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(54) **EARTHWORK BAG BODY AND EARTHWORK STRUCTURE**

(57) [Problems to be solved] A bag body for civil engineering work and a structure body for civil engineering work are provided, by which a problem caused by filler material to damage the bag body and a problem of a mesh of the bag body caused to be torn by lifting a lifting rope, could be solved simultaneously.

[Means for solving problems] A bag body for civil engineering work includes: a bag body 21 having a mesh shape; a mouth-narrowing rope so inserted through a mesh in proximity to an opening of the bag body 21 as to be attached thereto; a lifting rope 27 of an endless structure so inserted through a mesh in a lower position with respect to the mouth-narrowing rope as to be attached thereto; and an intermediate-mouth narrowing rope 28 so inserted through a mesh in a lower position with respect to the lifting rope 27 as to be attached thereto, wherein the intermediate-mouth narrowing rope 28 is attached to a part of an unhousing portion 25 for not housing filler material 30 at an upper half of the bag body 21, and, when the lifting rope 27 is lifted, a constriction occurs at a part, of the unhousing portion 25, attached with the intermediate-mouth narrowing rope 28.

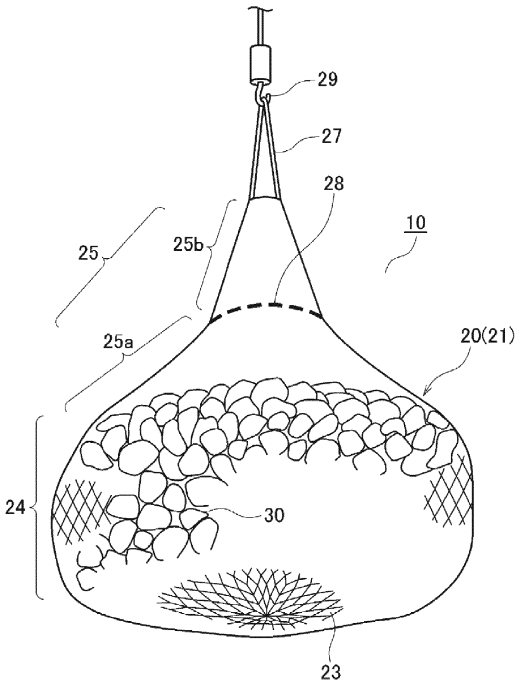

FIG. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a bag body for civil engineering work and a structure body for civil engineering work applicable for various sorts of civil engineering work such as foot protection work, shore protection work, and temporary foundation work in the river or ocean, or on land.

DESCRIPTION OF THE BACKGROUND ART

[0002] A structure body for civil engineering work obtained as a result of housing filler material in a bag body for civil engineering work has been well known.

[0003] A general bag body for civil engineering work includes a bag body made of net fabric having a mesh shape, a lifting rope of an endless structure looped around a mesh in proximity to an opening of the bag body so as to be attached to the bag body, and a mouth-narrowing rope for preventing the opening of the bag body from opening (Patent Document 1).

[0004] Bag bodies, each of which has a mesh uniform in strength and size as a whole, but each of which is different from other in external dimension, have been used in accordance with their respective volumes (1 to 4 t) of filler material.

[0005] A method of manufacturing a structure body for civil engineering work through the use of a bag body for civil engineering work 50 described in Patent Document 1 is explained with reference to FIG. 8.

[0006] In a state where a bag body 51 attached with a lifting rope 52 set inside a mold 40 is widely opened at its opening, filler material 30 is put into the bag body 51.

[0007] After the completion of putting the filler material 30 into the bag body 51, halfway portions of the lifting rope 52 inserted through a mesh of the bag body 51 are drawn in loop shapes from a plurality of parts of the bag body 51, respectively, and a plurality of the relevant parts of the lifting rope 52 are lifted by a crane or the like so as to take the bag body 51 out from the mold 40 ((A), (B) of FIG. 8).

[0008] Under such circumstances where the bag body 51 is lightly lifted, by winding a mouth-narrowing rope 53 around a top portion of the bag body 51 or around a root portion of the lifting rope 52, the opening is closed.

[0009] The structure body for civil engineering work (50) thus completed is transported to a predetermined site and is laid thereon ((C) of FIG. 8).

[0010] When the completed structure body for civil engineering work (50) is laid on the site, the filler material 30 as a whole is extended in a horizontal direction. For this reason, it has been difficult to secure a desired height.

[0011] Patent Document 2 discloses that a height of filler material is regulated at a certain level by a reinforcing belt looped around to be attached to a bag body for civil engineering work.

[0012] Patent Document 3 discloses that, in a state where a lifting rope is lifted after a bag body for civil engineering work is housed with filler material, an adjustment rope attached to the bag body in proximity to a top end of the housed filler material is adjusted in length so that a height and an outer circumferential dimension of a housing portion of the bag body housing the filler material could eventually be adjusted.

[0013] Patent Document 4 discloses a bag body for civil engineering work having some part through which a lifting rope is inserted formed thereon to be larger only in mesh size than other parts formed thereon so that a mesh through which the lifting rope is inserted could be prevented from being torn when the lifting rope is lifted.

(Prior Art Documents)

(Patent Documents)

[0014]

Patent Document 1: Japanese Patent Application Publication No. 2000-1828
Patent Document 2: Japanese Patent Application Publication No. H11-50428
Patent Document 3: Japanese Patent Application Publication No. 2016-194216
Patent Document 4: Japanese Patent No. 6188184

(Problems to be solved)

[0015] The conventional bag bodies for civil engineering work or conventional structure bodies for civil engineering work had the technical problems below:

[1] In the bag body for civil engineering work 50 described in Patent Document 1, a rate of a housing portion of the filler material 30 has been approximately a half of a total volume of the bag body 51, and the net fabric of the remaining unhousing portion has been arbitrarily deformable.

[0016] For this reason, when the structure body for civil engineering work is translocated, the filler material 30 could move freely inside the bag body 51, and as a result, a tear caused by wear or cut has easily occurred in the net fabric.

[2] In the bag body for civil engineering work described in Patent Document 2, the reinforcing belt attached to a lower half of the bag body is not configured such that the free movement of the filler material at a top end (upper surface) is regulated but configured such that a side surface of the filler material housed in the lower half of the bag body is only tightened.

[0017] Further, an area of an unhousing portion of an upper half of the bag body for civil engineering work is so large that, when such a bag body is translocated or stacked on top of another bag body, the filler material at a top end could easily overcome the reinforcing belt, and as a result, a tear has easily occurred in the net fabric.

[3] In the bag body for civil engineering work described in Patent Document 3, the adjustment rope attached to the bag body does not have such a structure that the free movement of the filler material a top end (upper surface) is regulated but has only a function of adjusting a height and an outer circumferential dimension of the housing portion of the bag body.

[0018] For this reason, when such a bag body is translocated, the filler material at a top end could be rolled down, and as a result, a tear has easily occurred in the net fabric of an unhousing portion.

[4] As a method of regulating the free movement of the filler material put into the bag body without changing its amount, the reduction of external dimension of the bag body could be considered.

[0019] If the external dimension of the bag body is reduced, an area of the unhousing portion of the bag body is reduced, and in theory, it would be possible to regulate the free movement of the housed filler material. In practice, however, if the external dimension of the bag body is reduced, it has not only been difficult to perform a work of putting the filler material into such a bag body but also been significantly difficult to perform another work of narrowing an opening of such a bag body in such a manner that the housed filler material is prevented from leaking out from the bag body.

[5] Due to the fact that the conventional bag body for civil engineering work has a mesh uniform in size, such a mesh through which the lifting rope is inserted is pulled laterally, when the lifting rope is lifted, to such an extent that knitting yarns surrounding the mesh are torn and cut, and as a result, the so-called crotch splitting problem has easily occurred.

[6] It has been known that, for avoiding the technical problem of a mesh torn by the lifting rope, a lifting height H_0 of the unhousing portion shown in (B) of FIG. 8 is enlarged while a lifting angle θ_0 with respect to a top portion of the bag body 51 is reduced. If the lifting angle θ_0 with respect to the top portion of the bag body 51 is reduced, a tearing force applied to the mesh through which the lifting rope 52 is inserted could be suppressed.

[0020] In contrast to the above, if the lifting height H_0 of the unhousing portion is enlarged, the external dimension of the bag body 51 is so enlarged as to elevate the cost, and also, the housed filler material 30 could easily move inside the bag body 51, which results in causing the technical problem described in above item [1] to easily occur.

[0021] As described above, the conventional bag body for civil engineering work could not solve both of the technical problems in manufacturing cost and in bag-body damage, simultaneously.

[7] It has been known that, as another means for avoiding the technical problem in mesh tear caused by the lifting rope, the bag body for civil engineering work described in Patent Document 4, having a part through which the lifting rope is inserted formed to be larger only in mesh size than the other parts formed thereon, is used.

[0022] For making net fabric partially varying in mesh size, it has been necessary to apply the advanced manufacturing technology thereto, which has resulted in elevating the cost.

[8] By tying an outer circumference of the bag body housing the filler material through a plurality of ropes or belts longitudinally and laterally, the free movement of the housed filler material is completely regulated so that the technical problem in bag-body damage could be solved. If the filler material as a whole is firmly tightened, however, inherent flexibility of the structure body for civil engineering work is sacrificed.

