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(54) ENGINE STARTING DEVICE

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(57) **ABSTRACT**

An engine starting device includes a drainage member which is attached to an attachment hole provided in a machine casing of the device and drains water intruded in the device. The drainage member includes: a torso section; a neck section; a flange section and a claw section, which are integrally configured with the neck section, and in which when the neck section is fitted in the hole, the flange section comes in contact with the inside of the casing and the claw section comes in contact with the outside of the casing, at least one section of the claw section being formed on the outside of the torso section; and partition plates separated in parallel so as to be capable of being overlapped each other and easily deformed when the claw section is pressed from the outside to the inner periphery of the torso section at the claw section.

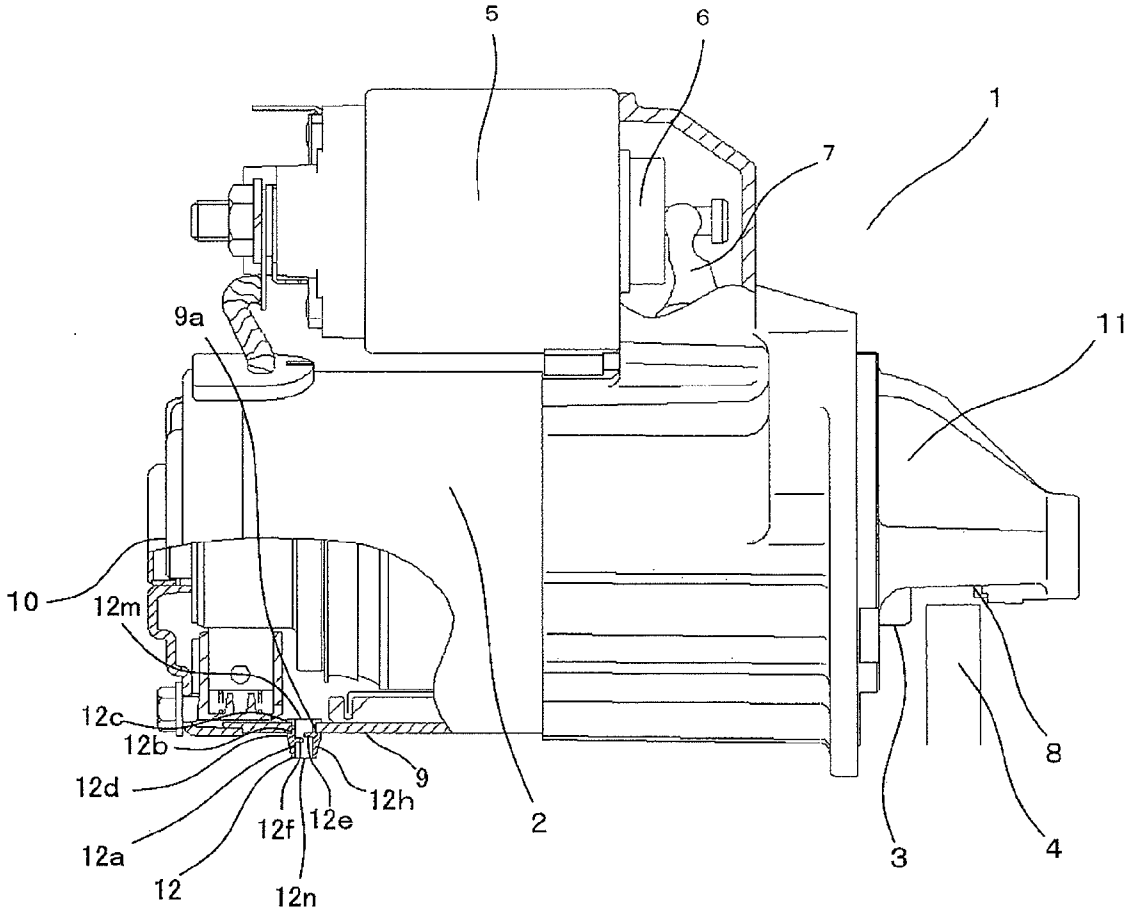

Fig. 1

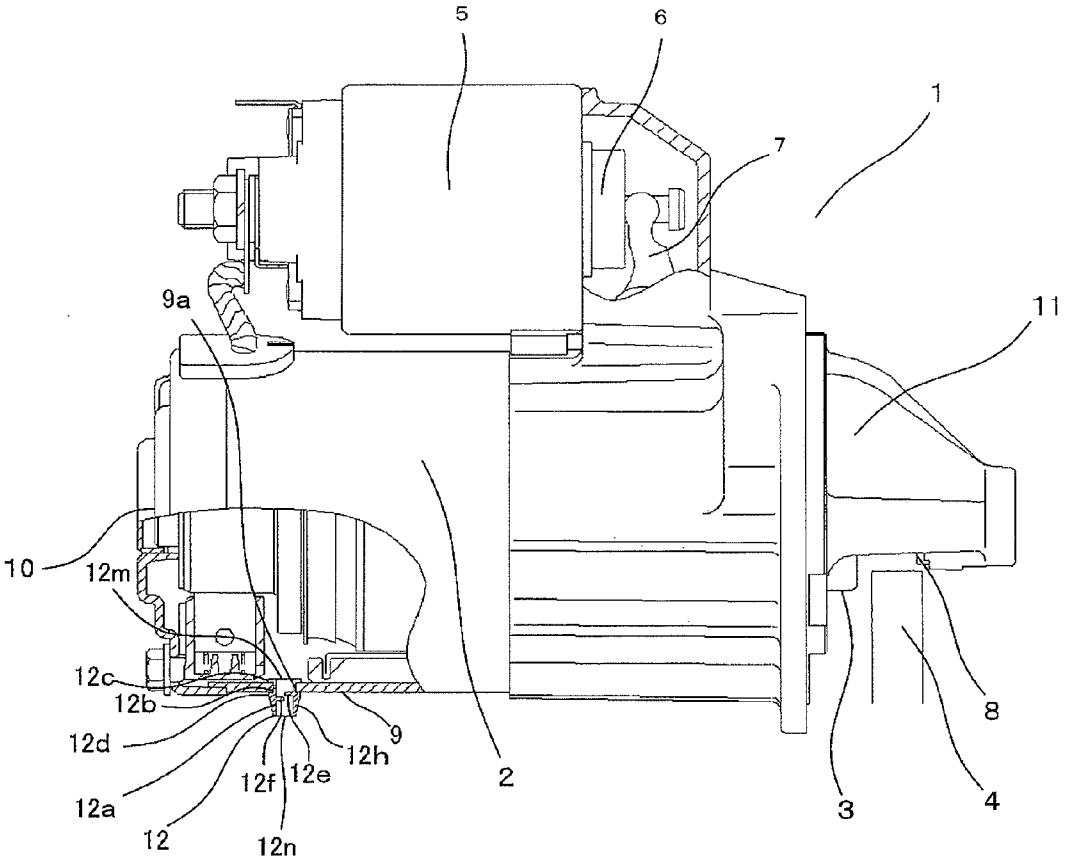
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Fig. 2

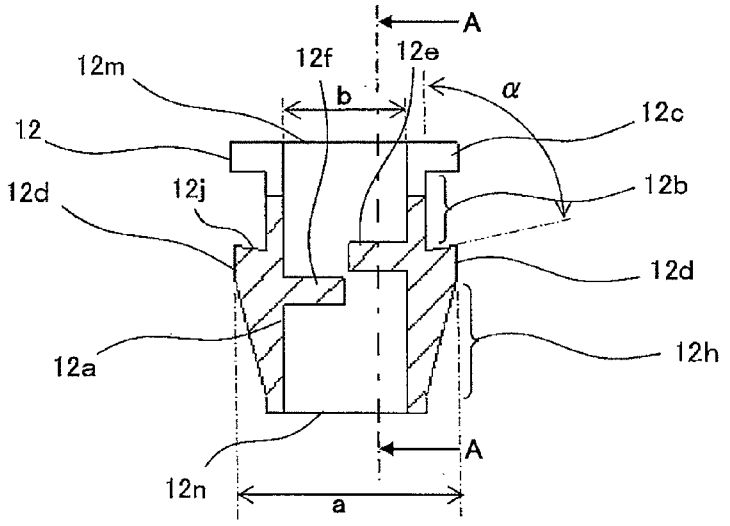
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Fig. 3

