in FIG. 7, therefore, the treatment elements 52 mounted to the front end of the arm 51 are also biased inward in the left-right direction, i.e., toward the corresponding calf L. The treatment elements 52 are thus pressed against the calf L to achieve a suitable acupressure massage.

[0045]

FIG. 8 is a sectional view taken along line A-A in FIG. 7.

As illustrated in FIGs. 6 and 8, a position adjustment mechanism 61 (a distance adjustment mechanism 61) is disposed between the rotation shaft 35 and each outer treatment member 37. The position adjustment mechanism 61 is configured to adjust the position of the outer treatment member 37 in the left-right direction along the axis of the rotation shaft 35. The position adjustment mechanism 61 includes a threaded member 62 mounted to an outer peripheral surface of the rotation shaft 35, and a nut member 63 into which the threaded member 62 is screwed. The threaded member 62 rotates together with the rotation shaft 35. When the threaded member 62 rotates together with the rotation shaft 35 in the forward direction, the nut member 63, into which the threaded member 62 is screwed, moves inward in the left-right direction, for example. When the threaded member 62 rotates together with the rotation shaft 35 in the reverse direction, the nut member 63 moves outward in the left-right direction, for example. The rotation shaft 35 is provided with a pair of left and right stoppers 64 between which the threaded member 62 is sandwiched, so that movement of the nut member 63 in the left-right direction is restricted by the left and right stoppers 64. The nut member 63 is movable

in the left-right direction within a range between the left and right stoppers 64.

[0046]

A mount member 65 is mounted to an outer peripheral surface of the nut member 63. The mount member 65 is slidably attached to the nut member 63 around an axis of the nut member 63. The mount shaft 53 protrudes from upper and lower ends of the mount member 65, and the arm 51 of the outer treatment member 37 is swingably mounted to the mount shaft 53. Therefore, when the rotation shaft 35 and the threaded member 62 rotate in the forward and reverse directions to move the nut member 63 in the left-right direction, the outer treatment member 37 also moves in the left-right direction. It is thus possible to adjust the position of the outer treatment member 37 (i.e., the distance between the outer treatment member 37 and the corresponding inner treatment member 39) in the left-right direction in accordance with the thickness of the calf L.

[0047]

When the movement of the nut member 63 in the left-right direction is restricted by the left and right stoppers 64, the nut member 63 rotates together with the threaded member 62. Since the mount member 65 is slidable on the outer peripheral surface of the nut member 63, the mount member 65 does not hinder the rotation of the nut member 63 and does not hinder the rotation of the rotation shaft 35 and threaded member 62. It is therefore possible to move the outer treatment member 37 and the rear treatment member 38 up and down by the rotation of the rotation shaft 35 as will be described below after the position of the outer treatment member 37 in the left-right direction is adjusted by the rotation of the rotation shaft 35 in the forward or reverse direction.

[0048]

(Configuration of rear treatment member)

As illustrated in FIGs. 4 and 7, the rear treatment member 38 includes a treatment

element 57 of a roller shape rotatably supported by the rotation shaft 35. The treatment element 57 has an outer peripheral surface in the form of an arc disk or a flat sphere. The treatment element 57 of the rear treatment member 38 comes into contact with the back of the corresponding calf L to apply an acupressure massage to the back of the calf L. In the present embodiment, the treatment element 57 comes into contact with the calf L with the liner 16 interposed between the treatment element 57 and the calf L. The movable frame 34 is partially curved rearward so as to avoid interference with the rear treatment member 38.

[0049]

(Configuration of inner treatment member)

As illustrated in FIGs. 2 and 4, the inner treatment members 39 are respectively mounted to left and right side surfaces of the central wall 28 of the case 21 of the upper massage apparatus 11. Each inner treatment member 39 is disposed opposite the corresponding outer treatment member 37 in the left-right direction. Accordingly, the calves L fit in the recesses 29 are sandwiched between the inner treatment members 39 and the outer treatment members 37 in the left-right direction. The inner treatment members 39 of the present embodiment each include an airbag. The airbag expands by air supplied thereto. Therefore, the inner treatment members 39 are capable of applying an acupressure massage to the left sides of the calves L fit in the recesses 29 in the case 21.