[0023] As described above, for the conventional bag body for civil engineering work, it has been difficult to solve the technical problem in bag-body damage caused by the filler material while maintain the flexibility of the structure body.

SUMMARY OF THE INVENTION

[0024] In view of the foregoing points, an objective of the present invention is to provide a bag body for civil engineering work and a structure body for civil engineering work that could solve simultaneously a problem in bag-body damage caused by filler material and a problem in mesh torn as a result of lifting a lifting rope, as well as could suppress an amount of net fabric to be used thereby to reduce manufacturing cost of the bag body for civil engineering work.

[0025] Further, another objective of the present invention is to provide a bag body for civil engineering work and a structure body for civil engineering work that could secure flexibility so as to absorb unevenness on a laying site, as well as could suppress large translocation of filler material.

(Means for Solving Problems)

[0026] One aspect of the present invention is a bag body for civil engineering work including: a bag body having a mesh shape capable of housing filler material, wherein the bag body consists of a housing portion for housing a predetermined amount of filler material at a lower half thereof and an unhousing portion for not housing any filler material at an upper half thereof; a mouth-narrowing rope for opening/closing an opening of the bag body; and a lifting rope of an endless structure inserted through a mesh in an upper portion of the bag body so as to be attached to the bag body, characterized by being configured such that the bag body is capable of: being attached with an intermediate-mouth narrowing rope at a part of the unhousing portion thereof in a lower position with respect to the lifting rope; and having, when the lifting rope is lifted, a constriction occurring at a part of the unhousing portion thereof attached with the intermediate-

mouth narrowing rope.

[0027] In another aspect of the present invention, the unhousing portion may have: a shoulder portion formed at a lower half thereof with respect to the constriction as a boundary, the shoulder portion being capable of covering to hold a circumferential edge portion of a top end surface of filler material; and a neck portion formed at an upper half thereof with respect to the constriction as a boundary, the neck portion being attached with the mouth-narrowing rope and the lifting rope.

[0028] In still another aspect of the present invention, there may be such a relation between the neck portion of the unhousing portion and the shoulder portion of the unhousing portion that, when the lifting rope is lifted, a lifting angle with respect to the neck portion is less than a lifting angle with respect to the shoulder portion.

[0029] In still another aspect of the present invention, there may be such a relation between the neck portion of the unhousing portion and a top portion of the bag body without having the intermediate-mouth narrowing rope attached to the unhousing portion that, when the lifting rope is lifted, a lifting angle with respect to the neck portion of the unhousing portion is less than a lifting angle with respect to the top portion of the bag body without having the intermediate-mouth narrowing rope attached to the unhousing portion.

[0030] In still another aspect of the present invention, the lifting rope may be positioned between the mouth-narrowing rope and the intermediate-mouth narrowing rope.

[0031] Another aspect of the present invention is a structure body for civil engineering work having filler material housed therein, the structure body including: a bag body for civil engineering work as described in any one of the foregoing aspects; and filler material housed in the bag body for civil engineering work, wherein a circumferential edge portion of a top end surface of the filler material is covered to be held by an intermediate-mouth narrowing rope and a shoulder portion formed at a lower half of an unhousing portion of the bag body with respect to an attachment position, as a boundary, of the intermediate-mouth narrowing rope.

(Advantageous Effects of the Invention)

[0032] According to the above-described aspects of the present invention, at least one of the following effects could be achieved:

[1] Only as a result of partial occurrence of a constriction at a part of the unhousing portion of the bag body attached with the intermediate-mouth narrowing rope, it is possible to reduce a lifting height of the unhousing portion while reducing a lifting angle with respect to a top portion of the bag body through which the lifting rope is inserted.

[0033] The amount of net-fabric usage for making the bag body could be reduced, and thereby, it is possible to make the bag body at a relatively low cost and to reliably prevent a mesh through which the lifting rope is inserted from being torn.

[2] The entire range of the filler material could be covered to be held by the bag body combined with the intermediate-mouth narrowing rope.

[0034] As a result, at a time when the structure body for civil engineering work is manufactured, at a time when the structure body for civil engineering work is translocated, and at a time after the structure body for civil engineering work is laid on the laying site, the free movement of the filler material could be suppressed by the covering/holding action of the bag body, and thereby, it is possible to reduce effectively the net-fabric tear caused by the free movement of the filler material.

[3] The circumferential edge portion of the top end surface of the filler material could be covered to be held by the intermediate-mouth narrowing rope in a cooperative relation with the shoulder portion of the unhousing portion, and thereby, the collapse of the filler material could be effectively suppressed.

[4] The spill of the filler material could be suppressed by the intermediate-mouth narrowing rope in a cooperative relation with the shoulder portion of the unhousing portion, and thereby, a burden to be imposed on the mouth-narrowing rope provided in the closest position to the opening could be significantly reduced.

[0035] As aresult, for the mouth-narrowing rope, a low-cost low-strength rope could be applied, and a work of attaching the mouth-narrowing rope to the bag body and a work of mouth-narrowing the bag body could be simplified.

[5] It is possible to provide the bag body for civil engineering work that could have both of the ability to cover/hold the filler material and the flexibility so as to absorb unevenness on a laying site.

BRIEF DESCRIPTIONS OF THE DRAWINGS

[0036] For more thorough understanding of the present invention and advantages thereof, the following descriptions should be read in conjunction with the accompanying drawings in which:

FIG. 1 depicts a perspective view of a structure body for civil engineering work.

FIG. 2 depicts a side view of a bag body for civil engineering work included in the structure body for civil engineering work.

FIG. 3A depicts an explanatory view of a method of manufacturing the structure body for civil engineering work, of which: (A) is an explanatory view up to a step of putting filler material into the bag body for civil engineering work set inside a mold; and (B) is

an explanatory view in a step of reducing a part of an unhousing portion of the bag body in diameter through an intermediate-mouth narrowing rope.

FIG. 3B depicts another explanatory view of the method of manufacturing the structure body for civil engineering work, of which: (C) is an explanatory view in a step of lifting the structure body for civil engineering work; and (D) is an explanatory view after a step of laying the completed structure body for civil engineering work.

FIG. 4 depicts a plan view of the bag body for civil engineering work before the structure body for civil engineering work is lifted.

FIG. 5 depicts an explanatory view of a relation in lifting angle with respect to the unhousing portion between: (A) model of reference without any intermediate-mouth narrowing rope; and (B) model of example according to the present invention with the intermediate-mouth narrowing rope.

FIG. 6 depicts a model diagram of reference having the entire range of the filler material tightened by the bag body.

FIG. 7 depicts a model diagram for explaining characteristics of the structure body for civil engineering work made to land.

FIG. 8 depicts an explanatory view of a method of manufacturing a structure body for civil engineering work including a conventional bag body for civil engineering work.

DESCRIPTIONS OF EMBODIMENTS OF THE INVENTION

[0037] Hereinafter, embodiments according to the present invention will be described with reference to the drawings.

[1] STRUCTURE BODY FOR CIVIL ENGINEERING WORK

[0038] Descriptions will be provided with reference to FIGS. 1, 2, and a structure body for civil engineering work 10 includes a bag body for civil engineering work 20 (hereinafter, referred to as "bag body 20") and filler material 30 which housed in the bag body 20.

[2] BAG BODY (20)

[0039] The bag body 20 includes: a bag body 21 to be filled with filler material 30; a mouth-narrowing rope 26 attached to the closest position to an opening 22 of the bag body 21; a lifting rope 27 of an endless structure attached in a lower position with respect to the mouth-narrowing rope 26 in proximity to the opening 22 of the bag body 21; and an intermediate-mouth narrowing rope 28 attached in a lower position with respect to the lifting rope 27 at a distance from the opening 22 of the bag body 21.

[0040] Three ropes 26 to 28, the mouth-narrowing rope 26, the lifting rope 27, and the intermediate-mouth narrowing rope 28, are attached to the bag body 21 from the opening 22 toward a bottom portion 23 in this order.

BAG BODY (21)

[0041] The bag body 21 is a net-fabric made bottomed bag provided with the opening 22 and the bottom portion 23.

[0042] The bag body 21 consists of: a housing portion 24 for housing the filler material 30; and an unhousing portion 25 for not housing any filler material 30.

[2.1.1] NET FABRIC

[0043] In an embodiment according to the present invention, in order to suppress wasting the net fabric, the bag body 21 manufactured in accordance with an amount of the filler material 30 to be housed (e.g., 1 to 4 m^3) is used, and such a bag body 21 is manufactured through the use of the net fabric having the minimum necessary area corresponding to the amount of the filler material 30 to be housed.

[0044] As the net fabric of the bag body 21, e.g., an extra-thick Raschel (Russell) net obtained by double knitting a synthetic fiber yarn such as polyester (1500 d/20 pieces, strength of 100 kgf/2 legs, or fracture elongation of 50%) may be used.

[0045] The unfolded shape of a mesh of the net fabric is a quadrangle or hexagon, and the entire range of mesh is uniform. The size of mesh is set such that the filler material 30 is prevented from going out of the mesh, and a general mesh size is 25 to 50 mm.