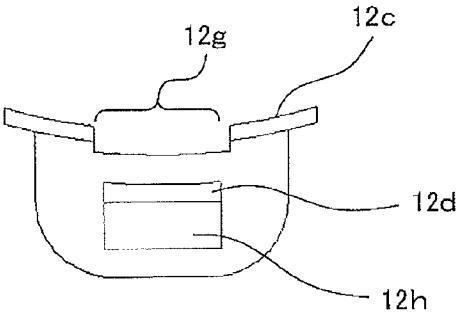


Fig. 4

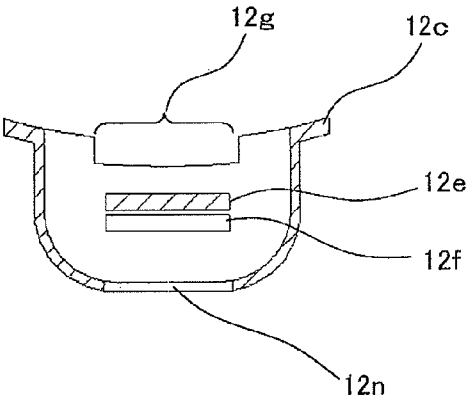


Fig. 5

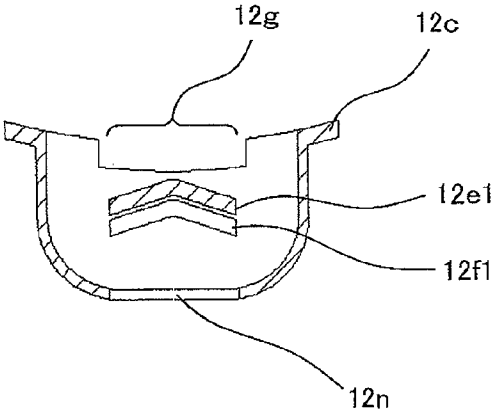


Fig. 6

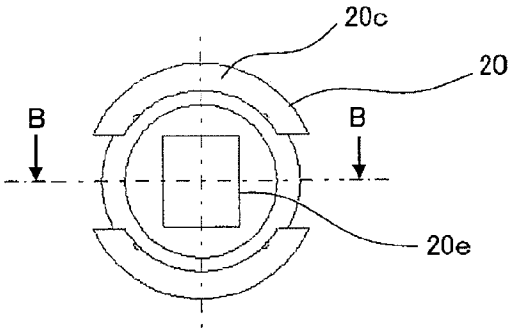


Fig. 7

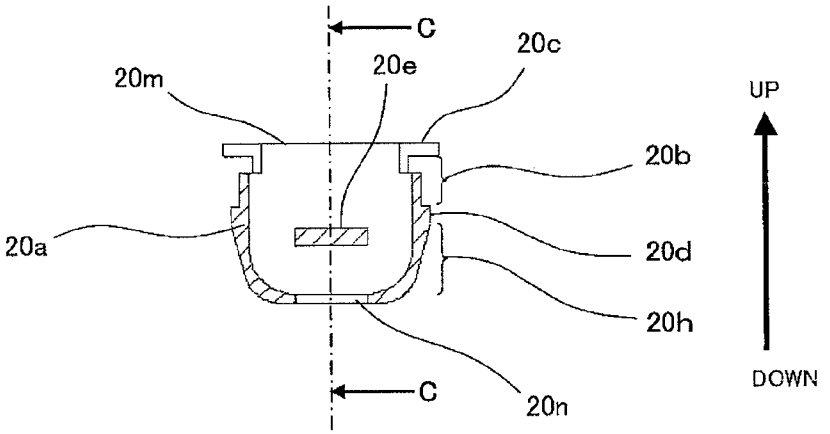


Fig. 8

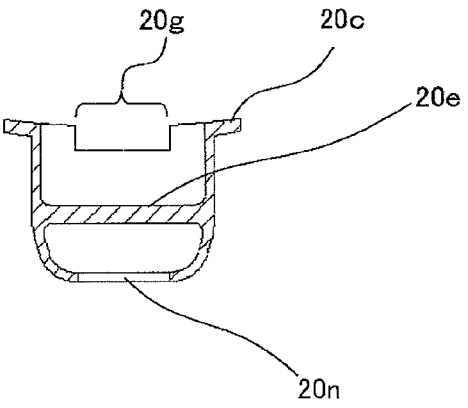


Fig. 9

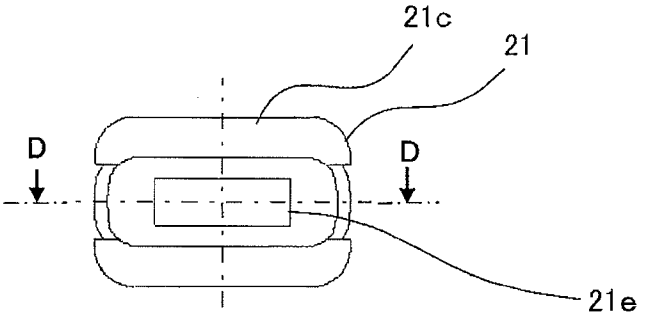


Fig. 10

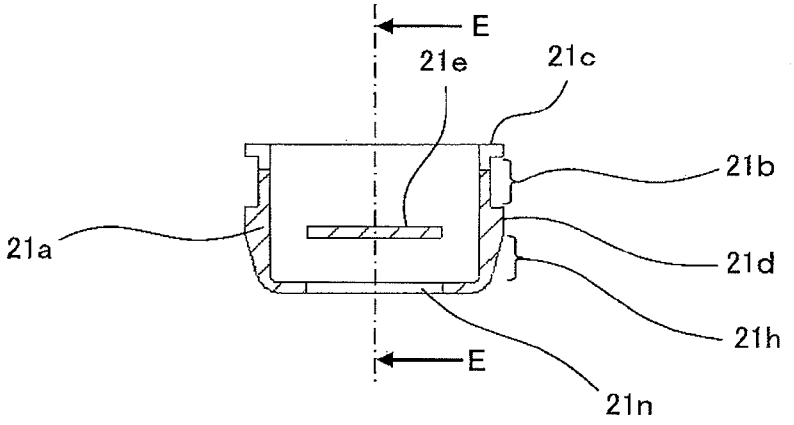
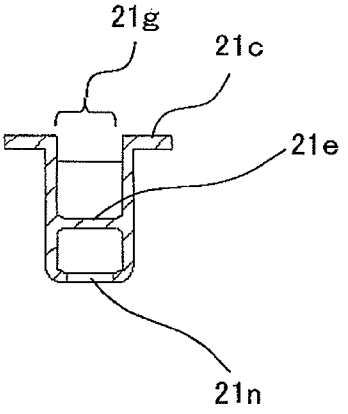


Fig. 11



ENGINE STARTING DEVICE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to engine starting devices and, more particularly, relates to a drainage structure of water intruded in the inside of an engine starting device.

[0003] 2. Description of the Related Art

[0004] As a drainage structure of a conventional engine starting device, for example, there is a drainage member on an engine starting device disclosed in Patent Document 1.

[0005] Such a conventional drainage member is a resin member to be attached to a machine casing of the engine starting device, the drainage member is composed of a neck section to be fitted into an attachment hole provided in the machine casing and a torso section having a labyrinth structure which is for preventing the drainage member from being covered with water from the outside, and a drainage path passes through from the neck section to the torso section.

[0006] As attachment methods in which the drainage member is attached to the machine casing, there are methods as follows: a method **1** (Patent Document 1) in which the drainage member is fitted into an attachment hole of the machine casing from the outside to the inside, a method **2** (Patent Document 2) in which the drainage member is fitted into the machine casing from the inside to the outside, a method **3** (Patent Document 3) in which the drainage member is sandwiched by two machine casings with respect to an opened attachment hole, and the like.

[0007] In the aforementioned method **1** and method **2**, the drainage member includes a claw section to be attached to the machine casing while being elastically deformed and a flange section which sandwiches the machine casing together with the claw section after attachment. Furthermore, in the method **3**, the drainage member is configured such that the machine casings are sandwiched by two flange sections.

