

ATTACHMENT STRUCTURE FOR ATTACHING PLURALITY OF LANE ROPE

FLOATS TO ROPE, LANE ROPE FLOAT SET, AND LANE ROPE FLOAT

FIELD

[0001] The invention of the present application is related to an attaching structure for
5 attaching a lane rope float installed in a swimming pool or the like to a rope, and a lane rope float
set. In addition, the present invention also is also related to a float which can be attached to a rope
configured for dividing a water surface or water (hereinafter collectively referred to as “water
surface”) in a pool into lanes.

BACKGROUND

10 **[0002]** Various types of lane rope floats have been conventionally known. For example, a
lane rope float disclosed in Patent Literature 1 includes a rope insertion hole, through which a rope
is inserted into a central portion of the lane rope float, and a plurality of blades arranged around
the rope insertion hole. Then, a plurality of lane rope floats are installed along the rope in a pool
to divide each lane. The lane rope floats are in a state of floating on a water surface and swings in
15 response to waves created by swimmers in each lane, whereby it attenuates and absorbs the waves,
that is, it performs “wave attenuation”, thus making swimming easier.

[0003] However, there is a problem that the swimmer may turn back and changes
swimming direction at an outer wall side of the lane, waves generated by the swimmer before
turning back make swimming more difficult.

20 **[0004]** In addition, in a pool for competitive swimming, a plurality of lane ropes are

provided to divide each lane for each swimmer, and many floats are attached to each rope (see Patent Literature 2). Regarding these floats, in order to attenuate and reduce the waves generated by swimmers traveling on the water surface (this phenomenon is hereinafter referred to as "wave attenuation"), there has been demands for improving the level of the wave attenuation functions recently.

[0005] In particular, in a swimming competition in which a large number of competitors participate, swimmers in the competition want to be able to participate in the swimming competition in a smooth situation without waves, avoiding be adversely affected by waves on the water surface which flow from another (adjacent) lanes.

[0006] In the case of Patent Literature 2, a float has an axial tube configured for inserting a rope formed at a center of the float, a plurality of blade plates extending outwardly are formed at the axial tube, and these blade plates divide the entire space in the float into a plurality of small spaces. A circumferential outer wall is formed at an outer edge of each blade plate for coupling adjacent blade plates to each other. The outer wall has an annular portion configured for stopping waves transmitted from the pool water surface outside the float, while the annular portion forms a window hole capable of introducing waves transmitted from the pool water surface.

[0007] In the case of the above-described float, since the energy of the wave transmitted to the water in the window hole is consumed by the swing of the float etc., the wave caused by the swimmer is gradually dissipated. Inventors of the present application have researched extensively about the oscillation of the float. The inventors discover that there is a possibility of further

improving wave attenuation through further improvements. The inventors completed the present invention after various trial and error experiments.

CITATION LIST

Patent Literature

5 **[0008]** Patent Literature 1: Japanese Patent Publication No. 61-15920

Patent Literature 2: Utility Model Registration No. 3039436

SUMMARY

Technical Issues

[0009] Thus, in view of the above problems, the present invention provides an attachment
10 structure for a lane rope float that makes it easy for swimmers to swim and also easy to swim after
turning back, as well as a lane rope float set. In addition, the object of the present invention is to
provide an improved float which is capable of consuming energies of waves propagating on the
water surface faster than that of the prior art by devising various structures in the float.

Solutions to Problem

15 **[0010]** In order to solve the above problem, an attachment structure according to claim 1
of the invention of the present application is characterized that configured for attaching a plurality
of lane rope floats to a rope, wherein the lane rope floats are attached to the rope by a tubular
portion and are connectable to an outer wall of a pool to partition each lane, and the lane rope
floats are made of a synthetic resin material, and wherein gaps between at least a part of the lane
20 rope floats at a rope side connected to the outer wall of the pool are wider than gaps between at

least a part of the lane rope floats arranged in a vicinity of a center of the pool.

[0011] According to the described features, at the rope side connected to the outer wall of the pool, wide gaps between the lane rope floats can make more waves escape to adjacent lanes, the fluctuation or the disturbance of the water surface can be reduced, such that the swimmer can easily swim after the turning back. On the other hand, due to the narrow gap between the lane rope floats in the vicinity of the center of the pool, the waves are difficult to escape to the adjacent lanes, and there is a moderate resistance feeling, and the swimmer can feel the weight of the water and easily pull while swimming.

[0012] Furthermore, a lane rope float set according to claim 2 of the present invention includes a plurality of lane rope floats attached to a rope via a tubular portion and connected to an outer wall of a pool to partition each lane, and the lane rope floats are made of a synthetic resin material, the lane rope float set comprises spacers arranged between the landed rope floats.

[0013] According to the above-described feature, at the rope side connected to the outer wall of the pool, since the gap between the lane rope floats can be widened by the spacers, more waves can escape to adjacent lanes, the fluctuation or the disturbance of the water surface can be reduced, such that the swimmer can easily swim after the turning back.

[0014] Furthermore, a lane rope float set according to claim 3 of the present invention includes the spacers arranged between the landed rope floats, such that gaps between at least a part of the lane rope floats at a rope side connected to the outer wall of the pool are wider than gaps between at least a part of the lane rope floats arranged in a vicinity of a center of the pool .

[0015] According to the above-described feature, at the rope side connected to the outer wall of the pool, since the gaps between the lane rope floats are widened by the spacers, more waves can escape to adjacent lanes, the fluctuation or the disturbance of the water surface can be reduced, such that the swimmer can easily swim after the turning back. On the other hand, due to the gaps between the lane rope floats in the vicinity of the center of the pool are narrow, the waves are difficult to escape to the adjacent lanes, and there is a moderate resistance feeling, and the swimmer can feel the weight of the water and easily pull while swimming.

[0016] Furthermore, An attachment structure according to claim 4 of the present invention is configured for attaching a plurality of lane rope floats to a rope, wherein the lane rope floats are attached to the rope via a tubular portion and connected to an outer wall of a pool to partition each lane, and the lane rope floats are made of a synthetic resin material, and wherein widths of at least a part of the lane rope floats arranged in the vicinity of a center of the pool are wider than widths of at least a part of the lane rope floats at a rope side connected to the outer wall of the pool.

[0017] According to the above-described feature, since the width of the lane rope float is wide in the vicinity of the center of the pool, the gaps between the lane rope floats is reduced, such that the waves are difficult to escape to the adjacent lanes, and there is a moderate resistance feeling, and the swimmer can feel the weight of the water and easily pull while swimming. On the other hand, since the width of the lane rope floats is narrow at the rope side connected to the outer wall of the pool, the gaps between the lane rope floats are increased, allowing more waves to escape to adjacent lanes, the fluctuation or the disturbance of the water surface can be reduced, such that it

can easily swim after the turning back.

[0018] Furthermore, an attachment structure according to claim 5 of the present invention is configured for attaching a plurality of lane rope floats to a rope, wherein the lane rope floats are attached to the rope via a tubular portion and connected to an outer wall of a pool to partition each
5 lane, and the lane rope floats are made of a synthetic resin material, and wherein a transmission rate of at least a part of the lane rope floats at a rope side connected to an outer wall of the pool is 2 % to 30 % and is higher than a transmission rate of at least a part of the lane rope floats arranged in a vicinity of a center of the pool .

[0019] According to the above-described feature, in the vicinity of the center of the pool
10 with low transmission rate, the waves are difficult to escape to the adjacent lanes, and there is a moderate resistance feeling, and the swimmer can feel the weight of the water and easily pull while swimming. On the other hand, at the rope side connected to the outside of the pool with high transmission rate, more waves can escape to adjacent lanes, the fluctuation or the disturbance of the water surface can be reduced, such that the swimmer can easily swim after the turning back.

15 In particular, by setting the transmission rate to 2% to 30%, the gaps between lane rope floats can be widened, allowing more waves to escape to adjacent lanes, the fluctuation or the disturbance of the water surface can be reduced, such that the swimmer can easily swim after the turning back.

[0020] Furthermore, an attachment structure according to claim 6 of the present invention is configured for attaching a plurality of lane rope floats to a rope, wherein the lane rope floats are
20 attached to the rope via a tubular portion and connected to an outer wall of a pool to partition each

lane, and the lane rope floats are made of a synthetic resin material, and wherein a transmission rate of at least a part of the lane rope floats at a rope side connected to an outer wall of the pool is 3 % to 7 %.

[0021] According to the above-described feature, at the rope side connected to the outside of the pool with high transmission rate, the waves easily escape to adjacent lanes, such that the swimmer can easily swim after the turning back. In particular, by setting the transmission rate to 3% to 7%, the gaps between lane rope floats can be widened, allowing more waves to escape to adjacent lanes, the fluctuation or the disturbance of the water surface can be reduced, such that the swimmer can easily swim after the turn.

[0022] Furthermore, in order to solve the above problems, the present invention has the following means. That is, according to one means embodying the present invention, a lane rope float attached to a rope for dividing a water surface of a pool into lanes, the lane rope float comprising: a central attachment portion configured to allow the rope to be inserted into a center of the float, an outer wall portion configured for stopping waves transmitted from the water surface of the pool at an outer side wall surface and forming an opening capable of guiding the waves transmitted from the water surface of the pool into a space in the float; a plurality of blades configured for connecting the outer wall portion to the central attachment portion, the plurality of blades extending in a direction in which the rope extends so as to divide the space in the float into a plurality of spaces; and a connecting portion configured for connecting the plurality of blades to each other and comprising a water vent configured for discharging the waves guided into the space

in the float via the opening, wherein in a case that a volume of an individual space partitioned at least by a pair of adjacent blades, the outer wall portion adjacent to the blades, and the connecting portion adjacent to the blades is defined as A1, and an area of the water vent associated with the individual space is defined as B1, a ratio of A1 and B1 is set to an allowable value which is not less than a lower limit and not more than an upper limit.

[0023] Furthermore, in order to solve the above problems, the present invention has the following means. That is, according to one means embodying the present invention, a lane rope float attached to a rope for dividing a water surface of a pool into lanes, the lane rope float comprising: a central attachment portion configured to allow the rope to be inserted into a center of the float, an outer wall portion configured for stopping waves transmitted from the water surface of the pool at an outer side wall surface and forming an opening capable of guiding the waves transmitted from the water surface of the pool into a space in the float; a plurality of blades configured for connecting the outer wall portion to the central attachment portion and extending in a direction in which the rope extends so as to divide the space in the float into a plurality of spaces; and a connecting portion configured for connecting the plurality of blades to each other, the connecting portion comprising a water vent configured for discharging the waves introduced into the space in the float via the opening, and a guide portion configured for guiding the waves guided into the space in the float via the opening..