[2.1.2] HOUSING AND UNHOUSING PORTIONS OF BAG BODY

[0046] In an embodiment according to the present invention, a range within which the filler material 30 is housed inside the bag body 21 is defined as the housing portion 24, and a range without housing any filler material 30 immediately above the housing portion 24 inside the bag body 21 is defined as the unhousing portion 25.

[0047] Further, explanations will be provided hereinafter, with respect to an attachment position, as a boundary, of the intermediate-mouth narrowing rope 28, a lower half of the unhousing portion 25 is defined as a shoulder portion 25a, and an upper half of the unhousing portion 25 is defined as a neck portion 25b.

[0048] The opening 22 is formed in an upper portion of the neck portion 25b, and the mouth-narrowing rope 26 and the lifting rope 27 are attached in advance around the opening 22.

MOUTH-NARROWING ROPE

[0049] The mouth-narrowing rope 26, positioned

above the lifting rope 27, is a rope for opening and closing the opening 22 of the bag body 21, and such a rope is attached to the bag body 21 such that it is inserted through the mesh in proximity to the opening 22.

[0050] Reasons for positioning the mouth-narrowing rope 26 above the lifting rope 27 are that: the opening 22 could be closed without being affected by any lifting rope 27; and a portion caused to occur by gathering the net fabric surrounding the opening 22 could be prevented from projecting upward the bag body 21.

[0051] By inserting the mouth-narrowing rope 26 through the mesh in a stitch-skipping manner, as necessary, the workability of attaching the mouth-narrowing rope 26 and the level of closeness of the opening 22 could be improved.

LIFTING ROPE

[0052] The lifting rope 27 is a rope, of an endless structure, attached to the bag body 21 such that it is inserted through the mesh between the mouth-narrowing rope 26 and the intermediate-mouth narrowing rope 28.

INTERMEDIATE-MOUTH NARROWING ROPE

[0053] The intermediate-mouth narrowing rope 28 is a composite rope having the function of causing a constriction to occur at a part of the unhousing portion 25 so as to cover to hold the filler material 30 as well as the function as a mouth-narrowing rope.

[0054] The intermediate-mouth narrowing rope 28 is attached to the bag body 21 by being inserted through an intermediate portion of the unhousing portion 25, i.e., by being inserted through the mesh between an attachment position of the lifting rope 27 and a top end of the filler material 30.

[0055] The intermediate-mouth narrowing rope 28 is attached so as to cause the constriction to occur at the part of the unhousing portion 25 in order that a lifting angle with respect to a top portion of the bag body 21 (neck portion 25a) is reduced, when the lifting rope 27 is lifted, so as to prevent the mesh through which the lifting rope 27 is inserted from being torn, and that, after the structure body for civil engineering work 10 is laid, a circumferential edge portion of a top end surface of the filler material 30 is elastically covered to be held with the shoulder portion 25a of the unhousing portion 25.

[0056] By selecting an attachment height of the intermediate-mouth narrowing rope 28 and a size of the occurring constriction (a constriction diameter) with respect to the unhousing portion 25, it is possible to adjust a lifting angle with respect to the top portion of the bag body 21, an area of the circumferential edge portion of the top end surface of the filler material 30 covered to be held with the shoulder portion 25a of the unhousing portion 25, and a burden of load to be imposed on the intermediate-mouth narrowing rope 28.

[0057] The attachment height of the intermediate-mouth narrowing rope 28 and the size of the occurring constriction are selected appropriately in consideration of an external dimension of the bag body 21, and an amount of the filler material 30 to be housed or the like.

[3] FILLER MATERIAL

[0058] For the filler material 30, natural aggregates such as a boulder, concrete rubble, fired material of various sorts of wastes, or the like may be applied.

[0059] When the filler material is used for foot protection works, such filler material 30 has a diameter of approximately 150 mm, and a size of the filler material 30 may be selected appropriately in accordance with purposes.

[Method of Manufacturing Structure Body for Civil Engineering Work]

[0060] Subsequently, a method of manufacturing the structure body for civil engineering work 10 using the bag body 20 will be described with reference to FIGS. 3A, 3B.

[1] Step of Setting of Bag Body ((A) of FIG. 3A)

[0061] A mold 40 in an inverted truncated-cone shape (grinding-bowl shape) having both sides longitudinally opened is prepared.

[0062] The bag body 21 is set inside the mold 40. The bag body 21 in proximity to the opening 22 widely opened is outwardly folded so as to cover a peripheral edge of an upper opening of the mold 40.

[2] Step of Putting Filler Material ((A) of FIG. 3A)

[0063] A predetermined amount of the filler material 30 is put into the bag body 21 through the use of heavy machinery such as a backhoe.

[3] Step of Narrowing Intermediate-mouth Narrowing Rope ((B) of FIG. 3A)

[0064] After completing the step of putting the filler material 30 into the bag body 21, the intermediate-mouth narrowing rope 28 attached to the unhousing portion 25 is narrowed to a predetermined circumferential length whose diameter is less than a diameter of the housing portion 23, while the bag body 21 being set inside the mold 40, and then, both ends of the intermediate-mouth narrowing rope 28 are firmly tied to each other by a tie or the like so as to be prevented from being easily released from each other.

[0065] Such a "predetermined circumferential length" includes a circumferential length of a constriction at which, by the constriction caused to occur by the intermediate-mouth narrowing rope 28 of said length, both of: the function of preventing the mesh through which the lifting rope 27 is inserted from being torn after the com-

pletion of the structure body for civil engineering work 10; and the function of covering to hold the top end surface of the filler material 30 with the shoulder portion 25a of the unhousing portion 25, could be performed.

[0066] The step of narrowing the intermediate-mouth narrowing rope 28 is started from a state where the unhousing portion 25 is untightened (loosened), and therefore the narrowing could be performed with a relatively small force.

[0067] It is to be noted that the intermediate-mouth narrowing rope 28 may be attached to the bag body 21 in advance, or may be attached to the bag body 21 on a laying site after completing the step of putting the filler material 30 into the bag body 21.

[4] Step of Narrowing Mouth-narrowing Rope (FIG. 4)

[0068] In a state where the unhousing portion 25 is untightened (loosened), the mouth-narrowing rope 26 is narrowed so as to close the opening 22 of the bag body 21.

[0069] The mouth-narrowing rope 26 is positioned above the lifting rope 27, and therefore, the opening 22 could be closed without being affected by the lifting rope 27.

[0070] It is to be noted that FIG. 4 shows the opening 22 in a state where it is opened for indicating its position; however, the opening 22 is actually closed to such an extent that the filler material 30 is prevented from leaking out from the bag body 21.

[0071] After closing the opening 22 of the bag body 21, drawing portions of the mouth-narrowing rope 26 are tied together so as not to be released.

[0072] It is to be noted that the step of narrowing the mouth-narrowing rope 26 and the step of narrowing the intermediate-mouth narrowing rope 28 may be performed in this order, or vice versa.

[5] Step of Taking out from Mold ((C) of FIG. 3B)

[0073] Halfway portions of the lifting rope 27 inserted through the mesh of the bag body 21 are drawn in loop shapes from a plurality of parts (e.g., six parts) of the bag body 21, and a plurality of the relevant parts of the lifting rope 27 are hung on a hook 29 of a crane or the like.

[0074] The lifting rope 27 is lifted so as to take the bag body 21 out from the mold 40, and as a result, the structure body for civil engineering work 10 is finished being manufactured.

[0075] The structure body for civil engineering work 10 thus completed is transported to a predetermined site and is laid thereon ((D) of FIG. 3B).

[Characteristics of Structure Body for Civil Engineering Work]

[0076] Subsequently, the major characteristics of the structure body for civil engineering work 10 will be described.

[1] Lifting Angle with respect to Unhousing Portion

[0077] The lifting angle with respect to the unhousing portion 25 formed by the intermediate-mouth narrowing rope 28 will be described with reference to FIG. 5.

[0078] FIG. 5 shows (A) reference of the bag body 21 lifted through the lifting rope 27 without any intermediate-mouth narrowing rope 28, and (B) example of the bag body 21, according to the present invention, attached with the intermediate-mouth narrowing rope 28 at a part of the unhousing portion 25 while being lifted through the lifting rope 27.

[0079] The bag bodies 21 shown in (A) and (B) of FIG. 5 are assumed to be the same in size and in amount of the housed filler material 30.

[0080] In the reference shown in (A) of FIG. 5, the lifting angle formed, when the bag body 21 is lifted through the lifting rope 27, without any intermediate-mouth narrowing rope 28 is assumed to be θ_1, and the lifting height of the unhousing portion 25 is assumed to be H_1.

[0081] In an example according to the present invention shown in (B) of FIG. 5, when the lifting rope 27 is lifted, the entire range of the unhousing portion 25 of the bag body 21 is to be formed into a uniform cone shape; nevertheless, such an increase in diameter of the unhousing portion 25 is regulated by the intermediate-mouth narrowing rope 28, and as a result, a constriction is so caused as to occur at a part of the unhousing portion 25.

[0082] As a result of the constriction caused to occur at a part of the unhousing portion 25, two lifting angles, θ_2 with respect to the neck portion 25b and θ_3 with respect to the shoulder portion 25a, could be formed in the unhousing portion 25.

[0083] Relation among Lifting Angles θ_1, θ_2, and θ_3 are as follows:

"Relation 1" The lifting angle θ_2 with respect to the neck portion 25b of the example is less than the lifting angle θ_3 with respect to the shoulder portion 25a of the example ($\theta_2 < \theta_3$).