PRIOR ART DOCUMENT

Patent Document

[0008] [Patent Document 1] Japanese Unexamined Utility Model Publication No. 4-93466

[0009] [Patent Document 2] Japanese Unexamined Utility Model Publication No. 2-75958

[0010] [Patent Document 3] Japanese Unexamined Patent Publication No. 2007-14191

PROBLEMS TO BE SOLVED BY THE INVENTION

[0011] In the engine starting devices of the aforementioned conventional examples, there are problems in that: as for the aforementioned attachment method **1** and the attachment method **2**, the claw section is easy to be elastically deformed, the size of the claw section is limited in order not to deteriorate attachment properties, and it is likely to be dropped or embedded due to external force in the case of being insufficient in size; and as for the attachment method **3**, the drainage member can be attached without being deformed and therefore the shape of the drainage member becomes difficult to be dropped or embedded; however, the drainage member needs to be attached in assembling the engine starting device and the position of the drainage member needs to be directed to the ground direction of a vehicle; therefore, a plurality of attachment hole positions are provided and thus an assembly device becomes complicated.

[0012] The present invention proposes a drainage structure which can satisfy the aforementioned difficulty to be dropped or embedded and easiness to be attached at the same time in consideration of drainage properties and waterproof properties based on the attachment method **2**. Therefore, in this case, description will be made in detail on the attachment method **2**.

[0013] As the drainage member according to the attachment method **2**, for example, a shape shown in FIG. **6** to FIG. **8** is included. A drainage member **20** shown in FIG. **6** to FIG. **8** includes a flange section **20***c* and a claw section **20***d*, which sandwich the machine casing. The flange section **20***c* is formed so as to contact with the inside of the machine casing; and the claw section **20***d* is formed so as to contact with the outside of the machine casing.

[0014] In this case, the flange section **20***c* does not need to be deformed in attaching and the flange section **20***c* can be provided to be large in size; and therefore, the drainage member **20** can be difficult to be dropped to the outside of the engine starting device.

[0015] A water intake port **20***m* is provided on the upper side of the drainage member **20** and a drainage port **20***n* is provided on the lower side thereof; and a drainage path passes through from the water intake port **20***m* to the drainage port **20***n*. A partition plate **20***e* is provided in the drainage path for preventing water from entering from the outside.

[0016] In the drainage member **20** shown in FIG. **6** to FIG. **8**, in order to avoid interference with components around the engine starting device, there is assumed the case where vertical height is limited; and, in order to lower the height, the claw section which is elastically deformed is provided at substantially the same height as the partition plate of the inner periphery of the drainage member.

[0017] In this case, a connecting portion of the partition plate **20***e* is high in rigidity against deformation to the inside; and therefore, an arrangement is made so that the claw section **20***d* is not located on the outside of a torso section **20***a* to which the partition plate **20***e* is connected. Next, problems of the drainage members **20** shown in FIG. **6** to FIG. **8** will be described.

[0018] In the attachment hole of the machine casing, in order to avoid interference between the components in the inside of the engine starting device and the drainage member, the attachment hole cannot be provided to be a circular shape and there is a case where the shape of the torso section **21***a* and the neck section **21***b* of the drainage member **21** is an oval or rectangular shape. A shape example at that case will be shown in FIG. **9** to FIG. **11**.

[0019] As described above, an arrangement in which a claw section **21***d* is located on the outside of a connecting portion of a partition plate **21***e* needs to be avoided; however, in the case of the oval shape, even the claw section **21***d* is attached at the same position as FIG. **6** to FIG. **8**, rigidity in a direction to be deformed in attaching becomes high. As a result, when attachment properties are taken into account, the height of the claw section **21***d* cannot be sufficiently provided and thus the drainage member **21** is easy to be embedded into the inside of the engine starting device.

SUMMARY OF THE INVENTION

[0020] The present invention is implemented to solve the foregoing problem, and an object of the present invention is to

provide an engine starting device capable of preventing a drainage member from being embedded into the engine starting device and capable of improving attachment properties.

MEANS FOR SOLVING THE PROBLEMS

[0021] According to the present invention, there is provided an engine starting device including a resin-made drainage member which is attached to an attachment hole provided in a machine casing of the engine starting device and drains water intruded in the engine starting device. In the engine starting device, the drainage member includes: a torso section formed with a drainage path in the inside thereof; a neck section to be fitted into the attachment hole provided in the machine casing; a flange section and a claw section, which are integrally configured with the neck section, and in which when the neck section is fitted in the attachment hole provided in the machine casing, the flange section comes in contact with the inside of the machine casing and the claw section comes in contact with the outside of the machine casing, at least one section of the claw section being formed on the outside of the torso section; and a pair of partition plates separated in parallel so as to be capable of being overlapped each other and easily deformed when the claw section is pressed from the outside to the inner periphery of the torso section at the claw section.