[0024] Furthermore, in order to solve the above problems, the present invention has the following means. That is, according to one means embodying the present invention, a lane rope

float attached to a rope for dividing a water surface of a pool into lanes, the lane rope float comprising: a central attachment portion configured to allow the rope to be inserted into a center of the float, an outer wall portion configured for stopping waves transmitted from the water surface of the pool at an outer side wall surface and forming an opening capable of guiding the waves transmitted from the water surface of the pool into a space in the float; a plurality of blades configured for connecting the outer wall portion to the central attachment portion and extending in a direction in which the rope extends so as to divide the space in the float into a plurality of spaces; and a connecting portion configured for connecting the plurality of blades to each other and comprising a water vent configured for discharging the waves introduced into the space in the float via the opening, wherein the lane rope float is attached to the rope by following way: at a connection portion which connects the outer wall portion and the blades, in a situation in which the blades are placed on the water surface, an wave preventing portion is arranged on one side of a portion which is cut in a direction perpendicular to the water surface and is in the direction in which the rope extends, and an ride-over portion is arranged on an opposite side, such that the wave preventing portion is located on a water surface side and the ride-over portion is located in the pool water .

Advantages Effects of the Invention

[0025] According to the attachment structure of the lane rope float according to the present invention and the lane rope float set, the swimmer is easy to swim and is easy to swim after the turn. In addition, according to the lane rope float of the present invention, the energy of the wave

passing through the water surface is generated early by the swimmer swimming in the pool lane, and the wave of the water surface can be calmed in a short time.

BRIEF DESCRIPTION OF DRAWINGS

[0026] FIG. 1 is an overall perspective view of a lane rope float according to a first embodiment of the present disclosure.

FIG. 2 (a) is a front view of the lane rope float, and FIG. 2 (b) is a side view of the lane rope float.

FIG. 3(a) is a top view of a pool in which a plurality of lane rope floats are attached to a rope.

FIG. 4 is a side view of the lane rope floats disposed at an outer wall side of the pool.

FIG. 5 is a side view of the lane rope floats disposed at the vicinity of a center of the pool.

FIG. 6 is another side view of the lane rope floats disposed at the outer wall side of the pool.

FIG. 7 is a front view of the lane rope float in a state of floating on a water surface of the pool.

FIG. 8 (a) is a side view of an attachment structure for the lane rope float according to a second embodiment of the present disclosure, the attachment structure attaching a plurality of lane rope

floats to a rope at a rope side which is connected to an outer wall of the pool, and FIG. 8 (b) is a

side view illustrating that a plurality of lane rope floats are attached to the rope in the vicinity of the center of the pool.

FIG. 9 is an overall perspective view of a lane rope float according to a third embodiment of the present invention.

FIG. 10 is an overall perspective view of a lane rope float and a spacer according to a fourth

embodiment of the present invention.

FIG. 11(a) is a side view illustrating that a state at which the spacer is attached to the lane rope float according to the fourth embodiment of the present invention, and FIG. 11(b) is a sectional view taken along a line A-A , in which a periphery of a tubular portion is enlarged.

FIG. 12 is a perspective view illustrating a float according to a fifth embodiment embodying from
5 the present invention.

FIG. 13 is a partially enlarged view illustrating one individual space in the float at a center.

FIG. 14 is an enlarged view illustrating a part of a connecting portion, a water vent, and a guide portion, etc., of the float.

FIG. 15 is an enlarged sectional view illustrating the connection portion and a periphery of the
10 float.

FIG. 16 is an explanatory diagram illustrating individual spaces of the float.

FIG. 17 is an explanatory diagram illustrating an opening defined in an outer wall of the float.

FIG. 18 is an explanatory diagram illustrating a water vent of the float.

FIG. 19 is a photograph showing a situation at which waves generated on a water surface when a
15 swimmer swims, the waves are not dissipated.

FIG. 20 is a photograph showing a situation at which the waves are dissipated by the float and the water surface becomes calm.

REFERENCE SIGNS LIST

[0027]

100: lane rope float

110: tubular portion

R:rope

900 :pool

910:outer wall

5 920: center

10: float

11A:arrow (a extending direction of the rope)

12: tubular portion for insertion

13: blade

10 14:connecting portion

15:outer wall portion

16:individual space

17: stopping portion

18: opening

15 19: water vent

20:guide portion (projecting portion)

20A:tapered surface

D1:water surface

A1: volume of the individual space

20 B1: area of the water vent

C1: area of the opening

21: connection portion

D2:vertical direction with respect to the water surface

22: wave preventing portion

5 23: ride-over portion

D1A: at a surface side of the pool

D1B: in the water of the pool

DETAILED DESCRIPTION

[0028] Hereinafter, embodiments of the present invention will be described with reference
10 to the drawings.

[0029] <First Embodiment >

First, FIG. 1 and FIG.2 show a lane rope float 100 according to the first embodiment of the present invention. FIG. 1 is an overall perspective view of the lane rope float 100, FIG. 2(a) is a front view of the lane rope float 100, and FIG. 2(b) is a side view of the lane rope float 100.

15 **[0030]** These lane rope floats 100 are floats for competition and have a same shape. The lane rope float 100 includes a long tubular portion 110 disposed at a center of the lane rope float 100 and through which a rope R can be inserted, a plurality of blades 120 protruding from a side surface 111 of the tubular portion 110 and parallel with the rope R, and a wall surface portion 130 coupled to side end portions 121 of the blades 120 and encircling the blades 120. In addition, an
20 outer periphery of the lane rope float 100 has a diameter of 110 ~150 mm (millimeters). The

reason why the diameter of the lane rope float 100 is set to 110 ~ 150 mm (millimeters) is that the lane rope float 100 of the present invention exhibits a significant effect on the ease of swimming when turning back. Especially when used in speed competitions, the effect of the lane rope float 100 is great. The lane rope float 100 is thus to be adapted to competition rules (refer to the “Pool Recognized Rule”, public financing official, refer to Japanese Swimming Association 2018). In addition, in these competition rules, the diameter of the lane rope float (lane rope buoy) is specified to be 50 mm or more and 150 mm or less, and it is specified to be 150 mm for international pools. Therefore, the diameter of the lane rope float 100 is set to 110 ~ 150 mm.

[0031] Further, as will be described later, a gap X, between the lane rope floats 100 located at a rope R side connected to an outer wall 910 of a pool 900 shown in FIG. 4, needs to be defined in the following way: the waves can easily escape to adjacent lanes, and the lane rope float 100 can withstand the waves by itself then rotate appropriately to ensure the wave attenuation performance.

[0032] Here, as illustrated in FIG. 4, a height H2 of the gap X between the lane rope floats 100 is equal to the diameter of the lane rope float 100. In addition, most of the waves which pass through the gap X can pass through its area excluding the rope R, the rope R may become an obstacle during the wave pass through. In particular, the height H1 (the height from the rope R or a spacer 800 to a wall portion 130 of the lane rope float 100) of the gap X at the area excluding the rope R is closely related to the ease of escape of the waves and the appropriate rotation of the lane rope float 100. More specifically, the lower the height H1 of the gap X, the easier the waves

get over the gap X and the lane rope float 100 and escape to the adjacent lane. On the other hand, if the height H1 of the gap X is too low, the generated waves may exceed the lane rope float 100, etc., and the waves flowing into the lane rope float 100 from the gap X side become too small, so that the appropriate rotation of the lane rope floats 100 cannot be achieved. Therefore, it is
5 necessary to ensure a certain degree of the height to prevent the height H1 of the gap X from being too low. In addition, the appropriate rotation of the lane rope float 100 is not limited to a case at which the float rope float 100 rotates once, but also includes a case at which the lane rope float 100 rotates several times from the horizontal state so as to consume wave energies.

[0033] Here, the swimming competition rules (refer to the “Swimming Competition Rules”

10 public financing official, Japanese Swimming Association) stipulate that one rope R is provided for dividing adjacent lanes, and the diameter of the rope R is 50 mm or more and 150 mm or less.

Therefore, assuming that the diameter of the rope R is 50 mm as the lower limit, the diameter of the float rope float 100 is set at 110 mm or more in the present invention. As a result, the height H1 of the gap X can be secured in a certain extent to prevent the height H1 from being too low,

15 the wave can easily escape to the adjacent lanes, and the lane rope float 100 can withstand the waves by itself then rotate appropriately to ensure the wave absorbing performance. In addition, when the diameter of the rope R is 50 mm as the lower limit, if the diameter of the lane rope float 100 is set 50 mm of the lower limit or more and less than 110 mm as specified by the competition rules, the height H1 of the gap X will be too low.

20 **[0034]** A wall portion 130 between adjacent blade plates 120 is formed obliquely. Openings

140 are formed at opposite sides of the portion which is formed obliquely, so as to define cutout in the wall portion 130, and the waves advancing from the side enter the lane rope float 100 from the opening 140. Further, a protruding plate 150 parallel to the rope R protrudes from an inner surface of the blade 120. Since the waves flowing from the opening 140 collide against the protruding plate 150, turbulence is more easily generated in the lane rope float 100.

[0035] In addition, as illustrated in FIG. 2(b), an outer end 112 of one side of the tubular portion 110 is slightly recessed inward than an outer end 122 of the blade 120, that is, an outer end 170 of the lane rope float 100. Further, an another outer end 113 of another side of the tubular portion 110 projects slightly outward than the outer end 122 of the blade 120, that is, the outer end 170 of the lane rope float 100. As described later, a plurality of lane rope floats 100 are attached to the rope R for use, the another protruding outer end 113 of the another side of the adjacent lane rope float 100 is fitted into the recessed outer end 112 of the one side of the adjacent lane rope float 100, so that positions and postures of the adjacent lane rope floats 100 can be maintained without deviation.

[0036] As illustrated in FIGS. 1 and 2, a partition wall 160 is integrated in the center of the lane rope float 100, and a water hole 161 that allows water to flow in from front to back is formed in the partition wall 160. In addition, six blades 120 are arranged at equal intervals, that is, at 60-degree intervals, around the tubular portion 110 in the lane rope float 100, so that the blades 120 opposite each other are aligned in a straight line. The number or arrangement of the blades 120 can be appropriately changed without being limited to the aspect illustrated in FIG. 1

and FIG.2. In addition, in the outer end 170 of the lane rope float 100, at least a half ($1/2$) of a range from a center of the tubular portion 110 to the wall portion 130, preferably $2/3$ of the range, more preferably $4/5$ of the range, is formed along a plane perpendicular to the tubular portion 110.