"Relation 2" The lifting angle θ_2 with respect to the neck portion 25b of the example is less than the lifting angle θ_1 with respect to the unhousing portion 25 of the reference ($\theta_2 < \theta_1$).

"Relation 3" The lifting angle θ_1 with respect to the unhousing portion 25 of the reference is less than the lifting angle θ_3 with respect to the shoulder portion 25a of the example ($\theta_1 < \theta_3$).

[0084] In such a manner, a relation of $\theta_2 < \theta_1 < \theta_3$ holds true.

[0085] As a result of comparison in lifting height of the unhousing portion 25 between the example and reference, the lifting height H_2 of the unhousing portion 25 of the example according to the present invention is shorter

in length than the lifting height H_1 of the unhousing portion 25 of the reference by a level of height corresponding to the constriction caused to occur by the intermediate-mouth narrowing rope 28 provided at a part of the unhousing portion 25 ($H_1 > H_2$).

[0086] In the reference, if the lifting height H_1 of the unhousing portion 25 is reduced so that an amount of net fabric to be used for making the bag body 21 is reduced, the lifting angle θ_1 increases, and as a result, there is a higher probability that the mesh through which the lifting rope 27 is inserted would be torn.

[0087] In the reference, the lifting angle θ_1 with respect to the unhousing portion 25 and the lifting height H_1 of the unhousing portion 25 are so related as to affect each other.

[0088] In contrast to the above, in the example according to the present invention, the lifting angle θ_2 with respect to the neck portion 25b and the lifting height H_2 of the unhousing portion 25 are not so related as to affect each other, and therefore the lifting angle θ_2 with respect to the neck portion 25b could be reduced without being affected by any lifting height H_2 of the unhousing portion 25.

[0089] As a result, in the example according to the present invention, the lifting height H_2 of the unhousing portion 25 could be reduced as well as the lifting angle θ_2 with respect to the neck portion 25b through which the lifting rope 27 is inserted could be reduced, and as a consequence, an amount of net fabric to be used for making the bag body 21 could be reduced while the mesh through which the lifting rope 27 is inserted could reliably be prevented from being torn.

[2] Constriction in Unhousing Portion

[0090] As a method of causing a constriction to occur in the unhousing portion 25, a method of tying the intermediate-mouth narrowing rope 28 after the lifting rope 27 is lifted may be considered.

[0091] Such a constriction-formation method connotes the occurrence of a problem that the mesh of the bag body 21 through which the lifting rope 27 is inserted is torn at the beginning of the lifting as well as a problem that a relatively large tightening force for tightening the unhousing portion 25 applied with a tension is needed.

[0092] For this reason, in an embodiment according to the present invention, the intermediate-mouth narrowing rope 28 is attached to a part of the unhousing portion 25 in such a manner that said part is prevented from being enlarged in diameter before the lifting, and then, a constriction is caused to occur at said part of the unhousing portion 25 with the aid of a lifting force.

[0093] In such an embodiment according to the present invention, therefore, it is not necessary to tie the intermediate-mouth narrowing rope 28 with a relatively large force in order to cause a constriction to occur, and further, any large tearing force is not generated in the mesh through which the lifting rope 27 is inserted at the beginning of the lifting.

[3] Burden of Load on Intermediate-mouth Narrowing Rope upon Lifting

[0094] FIG. 6 shows a reference having the filler material 30 housed therein, and thereafter, having the entire range including the top end surface of the housed filler material 30 tightened firmly by the bag body 21 through the intermediate-mouth narrowing rope 28.

[0095] In the reference, the filler material 30 is a hindrance to such an extent that it is difficult to tighten firmly the intermediate-mouth narrowing rope 28 only with a force exerted by a human operator, and a burden of load for enlarging the intermediate-mouth narrowing rope 28 in diameter at the time of the lifting is extremely enlarged.

[0096] In an embodiment according to the present invention, as shown in (B) of FIG. 3A, before the lifting, no tension is applied to the unhousing portion 25, and therefore a diameter-enlarging force is not generated on the intermediate-mouth narrowing rope 28. As shown in (C) of FIG. 3B, when the lifting rope 27 is lifted, a diameter-enlarging force is generated on the intermediate-mouth narrowing rope 28 for the first time.

[0097] When the lifting rope 27 is lifted, a slight margin is generated in the spread of the net fabric of the shoulder portion 25a of the unhousing portion 25, and by virtue of such a margin of the net fabric, in comparison with reference shown in FIG. 6, a burden of load for enlarging the intermediate-mouth narrowing rope 28 in diameter decreases.

[4] Covering/Holding Action on Filler Material

[0098] A covering/holding action on the filler material 30 by the bag body 21 will be described with reference to FIG. 7 showing a state where the structure body for civil engineering work 10 is laid on a laying site.

[0099] When the structure body for civil engineering work 10 is made to land, a group of pieces of filler material 30 is to be extended in a horizontal direction.

[0100] In order for the intermediate-mouth narrowing rope 28 to restrict the extended net fabric of the shoulder portion 25a of the unhousing portion 25 within a certain range, the circumferential edge portion of the top end surface of the filler material 30 is elastically covered to be held with the shoulder portion 25a of the unhousing portion 25.

[0101] As described above, in an embodiment according to the present invention, the entire range of the group of pieces of filler material 30 could be elastically covered to be held, by a combination of the bag body 21 and the intermediate-mouth narrowing rope 28, by taking advantage of the elasticity of the net fabric of the housing portion 24 and the shoulder portion 25a of the unhousing portion 25 of the bag body 21.

[0102] As a result, at a time when the structure body for civil engineering work 10 is manufactured, at a time

when the structure body for civil engineering work 10 is translocated, and at a time after the structure body for civil engineering work 10 is laid on the laying site, the free movement of the filler material 30 could be suppressed by the covering/holding action of the bag body 21, and thereby, it is possible to reduce effectively the net-fabric tear caused by the filler material 30.

[0103] The intermediate-mouth narrowing rope 28 could, in a cooperative relation with the shoulder portion 25a of the unhousing portion 25, not only cover to hold the filler material 30 but also serve as a mouth-narrowing rope.

[0104] Even if the top end surface of the filler material 30 is to collapse at a time of taking out from mold or at a time of translocation, the collapse of the filler material 30 could be effectively suppressed by the shoulder portion 25a of the unhousing portion 25 covering the top end surface of the filler material 30.

[0105] In such a manner, the collapse of the filler material 30 could be effectively suppressed by the shoulder portion 25a of the unhousing portion 25 of the bag body for civil engineering work 20, and thereby, it is possible to resolve a technical problem of the net-fabric tear caused by the collapse of the filler material 30.

[5] Flexibility of Structure Body for Civil Engineering Work

[0106] As shown in FIG. 6, in the reference having the entire range of filler material 30 tightened by the bag body 21, such a tightening effect on the filler material 30 is so large that the structure body for civil engineering work 10 losing the flexibility could not sufficiently follow unevenness of a laying surface.

[0107] In contrast to the above, in an embodiment according to the present invention, as shown in FIG. 7, the entire range of the group of pieces of filler material 30 could be elastically covered to be held, by the housing portion 24 of the bag body 21 in a cooperative relation with the shoulder portion 25a of the unhousing portion 25 attached with the intermediate-mouth narrowing rope 28.

[0108] As a result, the flexibility of the structure body for civil engineering work 10 could be maintained, and thereby, the unevenness of the laying surface could be followed.

[6] Mouth-narrowing Rope

[0109] As already described, the spill of the filler material 30 housed in the bag body 21 could be regulated by the intermediate-mouth narrowing rope 28, and thereby, a burden to be imposed on the mouth-narrowing rope 26 could be significantly reduced.

[0110] As a result, for the mouth-narrowing rope 26, a low-cost low-strength rope could be applied, and by causing the number of stitches skipped upon insertion of the mouth-narrowing rope 26 through the mesh of the bag body 21 to be significantly higher, the work of attaching the mouth-narrowing rope 26 to the bag body 21 and the work of mouth-narrowing the bag body 21 could be simplified.

(Reference Numerals)

[0111]

10	Structure body for civil engineering work
20	Bag body for civil engineering work (Bag body)
21	Bag body
22	Opening of bag body
23	Bottom portion of bag body
24	Housing portion
25	Unhousing portion
25a	Shoulder portion of unhousing portion
25b	Neck portion of unhousing portion
26	Mouth-narrowing rope
27	Lifting rope
28	Intermediate-mouth narrowing rope
30	Filler material
40	Mold

Claims

1. A bag body for civil engineering work comprising:

a bag body having a mesh shape capable of housing filler material, wherein the bag body consists of a housing portion for housing a predetermined amount of filler material at a lower half thereof and an unhousing portion for not housing any filler material at an upper half thereof;
a mouth-narrowing rope for opening/closing an opening of the bag body; and
a lifting rope of an endless structure inserted through a mesh in an upper portion of the bag body so as to be attached to the bag body,
characterized by being configured such that the bag body is capable of:

being attached with an intermediate-mouth narrowing rope at a part of the unhousing portion thereof in a lower position with respect to the lifting rope; and
having, when the lifting rope is lifted, a constriction occurring at a part of the unhousing portion thereof attached with the intermediate-mouth narrowing rope.