ADVANTAGEOUS EFFECT OF THE INVENTION

[0022] According to an engine starting device of the present invention, it becomes capable of preventing a drainage member from being embedded into the engine starting device and capable of improving attachment properties.

[0023] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] FIG. **1** is a relevant part sectional side view showing an engine starting device according to Embodiment 1 of the present invention;

[0025] FIG. **2** is a sectional view showing a drainage member on the engine starting device according to Embodiment 1 of the present invention;

[0026] FIG. **3** is a view in which the drainage member on the engine starting device according to Embodiment 1 of the present invention is seen from the front bracket side;

[0027] FIG. **4** is a sectional view taken along the line A-A of FIG. **2** showing the drainage member on the engine starting device according to Embodiment 1 of the present invention; and

[0028] FIG. **5** is a sectional view showing other example of a drainage member on the engine starting device according to Embodiment 1 of the present invention.

[0029] FIG. **6** is a view in which a drainage member on a conventional engine starting device is seen from the drainage port side;

[0030] FIG. **7** is a sectional view taken along the line B-B of FIG. **6** showing the conventional engine starting device; and

[0031] FIG. **8** is a sectional view taken along the line C-C of FIG. **7** showing the conventional engine starting device.

[0032] FIG. **9** is a view in which a drainage member on other conventional engine starting device is seen from the drainage port side;

[0033] FIG. **10** is a sectional view taken along the line D-D of FIG. **9** showing other conventional engine starting device; and

[0034] FIG. **11** is a sectional view taken along the line E-E of FIG. **10** showing other conventional engine starting device.

DETAILED DESCRIPTION OF THE INVENTION

Embodiment 1

[0035] Hereinafter, Embodiment 1 of the present invention will be described with reference to FIG. **1** to FIG. **5**; however, in each of the drawings, identical or equivalent members and portions will be described with the same reference numerals assigned thereto. FIG. **1** is a relevant part sectional side view showing an engine starting device according to Embodiment 1 of the present invention. FIG. **2** is a sectional view showing a drainage member on the engine starting device according to Embodiment 1 of the present invention. FIG. **3** is a view in which the drainage member on the engine starting device according to Embodiment 1 of the present invention is seen from the front bracket side. FIG. **4** is a sectional view taken along the line A-A of FIG. **2** showing the drainage member on the engine starting device according to Embodiment 1 of the present invention. FIG. **5** is a sectional view showing other example of a drainage member on the engine starting device according to Embodiment 1 of the present invention.

[0036] In these drawings, reference numeral **1** denotes an engine starting device, and **2** denotes a motor unit which generates rotational energy by being energized. **3** denotes a pinion and the rotational energy generated by the motor unit **2** is transmitted to an engine ring gear **4** through the pinion **3**. **5** denotes a switching device having a solenoid (not shown in the drawing) in the inside thereof. **6** denotes a plunger which is sucked to the inside of the switching device **5** by energizing the solenoid of the switching device **5**. **7** denotes a shift lever which transmits a movement of the plunger **6** to the pinion **3**. **8** denotes a stopper which controls a movement of the pinion **3**. **9** denotes a machine casing of a yoke which constitutes a part of the motor unit **2**, **10** denotes a rear bracket, and **11** denotes a front bracket.

[0037] Next, operation of the engine starting device **1** will be briefly described. When the solenoid of the switching device **5** is energized, the plunger **6** is sucked and the plunger **6** starts to move to the left side in FIG. **1**. Along with a movement thereof, the pinion **3** is extruded to the right side in FIG. **1** through the shift lever **7** loosely inserted in the plunger **6**, and the pinion **3** comes in contact with the engine ring gear **4**. After that, when the pinion **3** is engaged with the engine ring gear **4**, the pinion **3** moves to the right side in FIG. **1** until the pinion **3** comes in contact with the stopper **8** of the engine starting device **1**, and the rotational energy is transmitted to the engine ring gear **4** to start up an engine.

[0038] Next, a drainage structure of water intruded in the engine starting device **1** will be described. **12** denotes a drainage member which is attached to an attachment hole **9***a* of the machine casing **9** of the yoke of the engine starting device **1** and the drainage member **12** has a role to drain when the engine starting device **1** is covered with water and the water intrudes inside the engine starting device **1**.