[0037] Further, the entire float rope float 100 is integrally molded by injection molding a foaming synthetic resin material for floating on water, and polypropylene or polyethylene, etc. can be employed as the synthetic resin material. In addition, a soft material such as PE (polyethylene) or EVA (ethylene-vinyl acetate copolymer resin) can be used as the synthetic resin material. In addition, the Lane rope floats 100 may entirely be blow molded from the synthetic resin material. In addition, the lane rope float 100 may be molded from an EVA resin colored with an inorganic pigment for suppressing color fading.

[0038] Next, the attachment structure for attaching the plurality of lane rope floats 100 to the rope R will be described with reference to FIG. 3 to FIG. 7. FIG. 3 (a) is a top view of the pool 900 in which the plurality of lane rope floats 100 are attached to the rope R, FIG. 4 is a side view of the lane rope floats 100 disposed at an outer wall 910 side of the pool 900, FIG. 5 is a side view of the lane rope floats 100 disposed in the vicinity of a center 920 of the pool 900, FIG. 6 is a side view of the lane rope floats 100 disposed at the outer wall 910 side of the pool 900, and FIG. 7 is a front view of the lane rope float 100 in the state of floating on the water surface W of the pool.

[0039] As illustrated in FIG. 3, the rope R connected to the outer walls 910 located at opposite sides of the pool 900 and stretched partitions each lane (P1, P2, P2). The rope R is inserted through the tubular portion 110 of each lane rope float 100, and the plurality of lane rope floats

100 are connected along the rope R.

[0040] As illustrated in FIG. 4, in the attachment structure for the lane rope floats 100 according to the present invention, a spacer 800 is disposed between adjacent lane rope floats 100 at the rope R side connected to the outer wall 910 of the pool 900. The spacer 800 is formed of a synthetic resin material and has a substantially cylindrical shape, a through hole 810 which the rope R passes through is defined at a center of the spacer 800. The spacer 800 is attached to the rope R by inserting the rope R into the through hole 810. At the rope R side connected to the outer wall 910 of the pool 900, a width L1 of the gap between the adjacent lane rope floats 100, that is, the gap between the outer end portions 170 of the adjacent lane rope float 100 is widened by the spacer 800. The gap between the adjacent lane rope floats 100 is a gap between the outer end portions 170 of the adjacent lane rope floats 100, and is a portion of an area S2 between the outer end portions 170 of the lane rope floats 100.

[0041] By utilizing the spacer 800 which is separately formed with the lane rope float 100, the width L1 of the gap between the lane rope floats 100 can be easily changed by appropriately changing the width of the spacer 800. Further, when the spacer 800 is arranged and the lane rope float 100 is disposed, the spacer 800 is interposed between the lane rope floats 100 by outer end surfaces of the spacer 800 abutting against end surfaces (113C side) of the adjacent lane rope floats 100, so that the adjacent lane rope floats 100 do not directly contact with each other, it thus can prevent the lane rope floats 100 from being difficult to rotate what is caused by the lane rope floats 100 contacting with each other, or prevent the lane rope floats 100 from being worn out what is

caused by the lane rope floats 100 contacting with each other and. In addition, the spacer 800 is preferably formed of a synthetic resin material having a higher hardness than the synthetic resin material constituting the lane rope float 100. Further, an inner side of the spacer 800 is harder and smoother than an inner side of the tubular portion 110 of the lane rope float 100, so that the lane rope float 100 can easily rotate and the tubular portion 110 of the lane rope float 100 is hardly scraped. Further, the spacer 800 may be formed of polyethylene, and even if the spacer 800 is made of the same raw material as the lane rope float 100, a surface hardness of the spacer 800 can be harder than that of the lane rope float 100. The lane rope float 100 may be a foamed product molded by foam molding, or may be a non-foamed solid product molded by injection molding, the non-foamed solid product having a surface hardness harder than a blown product molded by blow molding. The spacer 800 is not limited to the embodiment shown in FIG. 4, and may be, for example, similar as an object placed in the tubular portion 110, or attached to the rope similar as a clip or a washer to form the gap between the lane rope floats 100. In addition, since a shrinkage rate of the lane rope float 100 varies depending on the color of the material which is used, it is preferable to adjust the gap by combining the spacer 800 with other articles, such as a gasket, so as to match the transmission rate per 1 m. Specifically, the lane ropes for the swimming pool is changed in colors to clarify a distance of 5m or 10m, the lane rope floats having a plurality of colors are attached to one lane rope, and the shrinkage rates of the lane rope floats of the respective colors are different, so that the spacer 800 is arranged between the lane rope floats to adjust the distance. In the case where the spacers 800 are arranged between the lane rope floats, the spacers

800 may be arranged at intervals of one or a plurality of lane rope floats, the spacers 800 may also be evenly or unevenly arranged on one lane rope. In addition, the spacer 800 is separated from the lane rope float 100, but the present invention is not limited thereto, a protrusion may be integrally formed at an end of the tubular portion 110, and the protrusion may be used instead of the spacer.

5 **[0042]** Next, as illustrated in FIG. 5, the spacer 800 is not attached between adjacent lane rope floats 100 in the vicinity of the center 920 of the pool 900. Therefore, the width L2 of the gap between the adjacent lane rope floats, that is, the gap between the outer end portions 170 of the adjacent lane rope floats 100, is narrowed. An L1 of the gap between the lane rope floats 100 at the rope R side connected to the outer wall 910 of the pool 900 is wider than an L2 of the gap
10 between the lane rope floats 100 arranged in the vicinity of the center 920 of the pool 900 ($L1 > L2$).

[0043] In addition, regardless of the rope R side connected to the outer wall 910 of the pool 900 shown in FIG. 4 or the center 920 side of the pool 900 shown in FIG. 5, the lane rope floats 100 serves the same purpose of wave absorbing performance. Specifically, as illustrated in
15 FIG. 7, the rope R is disposed in the vicinity of the water surface W, and the lane rope float 100 attached to the rope R floats on the water surface W. In this state, waves generated by swimmers in the adjacent lanes travel from a lateral side of the lane rope float 100 toward the lane rope float 100. In this way, a part of the waves (refer to W1) enters the interior of the lane rope float 100 from the opening 140 floating above the water surface W while shaking the water surface W up
20 and down.

[0044] In addition, another part of the waves (refer to W2) enters the interior of the lane rope float 100 from the opening 140 sunken below the water surface W. Then, the waves entering the interior of the lane rope float 100 collide with the blades 120 or the protruding plates 150, by a force created at this time, the lane rope float 100 is shaken up and down, or the lane rope float 100 swings around the rope R as the center. As described above, the kinetic energy of the waves is consumed by being converted into the rotational energy of the lane rope float 100, and as a result, the waves are disappeared.

[0045] However, at the outer wall 910 side of the pool 900, the swimming direction is changed by performing a turn action, after the turn action, the swimmer hits the waves which is generated when the swimmer swims before the turn action, thus making it difficult to swim. Furthermore, regarding the large waves when the swimmer turns back, compared to using the lane rope float 100 to eliminate most of the waves, allowing a portion of the waves to escape to an adjacent lane can more reduce the fluctuation or the disturbance of the water surface W, it will become easy to swim after the turn.

[0046] Therefore, as illustrated in FIG. 4, the width L1 of the gap X between the lane rope floats 100 at the rope R side connected to the outer wall 910 of the pool 900 is configured to be wider than the width L2 of the gap between the lane rope floats 100 arranged in the vicinity of the center 920 of the pool 900. At the rope R side connected to the outer wall 910 of the pool 900, since the gap X between the lane rope floats 100 is configured to be wider, the waves can easily escape to the adjacent lane, and the lane rope floats 100 themselves bear the waves and rotate

appropriately, the wave attenuation performance is thus ensured. As a result, in the attaching structure of the lane rope float 100 of the present invention, the fluctuation or the disturbance of the water surface W is reduced, and after turning back, it is less likely to be hit by the waves generated by themselves, and becomes more easier to swim. On the other hand, in the vicinity of the center 920 of the pool 900, since the gap between the lane rope floats 100 is more narrow, it is difficult for the waves to escape to the adjacent lanes, and there is a moderate resistance feeling, and the swimmer can feel the weight of the water and easily pull while swimming.

[0047] The width of the lane rope float 100 at the rope R side connected to the outer wall 910 of the pool 900 is same as the width of the lane rope float 100 arranged in the vicinity of the center 920 of the pool 900, but the width L1 of the gap X between the lane rope floats 100 is wider than the width of the lane rope float 100 at the rope R side connected to the outer wall 910 of the pool 900, such that the lane rope float 100 can be more easily rotate and wave absorbing performance is more high. In addition, as illustrated in FIG. 3, in the pool 900, in a distance L10 from the outer wall 910 along the longitudinal direction of the rope R is within 15 m (meters), preferably within 7 to 15 m (meters), or preferably within the Vassallo mark, the width L1 of the gap X between the lane rope floats 100 is configured to be wider than the width L2 of the gap between the lane rope floats 100 arranged in the vicinity of the center 920 of the pool 900. In addition, in the lane rope float 100 which occupies 80% to 99% of the distance L10 from the outer wall 910, the width L1 of the gap X between the lane rope floats 100 is wider than the width L2 of the gap between the lane rope floats 100 arranged in the vicinity of the center 920.

[0048] In addition, the lane rope float set of the present invention includes the lane rope float 100 and the spacer 800, and the gap between the lane rope floats 100 at the rope R side connected to the outer wall 910 of the pool 900 can be widened by the spacer 800. As a result, at the rope R side connected to the outer wall 910 of the pool 900, the waves easily escape to the adjacent lanes from the wider gap between the lane rope floats 100, and the lane rope floats 100 themselves easily rotate, thereby ensuring the wave absorbing performance. According to this, the fluctuation or the disturbance of the water surface W is reduced, and it makes easier to swim after turning back. On the other hand, in the vicinity of the center 920 of the pool 900, since the gap between the lane rope floats 100 is more narrow, the waves are not easy to escape to the adjacent lanes, and there is the moderate resistance feeling, the swimmer can feel the weight of the water and easily pull while swimming.

[0049] In addition, when arranging the lane rope floats 100, the gap between the adjacent lane rope floats 100 is provided at 8% or more in the up and down direction from the center of the lane rope float 100, such that the gap between the lane rope floats 100 can be widened, more waves are allowed to escape to the adjacent lanes, and the fluctuation or the disturbance of the water surface can be reduced, such that the swimmer can easily swim after turning back. That is, as illustrated in FIG. 4, the height H3 of a portion where the gap is closed at the center side of the lane rope float 100 (the portion is at which the rope R or the spacer 800 is located in FIG. 4) is less than 8% of the height H2 of the lane rope float 100. Furthermore, with respect to the height H2 of the lane rope float 100, the gap X is set to be more wider at a position more adjacent to the outside

for the portion occupying at least 8% in the up and down direction from the center of the lane rope float 100 (a portion of the height H3 corresponding to 8% of the height H2). Furthermore, if the gap between the lane rope floats 100 is disposed at the position of 8% or more, more preferably a position of 10%, in the up and down direction from the center, an appropriate amount of waves are stopped by the lane rope float 100 and then generating a resistance feeling (the weight of water), and by the appropriate resistance, the effect that it is easy for the swimmer to turn around and swim can be obtained.