2. The bag body for civil engineering work as claimed in claim 1, wherein the unhousing portion has: a shoulder portion formed at a lower half thereof with respect to the constriction as a boundary, the shoulder portion being capable of covering to hold a circumferential edge portion of a top end surface of

filler material; and a neck portion formed at an upper half thereof with respect to the constriction as a boundary, the neck portion being attached with the mouth-narrowing rope and the lifting rope.

3. The bag body for civil engineering work as claimed in claim 2, wherein there is such a relation between the neck portion of the unhousing portion and the shoulder portion of the unhousing portion that, when the lifting rope is lifted, a lifting angle with respect to the neck portion is less than a lifting angle with respect to the shoulder portion.

4. The bag body for civil engineering work as claimed in claim 2 or 3, wherein there is such a relation between the neck portion of the unhousing portion and a top portion of the bag body without having the intermediate-mouth narrowing rope attached to the unhousing portion that, when the lifting rope is lifted, a lifting angle with respect to the neck portion of the unhousing portion is less than a lifting angle with respect to the top portion of the bag body without having the intermediate-mouth narrowing rope attached to the unhousing portion.

5. The bag body for civil engineering work as claimed in claim 2, wherein the lifting rope is positioned between the mouth-narrowing rope and the intermediate-mouth narrowing rope.

6. A structure body for civil engineering work having filler material housed therein, the structure body comprising:

a bag body for civil engineering work as claimed in any one of claims 1 to 5; and
filler material housed in the bag body for civil engineering work, wherein
a circumferential edge portion of a top end surface of the filler material is covered to be held by an intermediate-mouth narrowing rope and a shoulder portion formed at a lower half of an unhousing portion of the bag body with respect to an attachment position, as a boundary, of the intermediate-mouth narrowing rope.

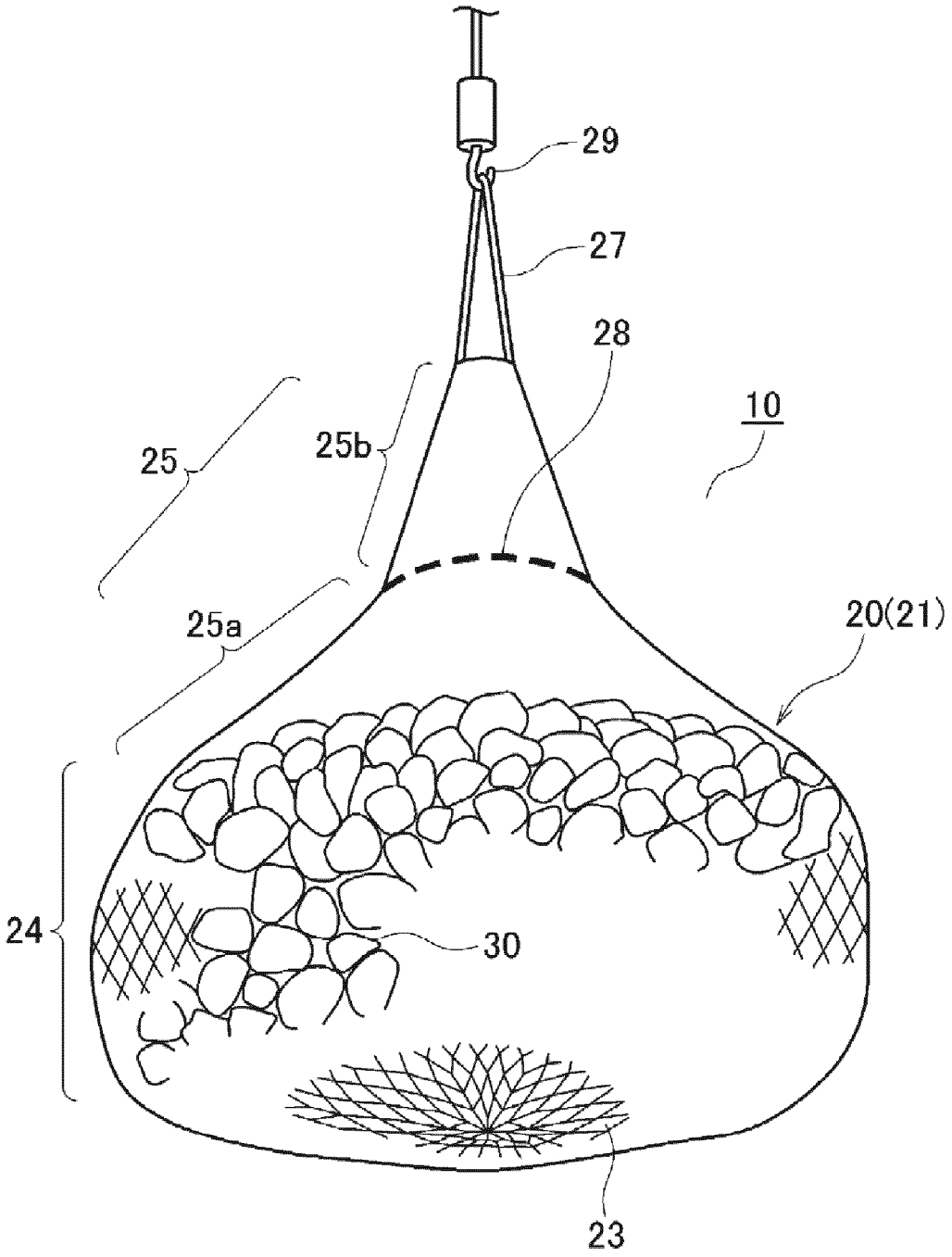


FIG. 1

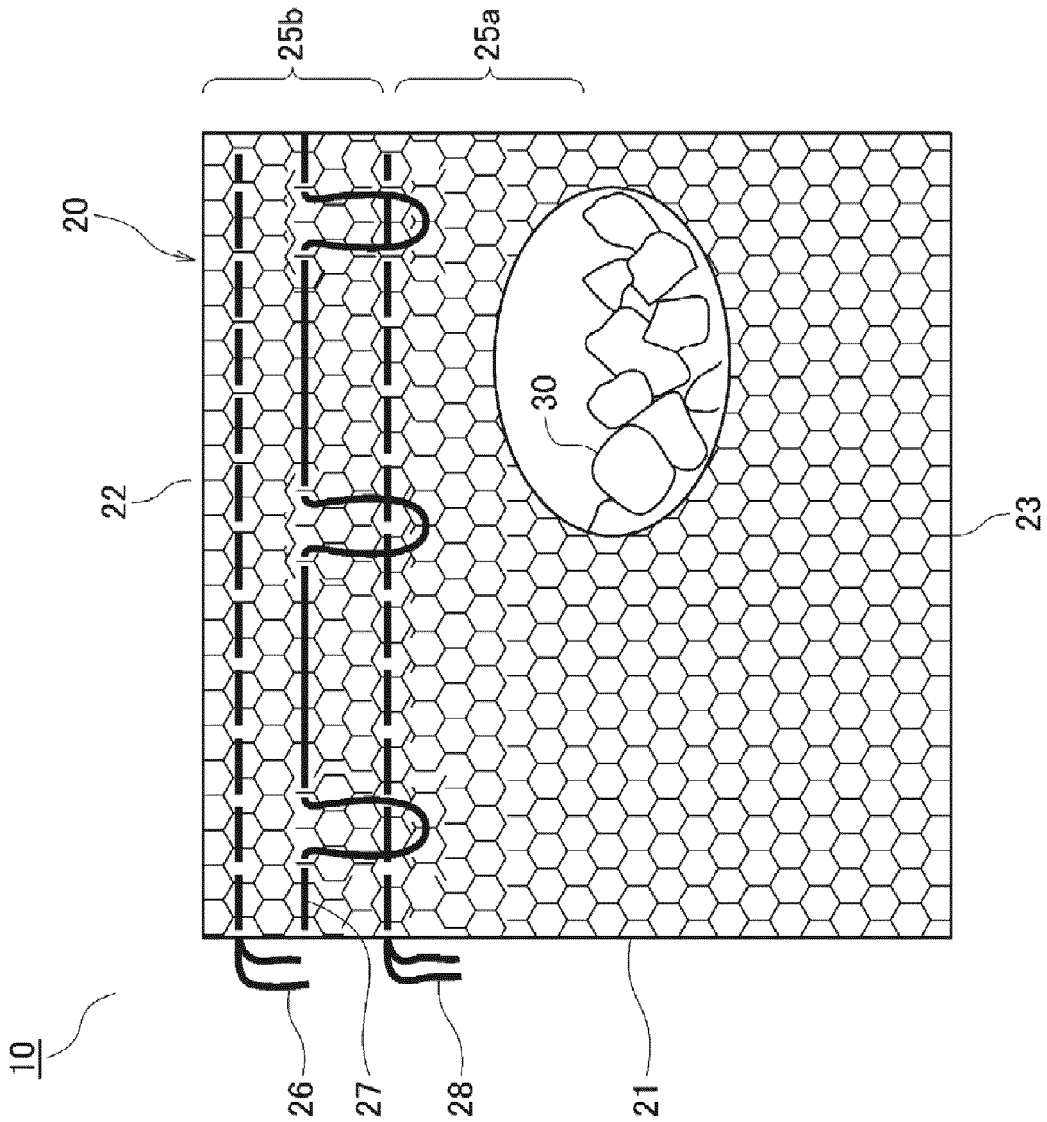
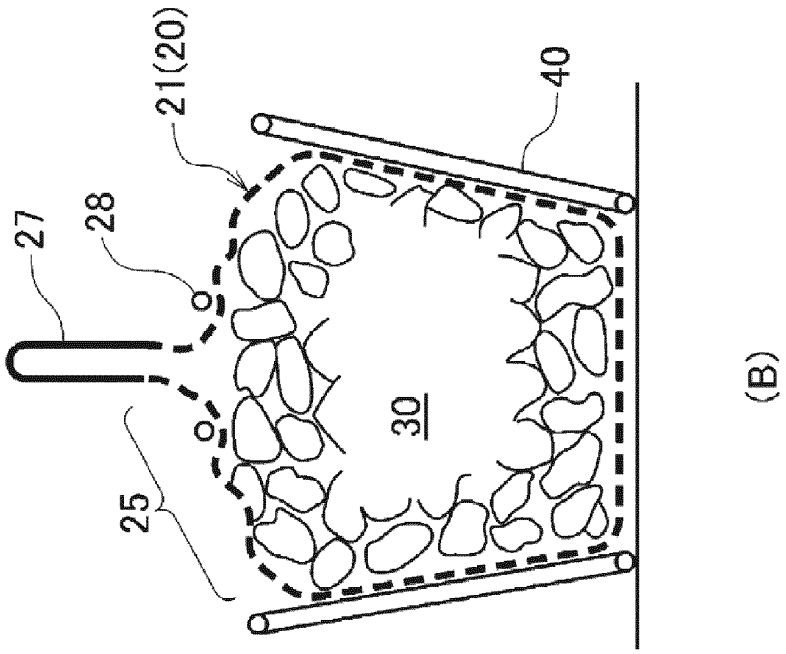
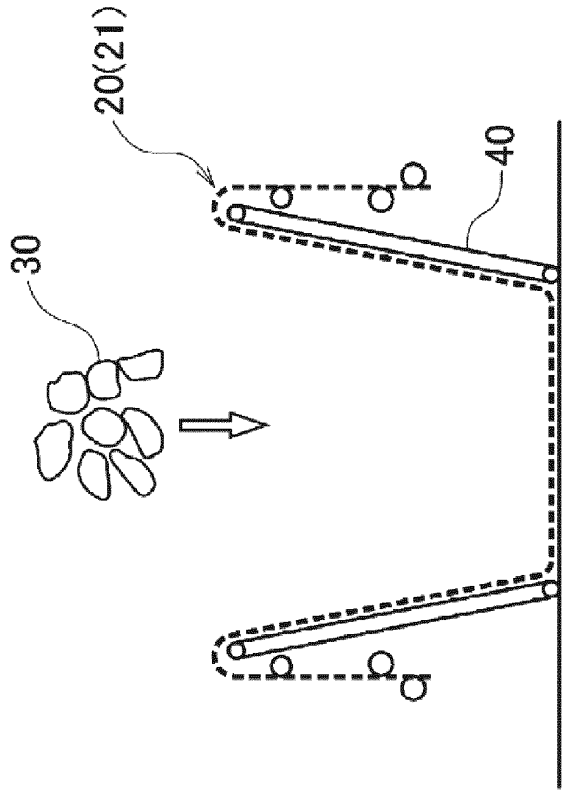