[0039] In this case, the drainage member **12** is made of resin. As shown in FIG. **2**, the drainage member **12** includes:

a torso section **12***a* formed with a drainage path in the inside thereof; a neck section **12***b* to be fitted into the attachment hole **9***a* provided in the machine casing **9** of the yoke; a flange section **12***c* and a claw section **12***d*, which are integrally configured with the neck section **12***b*, and in which when the neck section **12***b* is fitted in the attachment hole **9***a* provided in the machine casing **9**, the flange section **12***c* comes in contact with the inside of the machine casing **9** and the claw section **12***d* comes in contact with the outside of the machine casing **9**, at least one section of the claw section **12***d* being formed on the outside of the torso section **12***a*; and a pair of partition plates **12***e*, **12***f* which are arranged by being vertically shifted so as not to be butted and are vertically separated in parallel so as to be capable of being overlapped each other and easily deformed when the claw section **12***d* is pressed from the outside to the inner periphery of the torso section **12***a* at the claw section **12***d*. Incidentally, the drainage member **12** is provided with a water intake port **12***m* and a drainage port **12***n*.

[0040] The flange section **12***c* and the claw section **12***d* of the drainage member **12** are gently curved along a cylindrical shape of the machine casing **9** of the yoke in order to secure waterproof properties.

[0041] Furthermore, the flange section **12***c* of the drainage member **12** is provided with a slit **12***g* so as to facilitate water in the inside of the machine casing **9** of the yoke to be removed. In order to improve shape forming properties, the slit **12***g* is located at a position to be overlapped with the claw section **12***d* when seen from an attaching direction of the drainage member **12**, that is, when seen from an upper direction of the drainage member **12**. Such an arrangement is made; and accordingly, the configuration of a die can be simplified and an improvement in shape forming properties can be achieved.

[0042] Furthermore, the flange section **12***c* is not provided at a portion of the slit **12***g*; and therefore, a labyrinth structure cannot be formed between the machine casing **9** of the yoke and the slit **12***g* portion. However, in this embodiment, the labyrinth structure is formed between the claw section **12***d* and the machine casing **9** of the yoke; and therefore, it becomes possible to prevent water from intruding from the slit **12***g* portion and an improvement of waterproof properties can be achieved.

[0043] The claw section **12***d* of the drainage member **12** is provided with a tapered section **12***h* so that the drainage member **12** is easy to be deformed to the inside when the drainage member **12** is attached into the attachment hole **9***a* provided in the machine casing **9** of the yoke.

[0044] Then, the inside of the drainage member **12** has the partition plates **12***e*, **12***f* so as to form the labyrinth structure in order to prevent water from intruding from the outside, that is, from the drainage port **12***n*.

[0045] Next, attachment means of the drainage member **12** to the machine casing **9** of the yoke will be described. The aforementioned drainage member **12** is fitted and attached by being pressed from the inside of the machine casing **9** of the yoke to the outside of the machine casing **9**.

[0046] In mid flow of the attachment, the drainage member **12** is inserted from the tapered section **12***h* to the attachment hole **9***a* provided in the machine casing **9** of the yoke while deforming the claw section **12***d* gradually; and when the drainage member **12** reaches the neck section **12***b*, the deformation of the drainage member **12** is restituted and the attachment is completed. Finally, the drainage member **12** is fixed in a sandwiched manner that the machine casing **9** of the yoke is sandwiched by the flange section **12***c* and the claw section **12***d*.

[0047] By the way, when the drainage member **12** is fitted into the attachment hole **9***a* provided in the machine casing **9** of the yoke while deforming the claw section **12***d* of the drainage member **12**, a pair of the partition plates **12***e*, **12***f* provided being vertically separated in parallel to the inner periphery of the torso section **12***a* at the claw section **12***d* are easily deformed in a horizontal direction by pressing force from the outside of the claw section **12***d* so as to be overlapped each other without butting, the drainage member **12** can be easily attached to the machine casing **9** of the yoke, and the drainage member **12** is not embedded into the engine starting device **1**.