[0050] As illustrated in FIG. 5, the spacer 800 is not disposed in the vicinity of the center 920 of the pool 900, and the width L2 of the gap between the lane rope floats 100 is narrowed, but the present invention is not limited thereto. If the width L2 of the gap between the lane rope floats 100 in the vicinity of the center 920 of the pool 900 is narrower than the width L1 of the gap between the lane rope floats 100 at the outer wall 910 side of the pool 900, for example, even in the vicinity of the center 920 of the pool 900, a spacer having a width narrower than the spacer 800 shown in FIG. 4 may be attached between the lane rope floats 100. Further, as illustrated in FIG. 5, in the vicinity of the center 920 of the pool 900, the widths L2 of the gaps between the lane rope floats 100 are uniform, and as illustrated in FIG. 4, in the vicinity of the outer wall 910 of the pool 900, the widths L1 of the gaps between the lane rope floats 100 are configured to be uniform, but this is not limited thereto, and the widths of the gaps between the lane rope floats 100 may gradually widen from the center 920 of the pool 900 to the outer wall 910.

[0051] Further, as illustrated in FIG. 4, the lane rope floats 100 are continuously arranged

in the vicinity of the outer wall 910 of the pool 900 in such a way that the widths L1 of the gaps between the lane rope floats 100 become uniform, but the present invention is not limited thereto, and as long as the widths L1 of the gaps between at least a part of the lane rope floats 100 are widened in the vicinity of the outer wall 910 of the pool 900, the lane rope floats other than the

5 lane rope floats 100 configured with the width L1 may be configured and constructed arbitrarily.

For example, the lane rope floats other than the lane rope floats 100 configured with the width L1 may be disposed at intervals narrower than the width L1 or may be different types of lane rope floats. The reason is that, even in this case, if the widths L1 of the gaps between at least a part of the lane rope floats 100 are widened, the waves are easy to escape to the adjacent lanes, and the

10 lane rope floats 100 themselves easily rotate, thereby ensuring the wave absorbing performance, and the fluctuation or the disturbance of the water surface W is reduced, thus making it easier to swim after turning back. Similarly, as illustrated in FIG. 5, the lane rope floats 100 are continuously arranged in the vicinity of the center 920 of the pool 900 in such a way that the widths L2 of the gaps between the lane rope floats 100 become uniform, but the present invention is not limited thereto, and as long as the widths L2 of the gaps between at least a part of the lane rope floats 15 100 are narrowed in the vicinity of the center portion 920 of the pool 900, the lane rope floats other than the lane rope floats 100 configured with the width L2 may be configured and constructed arbitrarily.

[0052] In addition, as illustrated in FIG. 6, the gaps between the lane rope floats 100 at the 20 rope R side connected to the outer wall 910 of the pool 900 are widened to allow the waves to

easily pass therethrough, and a wave transmission rate which represents the ease of passage of the waves, that is a transmission rate of the gap, is set at 2~ 30%. Here, the transmission rate is used to define the ease of passage of the waves in the adjacent lane rope floats 100, and as illustrated in FIG. 6, in a side view, is the ratio of the area S2 of the gap X between the lane rope floats 100 to the area S1 occupied by the lane rope floats 100.

[0053] More specifically, as illustrated in FIG. 6, in the side view, the area S1 occupied by the lane rope floats 100 is an area (shown as a gray portion in FIG. 6) of a quadrangular portion surrounded by a center line D1 of the adjacent lane rope floats 100 and a straight line D2 connecting the wall surface portions 130 of outsides of the lane rope floats 100. As illustrated in FIG. 6, in the side view, the area S2 of the gap X between the lane rope floats 100 is an area (shown as a diagonal portion in FIG. 6) of the entire gap X between the outer end portions 170 of the adjacent lane rope floats 100. In addition, the transmission rate (%) is obtained by dividing the area S2 by the area S1 and then multiplying by 100, that is, by the formula of transmission rate (%) = (S2÷S1)×100.

[0054] Furthermore, at the rope R side connected to the outer wall 910 of the pool 900, the gap between the lane rope floats 100 can be widened by setting the transmission rate of the gap X between the lane rope floats 100 to be 2% to 30%, and more waves can escape to the adjacent lanes, and the fluctuation or the disturbance of the water surface can be reduced, so that the swimmer can easily swim after turning back. Further, if the transmission rate of the gap between the lane rope floats 100 is 2 to 10%, preferably 3 to 7%, more preferably 4 to 5%, the moderate

amount of waves are stopped by the lane rope floats 100 so that a resistance feeling is generated, and the effect of the swimmer easily swimming after turning back can be achieved by the appropriate resistance (the weight of water).

[0055] In addition, the openings 140 between respective adjacent lane rope floats 100 are

5 substantially parallelogram, they are configured in such a way that spanning the gap X between the lane rope floats 100. A portion of the opening between the adjacent lane rope floats 100 overlapping with the gap X is at least 0% to 10%, and more preferably 1% to 2%, such that the moderate amount of the waves entering from the opening 140 of the respective lane rope floats 100 can escape to the adjacent lanes, and the fluctuation or the disturbance of the water surface is
10 reduced, and it becomes easy to swim for the swimmer after turning back. More specifically, the waves entering the opening 140 become turbulent and then are attenuated, and are further attenuated when passing through the gap X. In other words, when the area of a large opening 141 (refer to an opening of a substantially parallel quadrangle in FIG. 6) which is formed by the openings 140 of the adjacent lane ropes 100 is represented by Z0, and the area of the portion where
15 the opening 141 overlaps the gap X (the portion indicated by the diagonal line in the opening 141 in FIG. 6) is represented by Z1, The optimal setting for the area Z1 is 0% to 10% of the area Z0, and more preferably 1% to 2%.

[0056] Among swimmers, Japanese top 10 swimmers called top-tip swimmers, or

swimming game players capable of swimming a few seconds later than the Japanese note easily
20 feel the resistance or weight of the water in the pool or the like through the skin, easily affecting

the swimming competition results.

[0057] On the other hand, as illustrated in FIG. 5, the spacer 800 is not disposed in the vicinity of the center 920 of the pool 900, the width L2 of the gap between the lane rope float 100 is thus narrowed. Therefore, in the vicinity of the center 920 of the pool 900, the transmission rate of the gap between the lane rope floats 100 decreases only at the narrower portion of the width L2 of the gap. That is, the transmission rate of the gap between the lane rope floats 100 at the rope R side connected to the outer wall 910 of the pool 900 shown in FIG. 6 is higher than the transmission rate of the gap between the lane rope floats 100 in the vicinity of the center 920 of the pool 900 shown in FIG. 5. As a result, the waves are not easy to escape to the adjacent lanes in the vicinity of the center 920 of the pool 900 having the low transmission rate, and there is a moderate resistance feeling, the swimmer can feel the weight of the water and easily pull while swimming. On the other hand, the waves easily escape to the adjacent lanes at the rope R side connected to the outer wall 910 of the pool 900 having the high transmission rate, then the swimmer can easily swim after turning back. In addition, it is preferable that a difference (T1-T2) between the transmission rate (T1) of the gap between the lane rope floats 100 at the rope R side connected to the outer wall 910 of the pool 900 and the transmission rate (T2) of the gap between the lane rope floats 100 in the vicinity of the center 920 of the pool 900 is $0 < (T1-T2) < 10$, and more preferably $0 < (T1-T2) < 5$.

[0058] [Second Embodiment]

Next, referring to FIG. 8, an attachment structure of a lane rope float using a lane rope float 100A

according to a second embodiment of the present invention will be described. FIG. 8 (a) is a side view showing a state in which a plurality of lane rope floats 100A are attached to the rope R at the rope R side connected to the outer wall 910 of the pool 900, and FIG. 8(b) is a side view showing a state in which a plurality of lane rope floats 100A are attached to the rope R in the vicinity of the center 920 of the pool 900. Further, the configuration of the lane rope float 100A according to the second embodiment of the present invention differs in that a width of the lane rope float 100A is wider than the width of the lane rope float 100 according to the first embodiment, and the other points are the same as those of the lane rope float 100 according to the first embodiment, and thus detailed description thereof is omitted.

[0059] As illustrated in FIG. 8(a), a plurality of lane rope floats 100 are attached to the rope R at the rope R side connected to the outer wall 910 of the pool. On the other hand, a plurality of lane rope floats 100A are attached to the rope R in the vicinity of the center 920 of the pool. Although the lane rope float 100A has the same structure as the float rope float 100, an overall length of the lane rope float 100A, that is, a width L3 along the extending direction of the rope R, is wider than the width L4 of the lane rope float 100. Since the lane rope float 100A and the lane rope float 100 are different only in width, the width L2 of the gap between the adjacent lane rope floats 100A is equal to the width L2 of the gap between adjacent lane ropes 100 when they are attached to the rope R.

[0060] Therefore, as illustrated in FIG. 8 (b), in the vicinity of the center 920 of the pool, the width L3 of the lane rope float 100A is wide, so that, in each unit length along the rope R, the

number of lane rope floats 100A that can be arranged is decreased and the number of the gaps between the lane rope floats 100A is decreased. On the other hand, as illustrated in FIG. 8(a), at the rope R side connected to the outer wall 910 of the pool, since the width L4 of the lane rope float 100 is narrow, in each unit length along the rope R, the number of the lane rope floats 100 that can be arranged is increased, and the number of the gaps between the lane rope floats 100 is increased.

[0061] More specifically, as illustrated in FIG. 8 (b), in the vicinity of the center 920 of the pool, there are two gaps with the width L2 between the lane rope floats 100A per unit length L5 along the rope R, whereas as illustrated in FIG. 8 (a), at the rope R side connected to the outer wall 910 of the pool, there are five gaps with the width L2 between the lane rope floats 100 per unit length L5 along the rope R.

[0062] Thus, as illustrated in FIG. 8 (b), since the width L3 of the lane rope floats 100A are wide in the vicinity of the center 920 of the pool, the number of the gaps between the lane rope floats 100A is decreased, it is not easy for the waves to escape to the adjacent lanes, and the waves are significantly eliminated by the lane rope floats 100A. On the other hand, as illustrated in FIG. 8(a), since the width L4 of the lane rope floats 100A are narrow at the rope R side connected to the outer wall 910 of the pool, the number of the gaps between the lane rope float 100A is increased, so that it is easy for the waves to escape to the adjacent lanes, and the lane rope floats 100A easily rotate by themselves, thereby ensuring the wave absorbing performance. As a result, the fluctuation or the disturbance of the water surface W is reduced, and after turning back, it is less

likely to be hit by the waves generated by themselves, and it is easy to swim after turning back.