FIG. 2



(B)



(A)

FIG. 3A

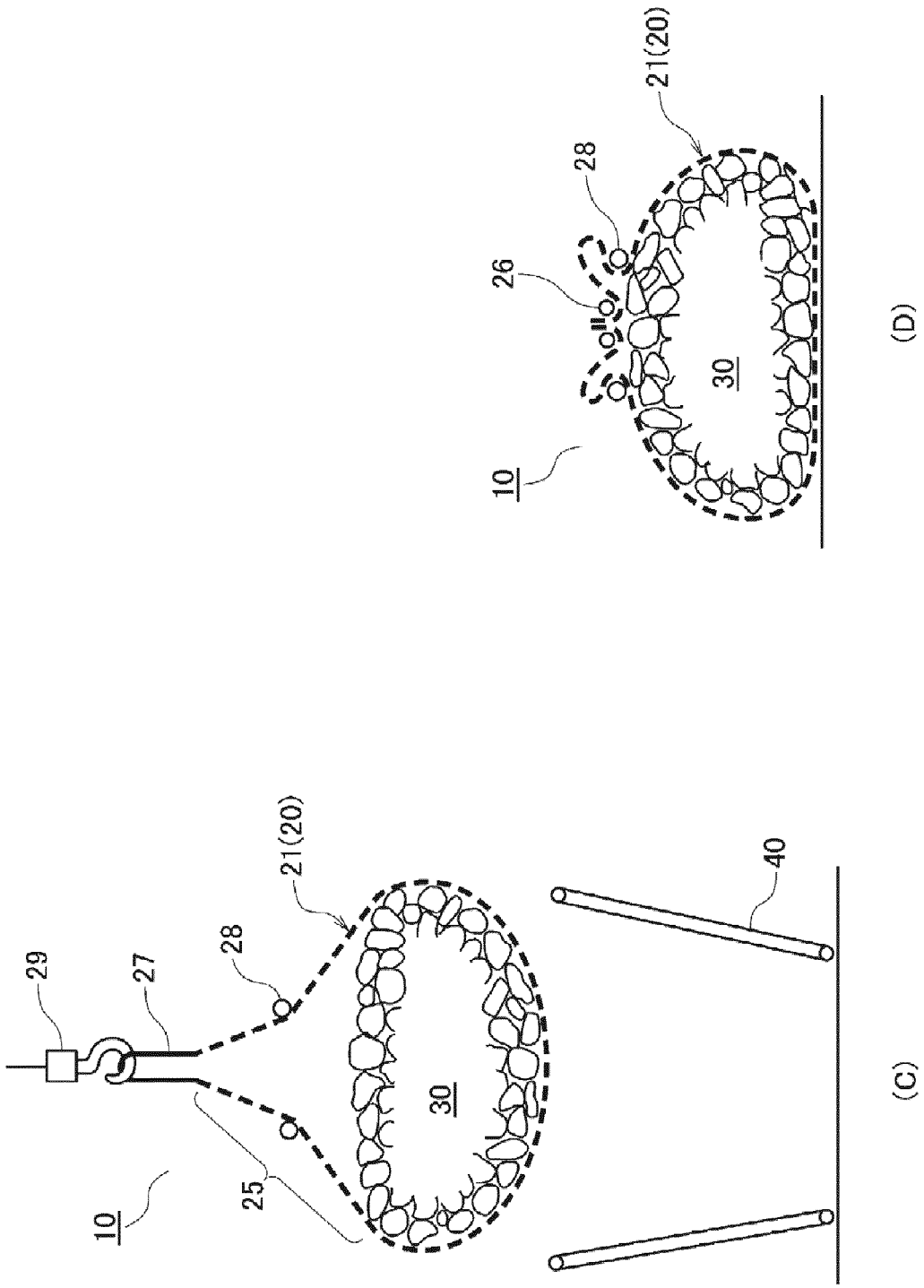


FIG. 3B

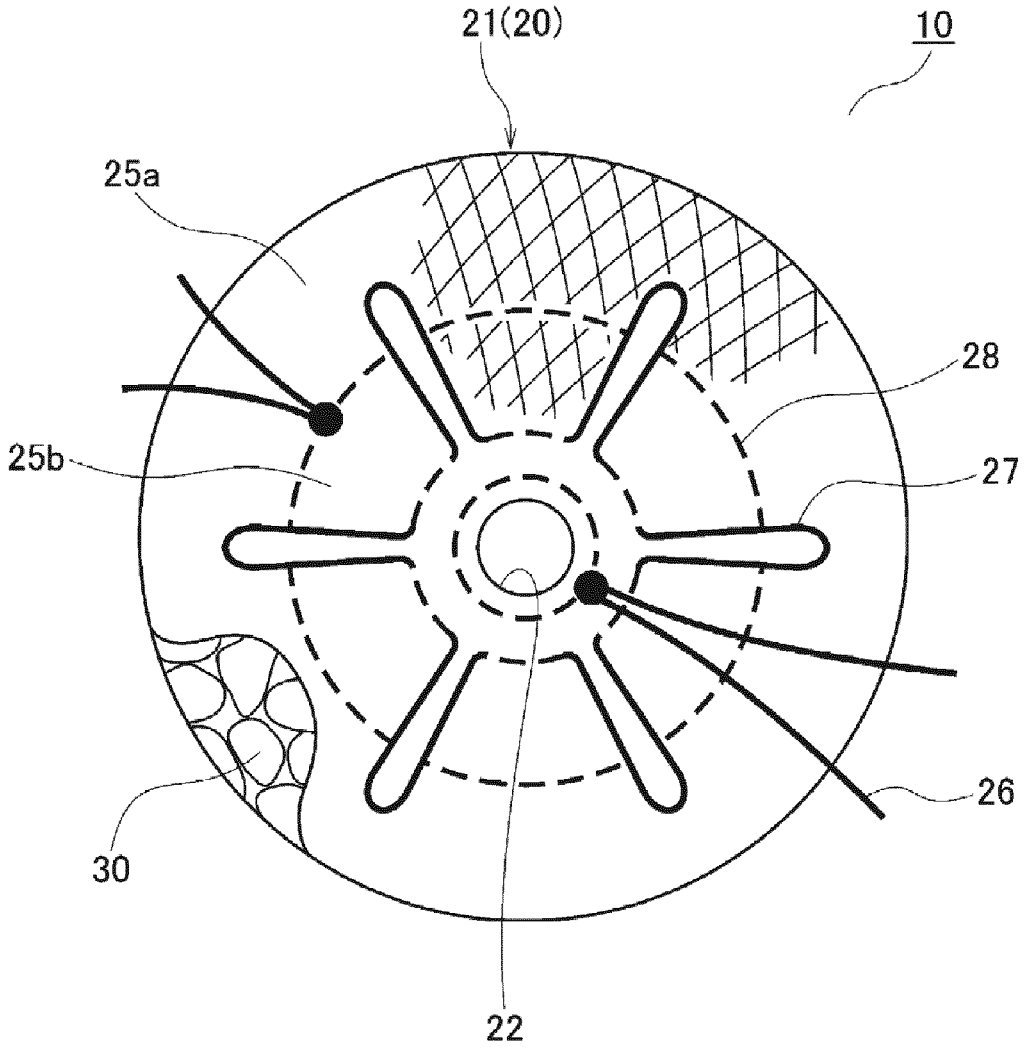
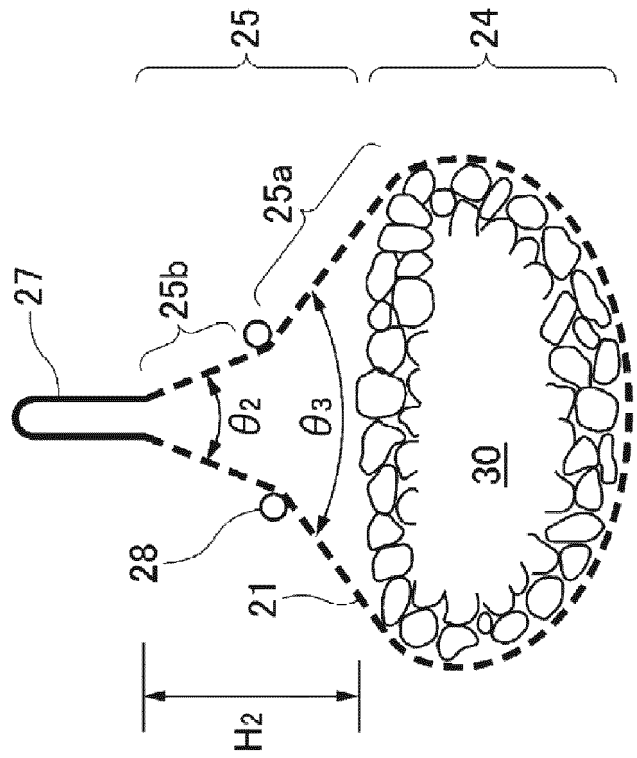
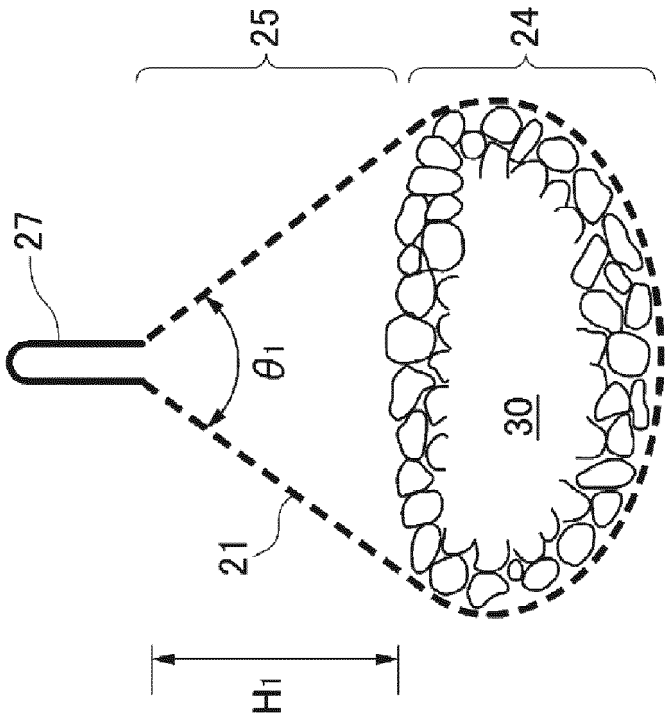


FIG. 4



(B)



(A)