[0050]

As illustrated in FIGs. 9A and 9B, the inner treatment members 39 each have a length L1 in the up-down direction. The length L1 overlaps with or covers a moving range (the details of which will be described below) of the outer treatment members 37 moving up and down. It is therefore possible to apply an acupressure massage to the calves L with the calves L sandwiched between the outer treatment members 37 and the inner treatment members 39.

[0051]

A second driver 41 configured to drive the inner treatment members 39 is disposed within the central wall 28 of the case 21. The second driver 41 is disposed forward of the first driver 36 configured to rotationally drive the rotation shaft 35. The second driver 41 includes a pump 73 configured to compress air, and a control valve 74 configured to control supply of the compressed air to each of the inner treatment members 39. The control valve 74 is an electromagnetic valve, a flow rate adjustment valve, or the like. The control valve 74 is disposed forward of the first driver 36, and the pump 73 is disposed below the control valve 74. The inner treatment members (the airbags) 39, the control valve 74, and the pump 73 are connected to each other with an air hose (not illustrated).

[0052]

(Configuration of linkage mechanism)

The linkage mechanisms 66 of the movement mechanism 23 are described below.

FIGs. 9A to 9C are side views of the movement mechanism. Specifically, FIG. 9A illustrates the treatment members at the upper limit positions, FIG. 9B illustrates the treatment members at the middle positions in the up-down direction, and FIG. 9C illustrates the treatment members at the lower limit positions.

[0053]

As illustrated in FIGs. 3, 4, and 9A to 9C, the linkage mechanisms 66 are disposed between the rotation shaft 35 and the support frames 22 and couple the rotation shaft 35 and the support frames 22 to each other. The linkage mechanisms 66 expand and contract between the rotation shaft 35 and the support frames 22. The linkage mechanisms 66 are located between the opposite ends of the rotation shaft 35 and the left and right support frames 22. The linkage mechanisms 66 of the present embodiment substantially constitute a crank mechanism.

[0054]

The linkage mechanisms 66 each include a first linkage member 67 and a second

linkage member 68. The first linkage member 67 is fixed to the end of the rotation shaft 35. Accordingly, the first linkage member 67 rotates together with the rotation shaft 35. The second linkage member 68 has a first end coupled to the first linkage member 67 and a second end coupled to the corresponding support frame 22.

[0055]

The first and second linkage members 67 and 68 are each formed of a plate. The first and second linkage members 67 and 68 are disposed with main surfaces of the first and second linkage members 67 and 68 oriented in the left-right direction. The first linkage member 67 has a round shape in side view. The shape of the first linkage member 67 in side view is not a perfect circle, but is a combination of circles with different radii of curvature.

[0056]

The first linkage member 67 is fixed to the rotation shaft 35 at a position eccentric to a center of the first linkage member 67. By forming the first linkage member 67 in a circular shape, it is possible to decrease a gap between the first linkage member 67 and the corresponding support frame 22 and to reduce a possibility that foreign matter enters the gap. The first linkage member 67 may have a perfect circular shape or may have a strip shape as with the second linkage member 68 described next.

[0057]

The second linkage member 68 has a long strip shape. The first end of the second linkage member 68 is swingably coupled to the first linkage member 67 by a first coupling shaft 69. The second end of the second linkage member 68 is swingably coupled to a lower portion of the support plate 31 of the corresponding support frame 22 by a second coupling shaft 70.