[0063] Further, as illustrated in FIG. 8(a), the lane rope floats 100A with the width L4 are continuously arranged in a long range in the vicinity of the outer wall 910 of the pool 900, but it is not limited to thereto, and in the vicinity of the outer wall 910 of the pool 900, as long as the width L4 of at least a part of the lane rope floats 100A is narrowed, the lane rope floats other than the lane rope floats 100A with the width L4 may be any width and constitution. For example, the lane rope floats other than the lane rope floats 100A having the width L4 may be configured to be wider than the width L4 or may be different types of lane rope floats. A reason is that, even in this case, if the width L4 of the at least a part of the lane rope floats 100A is narrowed, it is easy for the waves to escape to the adjacent lanes, the lane rope floats 100A easily rotate by themselves, thereby ensuring the wave absorbing performance, the fluctuation or the disturbance of the water surface W is reduced, and this makes it easier to swim after turning back. As a result, the fluctuation or the disturbance of the water surface is reduced, and after turning back, it is less likely to be hit by the waves generated by themselves, and it is easy to swim after turning back. Similarly, as illustrated in FIG. 8(b), the lane rope floats 100A having the width L3 are continuously arranged in a long range in the vicinity of the center 920 of the pool 900, but it is not limited thereto, the lane rope floats other than the lane rope floats 100A with the width L3 may be any width and constitution as long as the width L3 of at least a part of the lane rope floats 100A is wide.

[0064] <Third Embodiment>

Next, referring to FIG. 9, a lane rope float 100B according to a third embodiment of the present

invention will be described. In addition, FIG. 9 is an overall perspective view of the lane rope float 100B. Further, since the structure of the lane rope float 100B according to the third embodiment of the present invention is the same as the structure of the lane rope float 100 according to first embodiment except that the number of the blade plates 120B is different, therefore detailed description thereof will be omitted.

[0065] As illustrated in FIG. 9, five blades 120B, which project from a side surface 111B of the tubular portion 110B and are parallel to the rope R, are disposed in the lane rope float 100B. By reducing the number of blades 120B, when the lane rope float 100B is floated on the water, the lane rope float 100B becomes easy to rotate as compared with the lane rope float 100 of the first embodiment which has a total of six blades 120. Furthermore, either may only attach any one of the lane rope float 100B of the third embodiment and the lane rope float 100 of the first embodiment, which have different number of the blades, to the rope R, or may attach both of the lane rope float 100B of the third embodiment and the lane rope float 100 of the first embodiment to the rope R in a mixed manner. Although there are five total blades 120B in the lane rope float 100B of the third embodiment, the number of blades 120B can be set arbitrarily. Further, in the present invention, the lane rope floats having different numbers and types of blades may be used in the mixed manner.

[0066] < Fourth Embodiment >

Next, referring to FIG. 10 and FIG. 11, a lane rope float 100C and a spacer 800C according to a fourth embodiment of the present invention will be described. In addition, FIG. 10 is an overall

perspective view of the lane rope float 100C and the spacer 800C, FIG. 11(a) is a side view of a state in which the spacer 800C is attached to the lane rope float 100C, and FIG. 11(b) is a cross-sectional view taken along line A-A with a periphery of a tubular portion 110C being enlarged.

Further, since the configuration of the lane rope float 100C according to the fourth embodiment of the present invention is the same as the configuration of the lane rope float 100 according to first embodiment except that shapes around one outer end 112C and the other outer end 113C of the tubular portion 110C are different, and therefore detailed description thereof is omitted.

[0067] In the lane rope float 100C, an outer end 122C of a blade 120C in the vicinity of a tubular portion 110C is recessed more inward than the outer end 112C of the tubular portion 110C to form a recessed portion 125C. The outer end 122C of the blade 120C in the vicinity of the tubular portion 110C is recessed more inward than the outer end 113C of the tubular portion 110C to form a recessed portion 125C. By being recessed inward, a space in which the spacer 800C attached to the adjacent lane rope float abuts against the one outer end 112C or the other outer end 113C of the tubular portion 110 can be formed, the spacer 800C attached to the adjacent lane rope float engages on the outer end 122C of the blade 120C so as to prevent the spacer 800C from tilting, and it can be configured to arrange the lane rope floats 100C in a regular arrangement.

[0068] In addition, both the one outer end 112C and the other outer end 113C of the tubular portion 110C of the lane rope float 100C are disposed in a same plane with the outer end 122C of the blade 120C, but it is not limited thereto, and both the one outer end 112C and the other outer end 113C of the tubular portion 110C of the lane rope float 100C may protrude beyond the outer

end 122C of the blade plate 120C. Furthermore, the protrusion amounts may be the same or different.

[0069] In addition, the spacer 800C is made of synthetic resin material and has an approximately cylindrical shape, and being surrounded by an outer peripheral portion 801C, it has an inserting portion 820C having a through hole 810C, and the inserting portion 820C extends linearly across both end portions in a way that a metal wire is insertable therethrough. In addition, the inserting portion 820C is inserted into the tubular portion 110C and the spacer 800C is attached to the lane rope float 100C. The spacer 800C includes a protruding portion 830C on an end side of the inserting portion 820C, and the protruding 830c protrudes outwardly from the tubular portion 110C without inserting into the tubular portion 110C. An outer diameter of the protruding portion 830C may be larger than an outer diameter of the inserting portion 820C, and may be formed into a substantially T-shape in the side view. In addition, the construction of the spacer 800C is different from the spacer 800 shown in FIG. 4, but the effect is substantially the same as that of the spacer 800 shown in FIG. 4, the spacer 800C is disposed between the adjacent lane rope floats, and the width of the gap between the lane rope floats is adjustable.

[0070] Furthermore, by attaching the spacer 800C to the lane rope float 100C, it can prevent a shaft portion of the lane rope float 100C from being split when the lane rope float 100C is wound around a reel during storage. More specifically, as illustrated in FIG. 11(b), a strength, such as impact strength and compressive strength etc., from an inner surface 802C side of the inserting portion 820C toward an outer edge portion 801C of the spacer 800C is stronger than a

strength from an inner surface 114C side toward an outer surface 115C side of the tubular portion 110C of the lane rope float 100C. In addition, it may prevent the spacer 800C from being scratched by the metal wire by increasing a radius of curvature of an outer edge 811C of the through hole 810C of the spacer 800C, and may prevent the metal wire from being caught on the spacer 800C and causing the spacer 800C detaches from the tubular portion 110C of the lane rope float 100C when the lane rope float 100C is wound around the reel and stored.

[0071] By the way of making a wall thickness of the inserting portion 820C of the spacer 800C be thinner than a wall thickness of the tubular portion 110C of the lane rope float 100C, when the spacer 800C is attached to the lane rope float 100C, a step difference 108C between the inner surface 802C of the inserting portion 820C of the spacer 800C and the inner surface 114C of the tubular portion 110C of the lane rope float 100C is small, such that the metal wire is not easily being caught. Further, in the tubular portion 110C, the inner diameter is partially increased at a portion where the inserting portion 820C of the spacer 800C is inserted, and a recessed portion 116C having a shape recessed from the inner surface 114C of the tubular portion 110C is formed.

Therefore, when the inserting portion 820C of the spacer 800C is inserted into the recessed portion 116C, a step difference 108C between the inner surface 802C of the inserting portion 820C of the spacer 800C and the inner surface 114C of the tubular portion 110C of the lane rope float 100C becomes smaller, and the metal wire is less likely to be caught. In addition, a step difference 109C between the inner surface 114C of the tubular portion 110C and the recessed portion 116C is larger than the step difference 108C.

[0072] In addition, in the case of stretching the rope, a position of the inner diameter of the lane rope float 100C in the vicinity of the center of the tubular portion 110C and the inner diameter of the spacer 800C at the time of installing the spacer 800C may be located on a straight line (a same plane), such that the rope is not easily hooked. Further, when the spacer 800C is attached to one outer end portion of the tubular portion 110C and the lane rope floats 100C are arranged and the rope is stretched, the rope hits against the inner surface of each spacer 800C. Since the rope hardly hits against the tubular portion 110C of the lane rope float 100C, the lane rope float 100C is not easily broken. A construction of one outer end portion 112C side of the tubular portion 110C and a construction of the other outer end portion 113C side are bilaterally symmetrical. Moreover, in FIG. 10 and FIG.11, the spacer 800C is attached only to one outer end portion 112C side of the tubular portion 110C, but it is not limited thereto, and the spacer 800C may be attached only to the other outer end portion 113C side of the tubular portion 110C, or may be attached to both the outer end portion 112C and the outer end portion 113C.

[0073] Since both the lane rope float 100C and the spacer 800C are made of polyethylene, sorting is not required when they are discarded, and thus the recycling operation is easy.

[0074] The tubular portion 110C of the lane rope float 100C is provided in such a way that the diameter of the tubular portion 110C is increased from the center 117C to the outer end 118C. Therefore, it is easy to remove from the mold during molding. In addition, since it is configured that the diameter of the tubular portion 110C is increased from the center 117C toward the outer end 118C, the lane rope float 100C is hardly caught when the lane rope float 100C is

being attached to the metal wire or the like, such that the workability is improved.

[0075] <Fifth Embodiment>

Next, a fifth embodiment embodying the present invention will be described with reference to the drawings. FIG. 12 shows an entire float 10 of the fifth embodiment. The float 10 is formed by injection molding of a foaming synthetic resin material, and for example, a material that floats on the water is used so as to rapidly eliminate waves propagating on a surface side of the water stored in the pool or in the water (hereinafter, generically referred to as "water surface"). Specific examples of the material include polypropylene, polyethylene, etc., and the specific gravity of the entire float is 1 or less. However, when a floater or the like is attached to the float, the specific gravity of a float portion other than the floater may be more than 1.

[0076] As illustrated in FIG. 12 and FIG.13, the float 10 includes a tubular portion 12 for insertion of a rope 11 (virtually shown) at a center thereof. The tubular portion 12 includes an opening 12A extending along an extending direction (a direction of an arrow 11A) of the rope 11 which is stretched in the pool, and the float 10 can be attached to the rope 11 by inserting the rope 11 into the opening 12A, so that the tubular portion 12 functions as a central mounting portion. Here, the float 10 is formed with a point symmetrical structure based on a center point existed in the tubular portion 12. For convenience of description, of a structure of one side (a left side of a center line 10A), same reference numerals are given to same structures, and a description of an opposite side (a right side of the center line 10A) is omitted.