FIG. 5

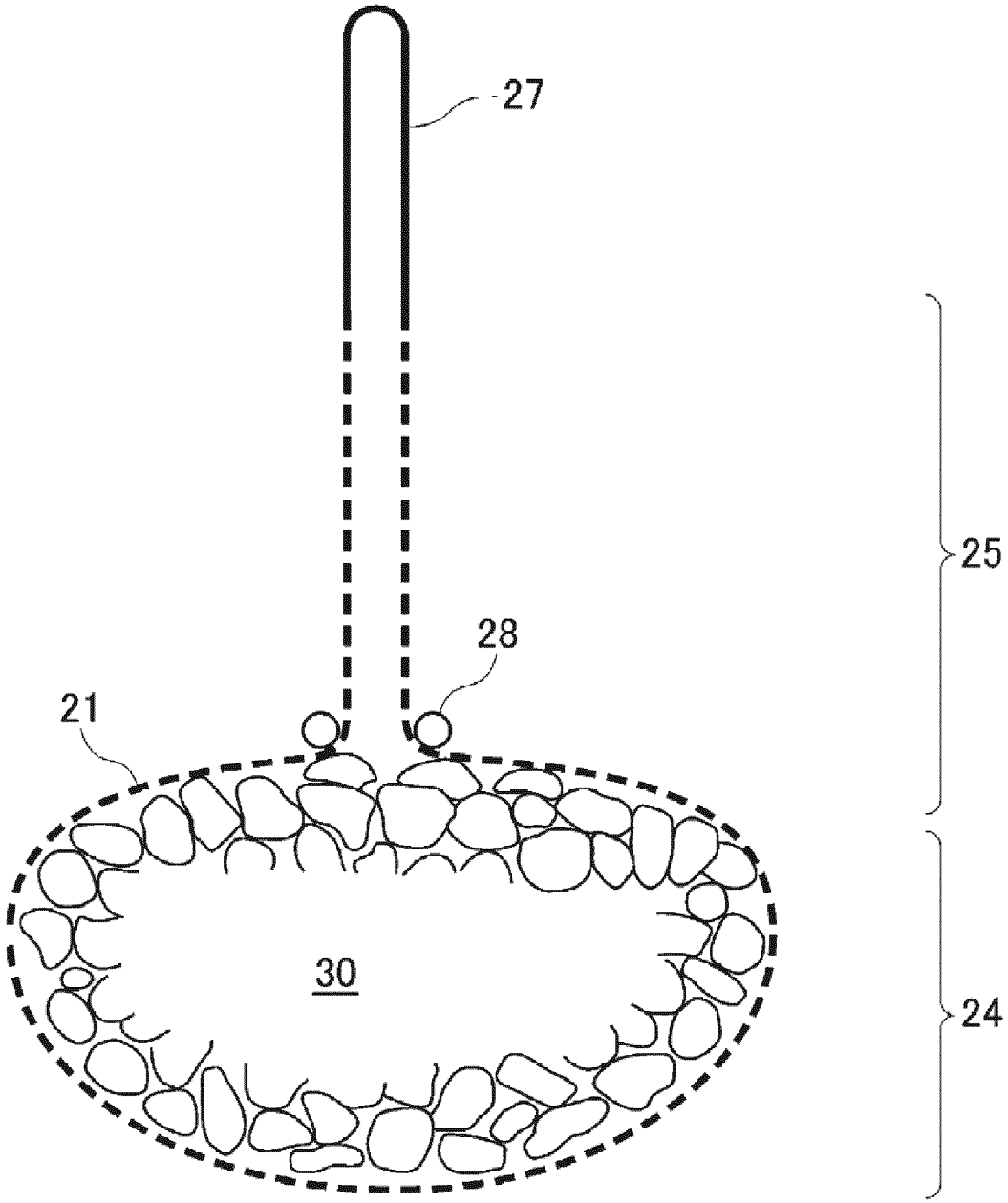


FIG. 6

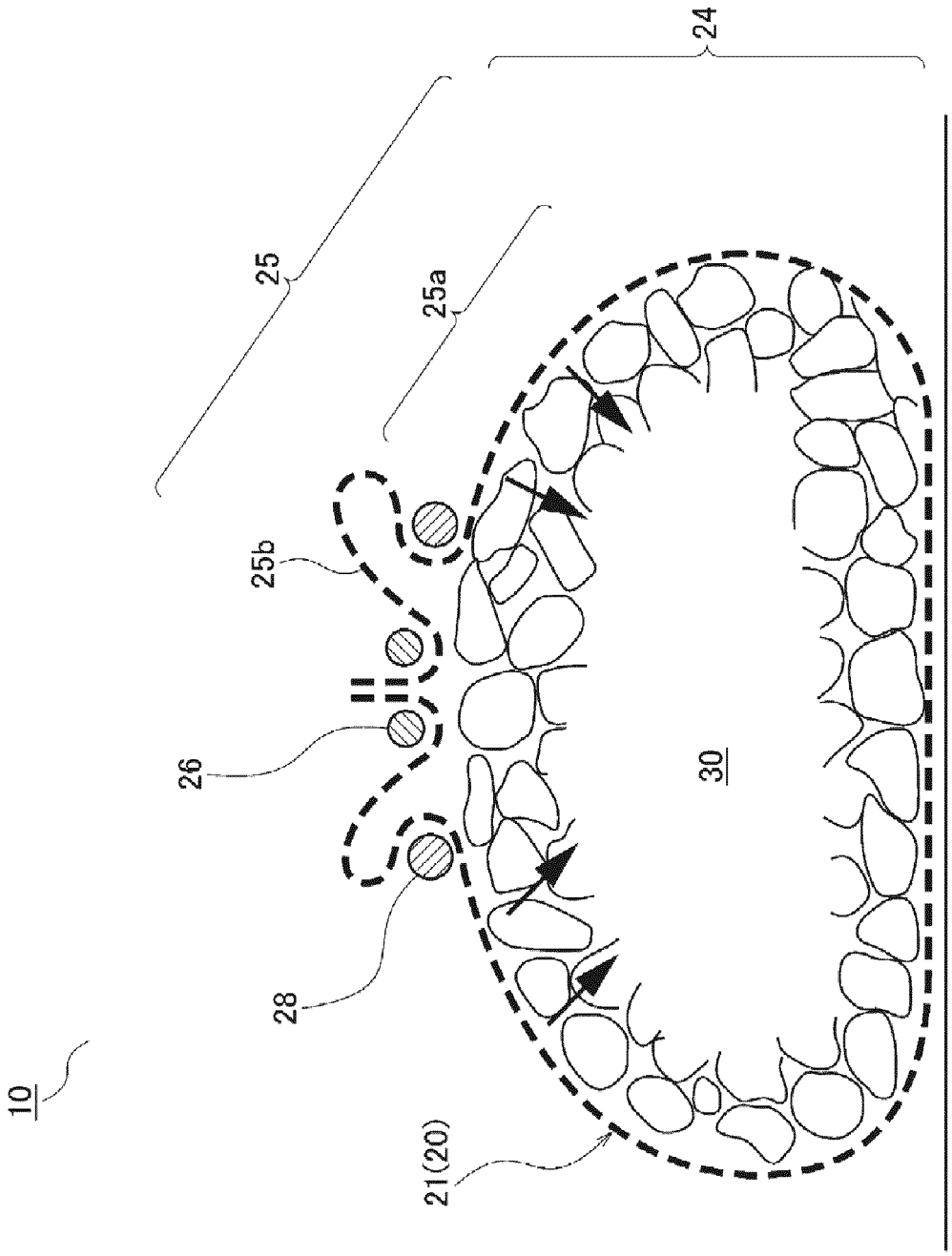


FIG. 7

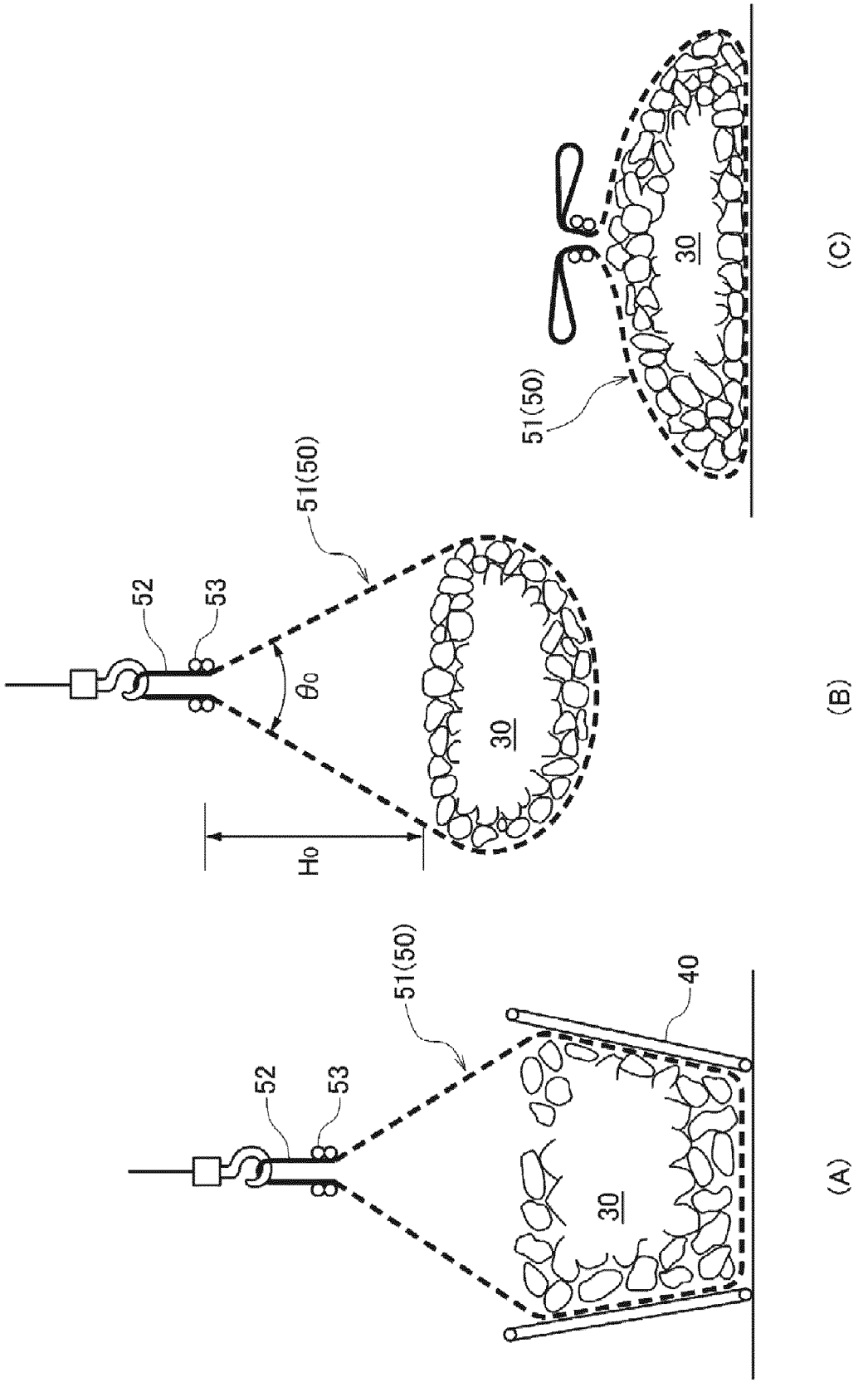


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2020/027494

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. E02B3/04(2006.01)i, E02D17/20(2006.01)i
FI: E02B3/04301, E02D17/20102A

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. E02B3/04, E02D17/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2020
Registered utility model specifications of Japan	1996-2020
Published registered utility model applications of Japan	1994-2020

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2017-227056 A (MAEDA KOSEN CO., LTD.) 28.12.2017 (2017-12-28), paragraphs [0001], [0010]-[0013], [0030], fig. 2	1-6
A	JP 2007-182739 A (MAEDA KOSEN CO., LTD.) 19.07.2007 (2007-07-19), paragraphs [0001], [0018]-[0025], [0028]-[0032], fig. 2, 4	1-6
A	JP 2000-1828 A (KYOWA CO., LTD.) 07.01.2000 (2000-01-07), paragraphs [0001], [0005]-[0012], fig. 5	1-6
A	JP 11-50428 A (SENI DOBOKU KAIHATSU KK) 23.02.1999 (1999-02-23), paragraphs [0001], [0010]-[0016], fig. 4	1-6