[0058]

As illustrated in FIG. 7, each support plate 31 has an approximately “L” shape in

plan view, and includes a first piece 31a disposed rearward and having a main surface oriented in the front-rear direction, and a second piece 31b bent forward from an outer end of the first piece 31a in the left-right direction and having a main surface oriented in the left-right direction. The second linkage member 68 is coupled to a front end of a lower portion of the second piece 31b by the second coupling shaft 70. As illustrated in FIGs. 9A to 9C, the second coupling shaft 70 is located below the rotation shaft 35. The second coupling shaft 70 is disposed at a position where the second coupling shaft 70 overlaps with the rotation shaft 35 in the front-rear direction. The second coupling shaft 70 is fixed at a given position.

[0059]

As illustrated in FIGs. 7 and 8, the second piece 31b of the support plate 31 and the first linkage member 67 are disposed at positions where the second piece 31b of the support plate 31 and the first linkage member 67 overlap with each other in the left-right direction. The second linkage member 68 is disposed outward of the second piece 31b and the first linkage member 67 in the left-right direction. In this way, since the second piece 31b, which corresponds to the outer end of the support plate 31 in the left-right direction, and the first linkage member 67 are disposed at the positions where the second piece 31b and the first linkage member 67 overlap with each other in the left-right direction, the size of the movement mechanism 23 can be reduced in the left-right direction. In addition, since the first linkage member 67 and the second linkage member 68 of each linkage mechanism 66 are each formed of a plate with its main surface oriented in the left-right direction, the dimension of each linkage mechanism 66 in the left-right direction can be reduced, so that the size of the movement mechanism 23 can be reduced in the left-right direction.

[0060]

(Operation of movement mechanism)

With reference to FIGs. 9A to 9C, raising and lowering operation by the

movement mechanism 23 is described next.

As the rotation shaft 35 rotates, a distance between the rotation shaft 35 and the second coupling shafts 70 changes as illustrated in FIGs. 9A to 9C. Since the rotation shaft 35 is supported by the movable frame 34 whose movement in the up-down direction is guided by the guide rails 32 of the support frames 22, the rotation shaft 35 moves up and down along the guide rails 32.

[0061]

FIG. 9A illustrates the rotation shaft 35 at the upper limit position. At this time, the rotation shaft 35 is farthest from the second coupling shafts 70. FIG. 9B illustrates the rotation shaft 35 at the middle position in the up-down direction. The rotation shaft 35 is approximately equal in height to the first coupling shafts 69. FIG. 9C illustrates the rotation shaft 35 at the lower limit position. At this time, the rotation shaft 35 is closest to the second coupling shafts 70. Therefore, as the rotation shaft 35 rotates, a distance L2 between the rotation shaft 35 and the second coupling shafts 70 changes, so that the linkage mechanisms 66 expand and contract to move the rotation shaft 35 up and down.

[0062]

Since the outer treatment members 37 and the rear treatment members 38 are mounted to the rotation shaft 35, the outer treatment members 37 and the rear treatment members 38 also move up and down together with the rotation shaft 35. As a result, the outer treatment members 37 and the rear treatment members 38 move up and down along the calves L to apply an acupressure massage to the calves L in a wide range in the longitudinal direction of the calves L.

[0063]

Since the rotation shaft 35 is rotatably supported by the movable frame 34, the movable frame 34 moves in the up-down direction while the rotation shaft 35 moves up and

down. Since the first driver 36, which drives the rotation shaft 35, is also supported by the movable frame 34, the first driver 36 also moves up and down together with the rotation shaft 35.

[0064]

FIG. 10 is a block diagram illustrating a control configuration of the upper massage apparatus.

The upper massage apparatus 11 includes a controller 75 configured to operate and control the electric motor 45, the pump 73, and the control valve 74. The electric motor 45 corresponds to the first driver 36. The pump 73 and the control valve 74 correspond to the second driver 41. The upper massage apparatus 11 also includes a current sensor 76 configured to detect a current value of the electric motor 45. The detection value of the current sensor 76 is input to the controller 75.