[0077] A plurality of blades 13 (six blades in this embodiment) extend from an outside of

the tubular portion 12. More specifically, each blade 13 extends only a predetermined length in the direction of the arrow 11A and extends outwardly from the outer side of the tubular portion 12 by 60 degrees. Each of the blades 13 forms a connecting portion 14 configured for connecting with each other, and circumferential outer wall portions 15 for connecting the blades 13 to each other are formed at outer edges of the six blade plates 13. The outer wall portion 15, the adjacent connecting portion 14, a pair of adjacent blades 13, and the tubular portion 12 form small spaces (hereinafter referred to as "individual space" 16) that divide the entire space in the float 10 into six equal parts. The position at which the tubular portion 12 and the blade 13 are connected can be appropriately changed, and the blade 13 may be configured not to contact the outside of the tubular portion 12. In this case, the individual space 16 is defined by the adjacent pair of blades 13, the adjacent connecting portions 14 and the adjacent outer wall portions 15.

[0078] In addition, the outer wall portion 15 includes a stopping portion 17 configured for stopping the waves propagated from the water surface D1 of the pool outside the float 10, the stopping portion 17 defines an opening 18 which is configured for introducing the waves propagated from the water surface D1 of the pool into the individual space 16. More specifically, as illustrated in FIG. 13, the stopping portion 17, which faces the opening 18, is a curve along an outer surface of the outer wall portion 15, and further, the amount of the inflow water entering from the pool water surface D1 is formed on the peripheral surface of the blade plate 13 facing the adjacent blade plate 13. Here, by forming the opening 18 including a large inflow amount portion E1 where the inflow amount is large and a small inflow amount portion E2 where the inflow

amount is small, the periphery of the stopping portion 17 which is in contact with the opening 18 is in a curved shape in such a way that the inflow amount of water from the opening 18 between the large inflow amount portion E1 and the small inflow amount portion E2 gradually changes. In addition, in a situation in which the inflow of water introduced into the individual space 16 is sufficiently satisfied, the kinetic energy of the waves transmitted to the water in the individual space 16 imparts the kinetic energy to the pair of blades 13, the adjacent connecting portions 14 and the adjacent outer wall portions 15, thereby enabling the entire float 10 to oscillate. At this time, the ratio of the opening 18 to the stopping portion 17 may be appropriately set for oscillating efficiently.

[0079] Further, three water vents 19 are defined in the connecting portion 14 which connects the blades 13 and the outer wall portion 15, and these water vents 19 allow the wave introduced into the individual space 16 flow into the water. In this case, the water in the left individual space 16 flows into the right individual space 16, in addition, the water in the right individual space 16 flows into the left individual space 16. As a structure relating to the connecting portion 14 and the water vent 19, a width of the connecting portion 14 (that is, a width for stopping the water) and widths of a water pathways of the three water vents 19 can be appropriately set. That is, the ratio can be arbitrarily changed by fixing one of the widths of the connecting portion 14 and the widths of the water pathway of the three water vents 19 and changing the other one. For example, the water vent 19 has an opening of 20 to 60% preferably 25 to 50%, and more preferably 30 to 45% with respect to the connecting portion 14. If the water vent 19 is opened too

much with respect to the connecting portion 14, the strength of the entire float may be reduced, and the float may be damaged or deformed in a packaged and wound state during storage. As a result, the inflow amount of water introduced into the individual space 16 can be adjusted to an appropriate inflow amount. As described above, by appropriately changing the width of the connecting portion 14 and the widths of the water pathways of the water vents 19, because the amount of water introduced into the individual space 16 is different, and the kinetic energy of the waves traveling through the water is different, the oscillation amount of the float 10 changes, and the degree of dissipation of the waves traveling on the water surface is changed. In addition, the width of the connecting portion 14 and the position and the shape of the water vent 19 may be appropriately changed other than those in this embodiment.

[0080] As illustrated in FIG. 14, the connecting portion 14 is provided with a protruding portion 20 for guiding the waves introduced into the float 10 through the opening 18. The protruding portion 20 functions as a guide portion for guiding the waves in the individual space 16, and a tapered surface 20A is formed at a part (in this case, a part on left and right sides of the protruding portion 20) of the protruding portion 20, and the tapered surface 20A is configured to guide the waves transmitted in the individual space 16 to the water vent 19. In addition, the protruding portion 20 may be changed to a shape other than the tapered surface, as long as the protruding portion 20 has a function of guiding the waves. More specifically, the shape of the protruding portion 20 can be arbitrarily adjusted by changing a height, a position, and a slope of the tapered surface, etc. of the protruding portion 20, which define the shape of the protruding

portion 20. For example, the amount of water flowing along a surface of the protruding portion 20 can be equally distributed by disposing the protruding portion 20 at a center of the connecting portion 14. Alternatively, for example, the position of the protruding portion 20 may be disposed closer to a side (one side) of the multiple water vents 19. Furthermore, the protruding portion 20 may be configured to connect the adjacent blades 13 to each other or to have a length of 80% to 100%, preferably 85% to 95%, between the blades 13. In addition, in order to improve the capability of the wave attenuation, the height of the protruding portion 20 can be an arbitrary height in the direction of the arrow 11A. A projecting plate 21 configured for reflecting and guiding the waves entering the individual space 16 and extending parallel to the direction of the arrow 11A is located at a position opposite the opening 18 in the blade plate 13, so as to. In this case, the projecting plate 21 is arranged at a position opposite to the adjacent blade 13 and is connected to the protruding portion 20 located on the outer periphery of the connecting portion 14. The structures of the protruding portion 20 and the projecting plate 21 are configured to guide the waves in the individual space 16 to the water vent 19, and a thickness of the projecting plate 21 is preferably set to be substantially equal to a thickness of the protruding portion 20. For example, the thickness of the projecting plate is equal to the width of the blade 13 or less than 1.5 times of the width of the blade 13, and the width of the projecting plate is equal to the length of the blade 13.

[0081] In the case of the above mentioned float 10, the stopping portion 17 stops the waves transmitted from the water surface D1 of the pool, which is outside the float 10, and reflects toward

the outside of the float 10. On the other hand, when the waves transmitted from the outside of the float 10 are introduced into the individual space 16 through the opening 18, since the waves collide with the blade 13, the connecting portion 14, and the projecting plate 21, etc. in the individual space 16, the turbulence may be generated in the water in the individual space 16, and this turbulence causes the shake, rotation, displacement, etc. (hereinafter simply referred to as “shake, etc.”) of the float 10 attached to the rope 11. Furthermore, the waves reflected by the collision against the blade 13 and the connecting portion 14, etc. are discharged from the opening 18 and the water vent 19 into the individual space 16 next to the shared connecting portion 14 and the water vent 19. As a result, the waves further generate the turbulence by hitting the blade 13, the protruding portion 20, the projecting plate 21, etc. in the adjacent individual space 16, and this turbulence causes the shake, rotation, displacement, etc. (hereinafter simply referred to as “shake, etc.”) of the float 10 attached to the rope. The energy of the waves transmitted into the individual space 16 in this way causes the turbulence in the water within the individual space 16, and the energy generating this turbulence is consumed within the float 10, with the result the waves caused by the swimmer are dissipated by the shake, etc. of the float 10. In addition, the area of the opening 18 is 40% to 70%, preferably 50% to 60%, of the outer wall 15, and the stopping portion 17 is 30% to 60%, preferably 40% to 50%, of the outer wall portion 15. The waves are prone to turbulence then be consumed by the area of the opening 18 being larger than that of the stopping portion 17. Among the waves entering from the opening 18, the waves entering from the opening 18 and the waves bouncing against the blade 13 generate the turbulence and are then dissipated, and further,

the turbulence is generated, and the waves are then dissipated at a rear surface side of the stopping portion 17. By making the area of the opening 18 be larger than that of the stopping portion 17, the amount of water increases, and the waves complicatedly generate the turbulence and are then dissipated.

5 **[0082]** Furthermore, at the connecting portion 14 including the protruding portion 20, the waves transmitted in the individual space 16 can be smoothly guided to the water vent 19, whereas assuming that the protruding portion 20 is not formed, there is a possibility that the waves transmitted in the individual space 16 cannot be smoothly guided to the water vent 19. Accordingly, the protruding portion 20 performs a function of guiding the waves introduced into the individual
10 space 16 via the opening 18 to the water vent 19.

[0083] In addition, as shown in Fig. 15, at the connection portion 15A which connects the outer wall portion 15 and the blade 13, an wave preventing portion (a portion where the waves pass) 22 is formed at one side of a position cut in a vertical direction D2, which is perpendicular to the water surface D1, and in the extending direction of the rope (in the direction of the arrow
15 11A), an ride-over portion (a portion where the waves do not pass) 23 is then formed on an opposite side of the position. More specifically, in the vicinity of the connection portion 15A, the one side and the opposite side of the blade 13 are shaped differently from each other, and the wave preventing portion 22 (in this case, has a shape different from the ride-over portion 23 and without convexity) is substantially co-plane with the water surface of the water surface side D1A of the
20 pool, so that the waves can easily pass over, while the ride-over portion 23 forms a convex shape

(a thicker shape) toward the water, the waves in the water thus cannot pass over the ride-over portion 23.

[0084] In this case, a shape of an outer end of the wave preventing portion 22 and an outer end of the ride-over portion 23 substantially coincide with the circumferential direction of the outer wall portion 15, and the outer end of the ride-over portion 23 is substantially co-plane with the outer wall portion 15. Further, the thickness of the ride-over portion 23 may be set to be thinner than the thickness of the outer wall portion 15 from the viewpoint of weight reduction. The shapes, positions, sizes, thicknesses, etc. of the wave preventing portion 22 and the ride-over portion 23 are not limited to these, but can be changed appropriately. Further, the height of the wave preventing portion 22 which the waves pass over only needs to be lower than the height of the ride-over portion 23. When the float 10 is attached to the rope, and due to the tension of the rope, the wave preventing portion 22 of the float 10 may sink from of the water surface side D1A of the pool. However, even in this case, a same effect can be obtained.