A	JP 2016-194216 A (NAKADA SANGYO KK) 17.11.2016 (2016-11-17), paragraphs [0001], [0015]-[0018], fig. 3-5	1-6

☒ Further documents are listed in the continuation of Box C.
☒ See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25.08.2020	08.09.2020

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2020/027494

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 6188184 B1 (MAEDA KOSEN CO., LTD.) 30.08.2017 (2017-08-30), paragraphs [0001], [0010], [0011], fig. 1	1-6
A	WO 2008/140172 A1 (GAMBO MATERIAL HANDLING BV) 20.11.2008 (2008-11-20), entire text, all drawings	1-6

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2020/027494

JP 2017-227056 A	28.12.2017	(Family: none)	
JP 2007-182739 A	19.07.2007	(Family: none)	
JP 2000-1828 A	07.01.2000	(Family: none)	
JP 11-50428 A	23.02.1999	(Family: none)	
JP 2016-194216 A	17.11.2016	(Family: none)	
JP 6188184 B1	30.08.2017	WO 2018/163303 A1 paragraphs [0001], [0010], [0011], fig. 1	
WO 2008/140172 A1	20.11.2008	KR 10-0847538 B1 entire text, all drawings	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2000001828 A **[0014]**
- JP H1150428 B **[0014]**
- JP 2016194216 A **[0014]**
- JP 6188184 B **[0014]**