[0065]

The controller 75 includes a processor such as a CPU and memories such as a RAM and a ROM. The memories store programs for controlling the electric motor 45, the pump 73, and the control valve 74, data used for the control, and others. The controller 75 controls operation of each of the electric motor 45, the pump 73, and the control valve 74 in such a manner that the processor executes a preset program, for example. In addition, the controller 75 controls the electric motor 45 in accordance with the detection value (the current value) of the current sensor 76. For example, the controller 75 controls the operation of the electric motor 45 while monitoring the current value of the electric motor 45 such that the current value falls within a predetermined range. The controller 75 may be used for controlling only the upper massage apparatus 11 or may be used for controlling the entire lower limb massage machine 10.

[0066]

The controller 75 of the present embodiment monitors the detection value of the current sensor 76. When the detection value exceeds a predetermined threshold value, the

controller 75 determines that the electric motor 45 becomes overloaded, and performs control for reducing the load. Specifically, the electric motor 45 becomes overloaded when a force to press the calves L excessively increases while the electric motor 45 is driven to move the outer treatment members 37 and the rear treatment members 38 up and down, for example, when the outer treatment members 37 and the rear treatment members 38 are pressed against the thick portions of the calves L. In this case, the controller 75 of the present embodiment causes the second driver 41 to discharge air from the airbags corresponding to the inner treatment members 39. It is thus possible to reduce a possibility that the electric motor 45 becomes overloaded and to reduce a possibility that the electric motor 45 becomes overheated and damaged. In addition, it is possible to prevent application of a pressing force higher than necessary to the lower limbs of the user.

[0067]

(Functional effects of embodiment)

(1) The present embodiment provides a lower limb massage machine 10 including: a treatment member (the outer treatment members 37, the rear treatment members 38) configured to massage a lower limb (the calves L); and a movement mechanism 23 coupled to the treatment member 37, 38 and configured to move the treatment member 37, 38 in a longitudinal direction of the lower limb. The movement mechanism 23 includes: a rotation shaft 35; a driver (the first driver 36) configured to rotate the rotation shaft 35; a support frame 22 supporting the rotation shaft 35 with the rotation shaft 35 movable in the longitudinal direction of the lower limb L; and a linkage mechanism 66 coupling the rotation shaft 35 and the support frame 22 together, and expandable and contractible by rotation of the rotation shaft 35. According to this configuration, it is possible to reciprocate the rotation shaft 35 and the treatment member 37, 38 along the longitudinal direction of the lower limb L by rotating the rotation shaft 35 in one direction. It is therefore possible to reduce a possibility that the control

of the driver 36 becomes complicated.

[0068]

(2) In the present embodiment, the linkage mechanism 66 includes: a first linkage member 67 fixed to the rotation shaft 35 and configured to rotate together with the rotation shaft 35; and a second linkage member 68 having a first end swingably coupled to the first linkage member 67, and a second end swingably coupled to the support frame 22. According to this configuration, it is possible to rotate the first linkage member 67 together with the rotation shaft 35 by rotating the rotation shaft 35 in one direction and to move the rotation shaft 35 up and down with respect to a coupling portion (the second coupling shaft 70) coupling the second linkage member 68 and the support frame 22 together. It is therefore possible to reciprocate the rotation shaft 35 and the treatment member 37, 38 with a simple configuration and by simple control.

[0069]

(3) In the present embodiment, the treatment member 37, 38 is mounted to the rotation shaft 35. It is therefore possible to directly move the treatment member 37, 38 together with the rotation shaft 35 by the rotation of the rotation shaft 35.

[0070]

(4) In the present embodiment, the lower limb massage machine 10 further includes a position adjustment mechanism 61 disposed between the treatment member 37, 38 and the rotation shaft 35 and configured to adjust a position of the treatment member (the outer treatment members) 37 in an axial direction of the rotation shaft 35 by rotation of the rotation shaft 35 in forward and reverse directions. According to this configuration, it is possible to move the rotation shaft 35 and the treatment member 37 in the longitudinal direction of the lower limb and to subject the treatment member 37 to a position adjustment or a distance adjustment in the axial direction of the rotation shaft 35, by rotating the rotation shaft 35.