[0085] As a result, in a situation that blade 13 is placed on the water surface D1, if the wave preventing portion 22 is positioned on the water surface side D1A and the ride-over portion 23 is positioned in the water D1B, when the waves transmitted from the outside of the float 10 are introduced into the individual space 16, it is easy for the waves to pass over the wave preventing portion 22, enter the individual space 16 and be reflected by the ride-over portion 23. By employing such a configuration, it is easy to shake, etc., the float 10 by the waves transmitted from the water surface D1 of the pool and out of the float 10. In addition, when a wall thickness of the

ride-over portion 23 including the convex shape is increased, the strength of the entire float 10 is ensured, and the damage during operating of the float 10 is prevented. Here, in the individual spaces 16 which share the water vent 19 at the left and right side shown in FIG. 12, the wave preventing portion 22 of the left float 10 becomes on the water surface side D1A, while the ride-over portion 23 becomes in the water D1B side, in contrast to this, the wave preventing portion 22 of the right float 10 becomes in the water D1B side, and the ride-over portion 23 becomes on the water surface D1A, and this structure is adopted from the viewpoint of eliminating complexity in judging the direction of the float 10 when attaching the float 10 to the rope. Here, in the case where the wave preventing portion 22 is disposed at the large inflow amount portion E1 side and the ride-over portion 23 is disposed at the small inflow amount portion E2 side, it is easy for the waves transmitted on the water surface D1 to pass over the wave preventing portion 22 from the large inflow amount portion E1 side so as to allow more waves enter the individual space 16, while more waves are reflected by the ride-over portion 23 at the small inflow amount portion E2 side, and the wave dissipating function by the shake, etc. of the float 10 is improved.

[0086] As described above, even if the wave preventing portion 22 of one float 10 (right side) becomes at the water D1B side and the ride-over portion 23 becomes at the water surface D1A side, and the wave preventing portion 22 of the float 10 on the opposite side (left side) becomes at the water surface D1A side and the ride-over portion 23 becomes at the water D1B side, such that it is easy for the waves transmitted from the water surface D1 of the pool and out of the float 10 to make the float 10 shake, etc.. In the case where the above-described configuration

is adopted, the waves can be quickly dissipated, and in order to quickly proceed the swimming competition, after a short wave attenuation time following a previous swimmer's competition, the next swimmer can start the competition.

[0087] The photograph shown in FIG. 19 shows a state in which the waves transmitted on

5 the water surface D1 of the pool are not dissipated immediately after the swimmer swam in the lane. On the other hand, the photograph shown in FIG. 20 shows a state in which the waves are dissipated by the floats 10 attached to the rope dividing the lane and the water surface D1 becomes calm after the swimmer swam in the lane. The inventors observed the conditions of these water surfaces D1, and examined a large number of images, and as a result, following results can be

10 achieved. Specifically, a volume of the individual space 16 (a colored portion in FIG. 16) is denoted by A1, and a total area (a colored portion in FIG. 18) of the water vent 19 is denoted by B1, and a total area of the opening 18 (the colored portion in FIG. 17) is denoted by C1. In this case, the volume of the individual space 16 is approximately one sixth of the total space (excluding the wall portion) in the float 10. The total area B1 of the water vents 19 may be calculated by

15 summing up areas of the three concentric water vents 19. Further, the total area C1 of the openings 18 can be calculated by subtracting the area of one sixth of the total area of the stopping portion 17 from one sixth of a total outer circumferential area of the float 10.

[0088] When the ratio of A1 (the volume of the individual space 16) to B1 (the total area

B1 of the water vents 19) is not more than 1000: 5 (not more than a lower limit), it can be inferred

20 that the attenuation amount of the waves transmitted in the individual space 16 is relatively small,

and the attenuation of the waves in the individual space 16 is insufficient. In addition, when the ratio of A1 to B1 is not less than 1000: 15 (not less than an upper limit), it can be inferred that the attenuation amount of the waves transmitted in the individual space 16 is relatively small and the attenuation of the waves in the individual space 16 is insufficient. It should be noted that, the so-called “the attenuation of the waves is insufficient” ,as a judgment basis, refers to a situation in which the waves are not dissipated before a predetermined time (for example, 1 minute and 30 seconds) passes after the swimmer swam. On the other hand, the so-called “the situation in which the attenuation of the waves is sufficient” refers to a situation in which the waves are dissipated before the predetermined time (for example, 1 minute and 30 seconds) after the swimmer swam.

As a result, it can be inferred that allowable values of the ratio of A1 to B1 which are not less than the lower limit (1000:5) and not more than the upper limit (1000:15) coincides with allowable values which are not less than a lower limit and not more than an upper limit based on a wave attenuation related basis (whether or not the predetermined time after the swimmer swam has elapsed). Further, when the ratio of A1 to B1 is within the allowable values which are not less than the lower limit and not more than the upper limit, it was found that the wave attenuation was sufficient. As a result, regarding the ratio of A1 to B1 , etc., we found that there was a possibility that the wave attenuation would be improved by further verification, and various trial and error tests are performed. For example, in addition to the above-described one minute and 30 seconds (the wave attenuation related basis), the predetermined period of time after the swimmer swam may be set to a shorter predetermined time, for example, one minute and 20 seconds, the shorter

the elapsed time after the swimmer swam, the higher the function of performing wave attenuation (wave attenuation performance). In addition, when the predetermined time after the swimmer swam is set to 1 minute and 20 seconds, if the ratio of A1 to B1 is within the allowable values which are not less than (1000: 6) (not less than the lower limit) and not more than (1000: 10) (not more than the upper limit), it is possible to notify that the wave attenuation is sufficient. In addition, as the wave attenuation related basis, another basis (official basis, internal basis, etc.) may be adopted except for the presence or absence of the predetermined time after the swimmer swam.

[0089] In addition, as a further examination for the situation of “the attenuation of the waves is insufficient” and the situation of “the attenuation amount of the waves is appropriate”,

the following criteria were found. That is, as in the case of the above-described determination criterion, when the ratio of A1 (the volume of individual space 16) to C1 (the total area of the openings 18) is not more than (1000: 15) (not more than a lower limit), it can be seen that the attenuation amount of the waves transmitted within the individual space 16 is relatively small and the attenuation of the waves in individual space 16 is not sufficient. When the ratio of A1 to C1 is not less than (1000: 25) (not less than an upper limit), it can be seen that the attenuation amount of the waves transmitted within the individual space 16 is relatively small and the attenuation of the waves in individual space 16 is not sufficient. As a result, it can be seen that the allowable values of the ratio of A1 to C1, which are not less than the lower limit (1000:15) and not more than the upper limit (1000:25), coincides with the allowable values which are not less than the lower limit and not more than the upper limit based on the radio wave correlation basis (whether or not

the predetermined time after the swimmer swam has elapsed). Further, when the ratio of A1 to C1 is within the allowable values which are not less than the lower limit and not more than the upper limit, it was found that the wave attenuation was sufficient. As a result, regarding the ratio of A1 to C1, etc., there was a possibility that the wave attenuation would be improved by further verification, and various trial and error tests are performed. For example, when the predetermined time after the swimmer swam was set to 1 minute 20 seconds (wave attenuation related basis), the ratio of A1 to C1 is found to be sufficient if the ratio of A1 to C1 is within the allowable values which are not less than 1000:17 (not less than a lower limit) and not more than 1000:23 (not more than an upper limit), it is possible to notify that the wave attenuation is sufficient. In addition, as the wave attenuation related basis, another basis (an official basis, an internal basis, etc.) may be adopted except for the presence or absence of the predetermined time after the swimmer swam. As described above, according to the float 10 of the present embodiment, the waves propagating on the water surface D1 can be eliminated in a short time by quickly consuming the energy of the waves on the water surface D1 generated by the swimmer who is swimming in the lane of the pool.

[0090] More specifically, as illustrated in photos in FIG. 19 and FIG. 20, a pool having a high wave attenuation function can be provided by arranging the ropes for dividing the water surface of the pool into lanes and attaching a plurality of floats shown in FIG. 12 to each rope. It should be noted that the present invention is not limited to the above-described embodiments, and various modifications are possible, and it is not always necessary to provide six blade plates, and for example, the configuration including five wings may be employed. Further, the number of the

water vents provided in the connecting portion may be any number other than three. A plurality of circular holes may be provided in addition to the concentric shape. In addition, a floating or the like may be appropriately attached to the float to adjust the position of the floating float. When the float is attached to a large number of ropes, the spacers may be attached between the float such that the floats appropriately slide with each other in order to secure a gap between the aligned floats. In this case, the gap between the adjacent floats can be maintained by attaching the spacer so as to be close to the tubular portion of the float. However, it is desirable to appropriately set the gap between the floats so that the wave generated by swimmers in the adjacent lane do not pass through the inter-floats. In addition, since the float in FIG. 12 has the above-described point-symmetric structure, the left and right floats have the same structure, but as a modification, an asymmetric structure other than the point-symmetric structure may be used.

[0091] A method of implementing the present invention will be described below.

According to the appendices (a1), a lane rope float attached to a rope for dividing a pool water surface for a lane, comprising: a central attachment portion configured to allow the rope to be inserted into a center of the float, an outer wall portion configured for stopping waves transmitted from the water surface of the pool at an outer side wall surface and forming an opening capable of guiding the waves transmitted from the water surface of the pool into a space in the float; a plurality of blades configured for connecting the outer wall portion to the central attachment portion, the plurality of blades extending in a direction in which the rope extends so as to divide the space in the float into a plurality of spaces; and a connecting portion configured for connecting the plurality

of blades to each other and comprising a water vent configured for discharging the waves guided into the space in the float via the opening, wherein in a case that a volume of an individual space partitioned at least by a pair of adjacent blades, the outer wall portion adjacent to the blades, and the connecting portion adjacent to the blades is defined as A1, and an area of the water vent associated with the individual space is defined as B1, a ratio of A1 and B1 is set to an allowable value which is not less than a lower limit and not more than an upper limit.

[0092] As appendices (a2), in the above appendices (a1), it is desirable that, in a case that the volume of the individual space partitioned at least by the pair of adjacent blades, the outer wall portion adjacent to the blades, and the connecting portion adjacent to the blades is defined as A1, and an area of the opening associated with the individual space is defined as C1, and a ratio of A1 to C1 is set to an allowable value which is not less than a lower limit and not more than an upper limit.

As appendices (a3), in the above appendices (a1 or a2), it is preferable that the connecting portion further comprises a guide portion configured for guiding the waves introduced into the space in the float via the opening.

As appendices (a4), in the above appendices (a3), it is preferable that the guide portion comprises a projecting portion projecting in the direction in which the rope extends.

As appendices (a5), in the above appendices (a4), it is preferable that the guide portion comprises a tapered surface at a part of the guide portion, and the tapered surface is configured for guiding the waves in the space to the water vent.

As appendices (a6), in the above appendices (a5), it is preferable that the lane rope float is attached to the rope by a following way: at the connection portion connecting the outer wall portion and the blades, in a situation when the blades are placed on a water surface, an wave preventing portion is arranged on one side of a portion which is cut in a direction perpendicular to the water surface and is in the direction in which the rope extends, and an ride-over portion is arranged at an opposite side, such that the wave preventing portion is located on a water surface side of the pool and the ride-over portion is located in the pool water.