[0071]

According to the technique disclosed in Patent Literature 1, the feed screw (the rotation shaft) rotates in the forward direction to raise the treatment member and rotates in the reverse direction to lower the treatment member. That is, it is necessary to rotate the feed screw in both forward and reverse directions (in other words, to rotate the electric motor in both forward and reverse directions) in order to move the treatment member up and down. In contrast to this, the lower limb massage machine 10 of the present embodiment is capable of moving the treatment member 37 up and down only by rotating the rotation shaft 35 in one of the forward direction and the reverse direction, and is capable of using the rotation of the rotation shaft 35 in the other one of the forward direction and the reverse direction, for the purpose of subjecting the treatment member 37 to a position adjustment or a distance adjustment in the axial direction of the rotation shaft 35.

[0072]

(5) In the present embodiment, the movement mechanism 23 includes a movable frame 34 supported by the support frame 22 so as to be movable in the longitudinal direction of the lower limb, and the rotation shaft 35 is supported by the movable frame 34. According to this configuration, it is possible to support the rotation shaft 35 by the support frame 22 such that the rotation shaft 35 is movable in the longitudinal direction of the lower limb by the movable frame 34.

[0073]

(6) In the present embodiment, the driver (the first driver) 36 is mounted to the movable frame 34. Therefore, it is possible to move the driver 36 (the electric motor 45, the transmitter 46) together with the rotation shaft 35 in the longitudinal direction of the lower limb. As a result, it becomes unnecessary to fix the driver 36 at a given position. Therefore, it is unnecessary to secure a space for fixing the driver 36, which contributes to a reduction in size of

the lower limb massage machine.

[0074]

(7) In the present embodiment, the rotation shaft 35, the movable frame 34, and the driver 36 (particularly the electric motor 45) are located so as to overlap with each other in the longitudinal direction of the lower limbs. Therefore, it is possible to make the arrangement of the rotation shaft 35, movable frame 34, and driver 36 compact in the longitudinal direction of the lower limb and to increase the moving range in the same direction.

[0075]

(8) In the present embodiment, the lower limb massage machine 10 includes a plurality of the treatment members 37, 38 for respective left and right lower limbs, and the driver 36 is disposed between the left and right treatment members 37, 38. According to this configuration, it is possible to reduce the size of the lower limb massage machine 10 in such a manner that the driver 36 is disposed by effectively using a space between the left and right lower limbs. In the present embodiment, a second driver 41 (the pump 73, the control valve 74) is also disposed between the left and right treatment members 37, 38. It is therefore possible to reduce the size of the lower limb massage machine 10.

[0076]

(9) In the present embodiment, the lower limb massage machine 10 includes a plurality of the treatment members 37, 38 for respective left and right lower limbs (the calves L), and the rotation shaft 35 extends across the left and right treatment members 37, 38 in a left-right direction. According to this configuration, it is possible to move the left and right treatment members 37, 38 in the longitudinal direction of the lower limbs L by the rotation of the single rotation shaft 35. It is also possible to mount the left and right treatment members 37, 38 to the single rotation shaft 35.

[0077]

(10) In the present embodiment, the linkage mechanism 66 is disposed on an end of the movement mechanism 23 in a left-right direction. According to this configuration, it is possible to reduce a possibility that the size of the lower limb massage machine 10 is increased in the front-rear direction or the up-down direction. In addition, the rotation shaft 35 extends across the left and right treatment members 37, 38 in the left-right direction, and a pair of the linkage mechanisms 66 are disposed on the opposite ends of the rotation shaft 35 in the left-right direction. According to this configuration, it is possible to operate the left and right linkage mechanisms 66, using the single rotation shaft 35 to which the linkage mechanisms 66 are mounted at its opposite ends in the left-right direction. In addition, it is possible to move the rotation shaft 35 and the left and right treatment members 37, 38 in the longitudinal direction of the lower limbs L.

[0078]

(11) In the present embodiment, the first and second linkage members 67, 68 of the linkage mechanism 66 each have a plate shape and are disposed with main surfaces of the first and second linkage members 67, 68 oriented in a left-right direction. According to this configuration, it is possible to reduce a width of the linkage mechanism 66 in the left-right direction and to reduce a possibility that the size of the lower limb massage machine 10 is increased in the left-right direction even in a case where the linkage mechanisms 66 are disposed on the left and right portions of the movement mechanism 23.

[0079]

(12) In the present embodiment, the lower limb massage machine 10 further includes a biasing member 55 biasing the treatment member (the outer treatment members) 37 so as to bring the treatment member 37 close to the lower limb. The lower limb has different thicknesses in the longitudinal direction. Therefore, when the treatment member 37 is moved in the longitudinal direction of the lower limb, the treatment member 37 may be separated from

the lower limb. In view of this, according to this configuration of the present embodiment, the treatment member 37 is biased by the biasing member 55. It is therefore possible to reliably bring the treatment member 37 into contact with the lower limb. It is also possible to apply an acupuncture massage effectively by pressing the treatment member 37 against the lower limb L, using the biasing force of the biasing member 55.

[0080]

(13) In the present embodiment, the treatment member 37, 38 includes: a first treatment member (the outer treatment members) 37 disposed sideward of the lower limb in a left-right direction; and a second treatment member (the rear treatment members) 38 disposed rearward of the lower limb. According to this configuration, it is possible to massage both the side of the lower limb in the left-right direction and the rear of the lower limb.

[0081]

(14) In the present embodiment, the lower limb massage machine 10 further includes: an airbag (the inner treatment member) 39 disposed opposite the treatment member (the outer treatment members) 37 with the lower limb interposed between the airbag 39 and the treatment member 37, and configured to expand by air supplied to the airbag 39; and a second driver 41 configured to drive the airbag 39. According to this configuration, it is possible to massage the lower limb with the lower limb sandwiched between the treatment member 37 and the airbag 39 in the left-right direction. The airbag 39 can be formed long in the longitudinal direction of the lower limb. It is therefore possible to massage a wide range of the lower limb in the longitudinal direction of the lower limb without moving the airbag 39 up and down as with the treatment member 37.

[0082]

(15) In the present embodiment, the lower limb massage machine 10 further includes a controller 75 configured to control the driver 36 and the second driver 41, the driver

36 includes: an electric motor 45 configured to generate rotational power for the rotation shaft 35; and a current sensor 76 configured to detect a current value of the electric motor 45, and the controller 75 discharges the air from the airbag 39 when the current value of the electric motor 45 is more than a predetermined threshold value. According to this configuration, for example, when the treatment member 37 is pressed against the lower limb strongly, causing a load on the electric motor 45 to become excessive, a value of current flowing through the electric motor 45 increases. In this case, the controller 75 discharges the air from the airbag 39 to decrease the force to press the treatment member 37 against the lower limb. It is thus possible to reduce the load applied to the electric motor 45. In addition, the current sensor 76 is provided for controlling the electric motor 45. It is therefore possible to reduce the load applied to the electric motor 45 without separately providing, for example, a load sensor configured to detect a load applied to a treatment element 52, 57 and a rotation sensor configured to detect a rotation speed of the rotation shaft. Alternatively, the lower limb massage machine 10 of the present embodiment may include the foregoing load sensor and rotation sensor.

[0083]

While various embodiments have been described herein above, it is to be appreciated that various changes in form and detail may be made without departing from the spirit and scope presently or hereafter claimed.

For example, in the foregoing embodiment, the linkage mechanisms 66 each include two linkage members, i.e., the first linkage member 67 and the second linkage member 68. Alternatively, each of the linkage mechanisms 66 may include an additional linkage member.

[0084]

The lower limb massage machine 10 is used with the lower limbs oriented in the up-down direction. Alternatively, the lower limb massage machine 10 may be used with the

lower limbs oriented in another direction such as the front-rear direction. In this case, the outer treatment members 37 and the rear treatment members 38 are configured to move in the front-rear direction along the longitudinal direction of the lower limbs.