[0093] According to the appendices (b1), a lane rope float attached to a rope for dividing a pool water surface for a lane, comprising: a central attachment portion configured to allow the rope to be inserted into a center of the float, an outer wall portion configured for stopping waves transmitted from the water surface of the pool at an outer side wall surface and forming an opening capable of guiding the waves transmitted from the water surface of the pool into a space in the float; a plurality of blades configured for connecting the outer wall portion to the central attachment portion and extending in a direction in which the rope extends so as to divide the space in the float into a plurality of spaces; and a connecting portion configured for connecting the plurality of blades to each other, the connecting portion comprising a water vent configured for discharging the waves introduced into the space in the float via the opening, and a guide portion configured for guiding the waves guided into the space in the float via the opening.

[0094] As appendices (b2), in the above appendices (b1), it is preferable that the guide portion comprises a projecting portion projecting in the direction in which the rope extends.

As appendices (b3), in the above appendices (b2), it is preferable that the guide portion comprises a tapered surface at a part of the guide portion, and the tapered surface is configured for guiding the waves in the space to the water vent.

As appendices (b4), in the above appendices (b3), it is preferable that, in a case that a volume of an individual space partitioned at least by a pair of adjacent blades, the outer wall portion adjacent to the blades, and the connecting portion adjacent to the blades is defined as A1, and an area of the water vent associated with the individual space is defined as B1, a ratio of A1 and B1 is set to an allowable value which is not less than a lower limit and not more than an upper limit.

As appendices (b5), in the above appendices (b4), it is preferable that, in a case that the volume of the individual space partitioned at least by the pair of adjacent blades, the outer wall portion adjacent to the blades, and the connecting portion adjacent to the blades is defined as A1, and an area of the opening associated with the individual space is defined as C1, and a ratio of A1 to C1 is set to an allowable value which is not less than a lower limit and not more than an upper limit.

[0095] According to the appendices (c1), a lane rope float attached to a rope for dividing a pool water surface for a lane, comprising: a central attachment portion configured to allow the rope to be inserted into a center of the float, an outer wall portion configured for stopping waves transmitted from the water surface of the pool at an outer side wall surface and forming an opening capable of guiding the waves transmitted from the water surface of the pool into a space in the float; a plurality of blades configured for connecting the outer wall portion to the central attachment portion and extending in a direction in which the rope extends so as to divide the space

in the float into a plurality of spaces; and a connecting portion configured for connecting the plurality of blades to each other and comprising a water vent configured for discharging the waves introduced into the space in the float via the opening, wherein the lane rope float is attached to the rope by following way: at a connection portion which connects the outer wall portion and the blades, in a situation in which the blades are placed on the water surface, an wave preventing portion is arranged on one side of a portion which is cut in a direction perpendicular to the water surface and is in the direction in which the rope extends, and an ride-over portion is arranged on an opposite side, such that the wave preventing portion is located on a water surface side and the ride-over portion is located in the pool water.

10 **[0096]** As appendices (c2), in the above appendices (c1), it is preferable that the connecting portion further comprises a guide portion configured for guiding the waves introduced into the space in the float via the opening.

As appendices (c3), in the above appendices (c2), it is preferable that the guide portion comprises a projecting portion projecting in the direction in which the rope extends.

15 As appendices (c4), in the above appendices (c3), it is preferable that the guide portion comprises a tapered surface at a part of the guide portion, and the tapered surface is configured for guiding the waves in the space to the water vent.

As appendices (c5), in the above appendices (c4), it is preferable that, in a case that a volume of an individual space partitioned at least by a pair of adjacent blades, the outer wall portion adjacent to the blades, and the connecting portion adjacent to the blades is defined as A1, and an area of the

water vent associated with the individual space is defined as B1, a ratio of A1 and B1 is set to an allowable value which is not less than a lower limit and not more than an upper limit. As appendices (c6), in the above appendices (c5), it is preferable that, in a case that the volume of the individual space partitioned at least by the pair of adjacent blades, the outer wall portion adjacent to the blades, and the connecting portion adjacent to the blades is defined as A1, and an area of the opening associated with the individual space is defined as C1, and a ratio of A1 to C1 is set to an allowable value which is not less than a lower limit and not more than an upper limit.

[0097] In addition, the attachment structure for attaching a plurality of lane rope floats to the rope, the lane rope float set, and the lane rope float are not limited to the above embodiment, and various deformations and combinations are included in the scope of the claim.

CLAIMS

Claim 1: An attachment structure configured for attaching a plurality of lane rope floats to a rope,

wherein the lane rope floats are attached to the rope by a tubular portion and are connectable to an outer wall of a pool to partition each lane, and the lane rope floats are made of a synthetic resin material, and

wherein gaps between at least a part of the lane rope floats at a rope side connected to the outer wall of the pool are wider than gaps between at least a part of the lane rope floats arranged in a vicinity of a center of the pool. Claim 2: A lane rope float set comprising a plurality of lane rope floats attached to a rope via a tubular portion and connected to an outer wall of a pool to partition each lane, and the lane rope floats are made of a synthetic resin material, the lane rope float set comprises spacers arranged between the landed rope floats.

Claim 3: The lane rope float set according to claim 2, wherein the lane rope float set comprises the spacers arranged between the landed rope floats, such that gaps between at least a part of the lane rope floats at a rope side connected to the outer wall of the pool are wider than gaps between at least a part of the lane rope floats arranged in a vicinity of a center of the pool.

Claim 4: An attachment structure configured for attaching a plurality of lane rope floats to a rope,

wherein the lane rope floats are attached to the rope via a tubular portion and connected to an outer wall of a pool to partition each lane, and the lane rope floats are made of a synthetic resin material, and

wherein widths of at least a part of the lane rope floats arranged in the vicinity of a center of the pool are wider than widths of at least a part of the lane rope floats at a rope side connected to the outer wall of the pool.

Claim 5: An attachment structure configured for attaching a plurality of lane rope floats to a rope,

wherein the lane rope floats are attached to the rope via a tubular portion and connected to an outer wall of a pool to partition each lane, and the lane rope floats are made of a synthetic resin material, and

wherein a transmission rate of at least a part of the lane rope floats at a rope side connected to an outer wall of the pool is 2 % to 30 % and is higher than a transmission rate of at least a part of the lane rope floats arranged in a vicinity of a center of the pool.

Claim 6: An attachment structure configured for attaching a plurality of lane rope floats to a rope,

wherein the lane rope floats are attached to the rope via a tubular portion and connected to an outer wall of a pool to partition each lane, and the lane rope floats are made of a synthetic resin material, and

wherein a transmission rate of at least a part of the lane rope floats at a rope side connected to an outer wall of the pool is 3 % to 7 %.

Claim 7: A lane rope float attached to a rope for dividing a water surface of a pool into lanes, the lane rope float comprising:

a central attachment portion configured to allow the rope to be inserted into a center of the float,

an outer wall portion configured for stopping waves transmitted from the water surface of the pool at an outer side wall surface and forming an opening capable of guiding the waves transmitted from the water surface of the pool into a space in the float;

a plurality of blades configured for connecting the outer wall portion to the central attachment portion, the plurality of blades extending in a direction in which the rope extends so as to divide the space in the float into a plurality of spaces; and

a connecting portion configured for connecting the plurality of blades to each other and comprising a water vent configured for discharging the waves guided into the space in the float via the opening,

wherein in a case that a volume of an individual space partitioned at least by a pair of adjacent blades, the outer wall portion adjacent to the blades, and the connecting portion adjacent to the blades is defined as A1, and an area of the water vent associated with the individual space is defined as B1, a ratio of A1 and B1 is set to an allowable value which is not less than a lower limit and not more than an upper limit.

Claim 8: The lane rope float according to claim 7, wherein in a case that the volume of the individual space partitioned at least by the pair of adjacent blades, the outer wall portion adjacent to the blades, and the connecting portion adjacent to the blades is defined as $A1$, and an area of the opening associated with the individual space is defined as $C1$, and a ratio of $A1$ to $C1$ is set to an allowable value which is not less than a lower limit and not more than an upper limit.

Claim 9: The lane rope float according to claim 7 or 8, wherein the connecting portion further comprises a guide portion configured for guiding the waves introduced into the space in the float via the opening.

Claim 10: The lane rope float according to claim 9, wherein the guide portion comprises a projecting portion projecting in the direction in which the rope extends.

Claim 11: The lane rope float according to claim 10, wherein the guide portion comprises a tapered surface at a part of the guide portion, and the tapered surface is configured for guiding the waves in the space to the water vent.

Claim 12: The lane rope float according to claim 7 or 8, wherein the lane rope float is attached to the rope by a following way:

at the connection portion connecting the outer wall portion and the blades, in a situation when the blades are placed on a water surface, an wave preventing portion is arranged on one side of a portion which is cut in a direction perpendicular to the water surface and is in the direction in which the rope extends, and an ride-over portion is arranged at an opposite side, such that the wave

preventing portion is located on a water surface side of the pool and the ride-over portion is located in the pool water.

Claim 13: A lane rope float attached to a rope for dividing a water surface of a pool into lanes, the lane rope float comprising:

a central attachment portion configured to allow the rope to be inserted into a center of the float,

an outer wall portion configured for stopping waves transmitted from the water surface of the pool at an outer side wall surface and forming an opening capable of guiding the waves transmitted from the water surface of the pool into a space in the float;

a plurality of blades configured for connecting the outer wall portion to the central attachment portion and extending in a direction in which the rope extends so as to divide the space in the float into a plurality of spaces; and

a connecting portion configured for connecting the plurality of blades to each other, the connecting portion comprising a water vent configured for discharging the waves introduced into the space in the float via the opening, and a guide portion configured for guiding the waves into the space in the float via the opening.

Claim 14: A lane rope float attached to a rope for dividing a water surface of a pool into lanes, the lane rope float comprising:

a central attachment portion configured to allow the rope to be inserted into a center of the float,

an outer wall portion configured for stopping waves transmitted from the water surface of the pool at an outer side wall surface and forming an opening capable of guiding the waves transmitted from the water surface of the pool into a space in the float;

a plurality of blades configured for connecting the outer wall portion to the central attachment portion and extending in a direction in which the rope extends so as to divide the space in the float into a plurality of spaces; and

a connecting portion configured for connecting the plurality of blades to each other and comprising a water vent configured for discharging the waves introduced into the space in the float via the opening,

wherein the lane rope float is attached to the rope by following way:

at a connection portion which connects the outer wall portion and the blades, in a situation in which the blades are placed on the water surface, an wave preventing portion is arranged on one side of a portion which is cut in a direction perpendicular to the water surface and is in the direction in which the rope extends, and an ride-over portion is arranged on an opposite side, such that the wave preventing portion is located on a water surface side and the ride-over portion is located in the pool water.