REFERENCE SIGNS LIST

[0085]

- 10 lower limb massage machine
- 11 upper massage apparatus
- 22 support frame
- 23 movement mechanism
- 34 movable frame
- 35 rotation shaft
- 36 first driver
- 37 outer treatment member
- 38 rear treatment member
- 39 inner treatment member (airbag)
- 41 second driver
- 45 electric motor
- 55 biasing member
- 61 position adjustment mechanism
- 66 linkage mechanism
- 67 first linkage member
- 68 second linkage member
- 75 controller
- 76 current sensor
- L calf (lower limb)

CLAIMS

1. A lower limb massage machine comprising:
a treatment member configured to massage a lower limb; and
a movement mechanism coupled to the treatment member and configured to move the treatment member in a longitudinal direction of the lower limb,
the movement mechanism including
a rotation shaft,
a driver configured to rotate the rotation shaft,
a support frame supporting the rotation shaft with the rotation shaft movable in the longitudinal direction of the lower limb, and
a linkage mechanism coupling the rotation shaft and the support frame together, and expandable and contractible by rotation of the rotation shaft.
2. The lower limb massage machine according to claim 1, wherein
the linkage mechanism includes:
a first linkage member fixed to the rotation shaft and configured to rotate together with the rotation shaft; and
a second linkage member having a first end swingably coupled to the first linkage member, and a second end swingably coupled to the support frame.
3. The lower limb massage machine according to claim 1 or 2, wherein
the treatment member is mounted to the rotation shaft.
4. The lower limb massage machine according to claim 3, further comprising
a position adjustment mechanism disposed between the treatment member and the

rotation shaft and configured to adjust a position of the treatment member in an axial direction of the rotation shaft by rotation of the rotation shaft in forward and reverse directions.

5. The lower limb massage machine according to claim 1 or 2, wherein
the movement mechanism includes a movable frame supported by the support frame so as to be movable in the longitudinal direction of the lower limb, and
the rotation shaft is supported by the movable frame.
6. The lower limb massage machine according to claim 5, wherein
the driver is mounted to the movable frame.
7. The lower limb massage machine according to claim 6, wherein
the rotation shaft, the movable frame, and the driver are located so as to overlap with each other in the longitudinal direction of the lower limb.
8. The lower limb massage machine according to claim 1 or 2, comprising
a plurality of the treatment members for respective left and right lower limbs,
wherein
the driver is disposed between the left and right treatment members.
9. The lower limb massage machine according to claim 3, comprising
a plurality of the treatment members for respective left and right lower limbs,
wherein
the rotation shaft extends across the left and right treatment members in a left-right direction.

10. The lower limb massage machine according to claim 1 or 2, wherein
the linkage mechanism is disposed on an end of the movement mechanism in a
left-right direction.
11. The lower limb massage machine according to claim 2, wherein
the first and second linkage members each have a plate shape and are disposed
with main surfaces of the first and second linkage members oriented in a left-right direction.
12. The lower limb massage machine according to claim 1 or 2, further comprising
a biasing member biasing the treatment member so as to bring the treatment
member close to the lower limb.
13. The lower limb massage machine according to claim 1 or 2, wherein
the treatment member includes:
a first treatment member disposed sideward of the lower limb in a left-right
direction; and
a second treatment member disposed rearward of the lower limb.
14. The lower limb massage machine according to claim 1 or 2, further comprising:
an airbag disposed opposite the treatment member with the lower limb interposed
between the airbag and the treatment member, and configured to expand by air supplied to the
airbag; and
a second driver configured to drive the airbag.

15. The lower limb massage machine according to claim 14, further comprising a controller configured to control the driver and the second driver, wherein the driver includes:
- an electric motor configured to generate rotational power for the rotation shaft;
- and
- a current sensor configured to detect a current value of the electric motor, and
- the controller discharges the air from the airbag when the current value of the electric motor is more than a predetermined threshold value.