[0048] Furthermore, the partition plates **12***e*, **12***f* of the drainage member **12** are arranged by being vertically separated in parallel in the horizontal direction as shown in FIG. **4**; however, the present invention is not limited to this. For example, as shown in FIG. **5**, the shape of partition plates **12***e***1**, **12***f***1** are formed by being bent in a chevron shape, for example, and end portions are formed toward the drainage port **12***n* side of the drainage path of the drainage member **12**; and accordingly, drainage properties can be further improved.

[0049] Incidentally, in the aforementioned Embodiment 1, the description has been made on the case where the drainage member **12** is attached to the machine casing **9** of the yoke that is the motor unit **2** as the machine casing of the engine starting device **1**; however, the present invention is not limited to this. A rear bracket **10** or a front bracket **11** may be served as the machine casing of the engine starting device **1** and the attachment hole which is for attaching the drainage member **12** is provided in such bracket; and accordingly, the drainage member **12** can be attached in the same manner and the same effects as the aforementioned Embodiment 1 can be exhibited.

[0050] According to the aforementioned configuration, in a deforming direction of the claw section **12***d* of the drainage member **12** in attaching the drainage member **12**, a space is formed between the partition plates **12***e*, **12***f* and the torso section **12***a* which forms the drainage path; and therefore, rigidity of the drainage member **12** against the deformation to the inside of the claw section **12***d* is lowered. As a result, a contact area between the claw section **12** and the machine casing **9** can be broadened; and therefore, the drainage member **12** can be formed in a shape that is difficult to be embedded into the engine starting device **1** and attachment properties can also be further improved.

[0051] This effect can be obtained until the amount of deformation of the claw section **12***d* reaches ½ of the width of the neck section **12***b*. That is, in the present invention, the partition plates **12***e*, **12***f* in the inside of the drainage member **12** are separated; and accordingly, the claw section **12***d* of the drainage member **12** is easy to be deformed and assembly properties can be facilitated. This effect can be obtained in a state where there is a space between the separated partition plates **12***e*, **12***f* and the inner walls of the drainage member **12**; however, after the partition plates **12***e*, **12***f* come in contact with the inner walls, the effect by the separation of the partition plates **12***e*, **12***f* is eliminated and the rigidity against the deforming direction is drastically increased.

[0052] In this case, the distance between the partition plates **12***e*, **12***f* and the inner walls is the longest in the case where the partition plates **12***e*, **12***f* are separated at the center; and there-

fore, the effect that improves the assembly properties by the separation of the partition plates **12***e*, **12***f* is in the case of ½ of the length of the neck section **12***b* (to be exact, length in which the thickness of the drainage member **12** is subtracted from the length of the neck section **12***b*).

[0053] Furthermore, the surface of the claw section **12***d*, which faces the machine casing **9**, can reduce a component of a load in which the claw section **12***d* deforms to the inside in the case where the load is applied to a direction in which the drainage member **12** is embedded, and strength against embedment can be further enhanced.

[0054] Furthermore, the surface **12***j* of the claw section **12***d*, which faces the machine casing **9**, of the drainage member **12** is configured so as to be disposed at a sharp angle with the outer periphery surface of the machine casing **9**. That is, as shown in FIG. **2**, the torso section **12***a* side of the surface **12***j* of the claw section **12***d*, which faces the machine casing **9**, of the drainage member **12** is formed in a tapered shape so as to be located on the drainage port **12***n* side with respect to the external end side of the surface **12***j* of the claw section **12***d*, which faces the machine casing **9**, of the drainage member **12**; and accordingly, the external end side of the surface **12***j* of the claw section **12***d*, which faces the machine casing **9**, of the drainage member **12** comes in contact with the outer periphery surface of the machine casing **9** and is firmly fixed and this makes it possible to further efficiently prevent the drainage member **12** from being embedded into the machine casing **9**.

[0055] Incidentally, according to Embodiment 1 of the present invention, an area of the drainage port **12***n* of the drainage member **12** scarcely changes; and therefore, conventional drainage properties can be secured.

[0056] While the presently preferred embodiments of the present invention have been shown and described. It is to be understood that these disclosures are for the purpose of illustration and that various changes and modifications may be made without departing from the scope of the invention as set forth in the appended claims.

What is claimed is:

1. An engine starting device comprising:

a resin-made drainage member which is attached to an attachment hole provided in a machine casing of said engine starting device and drains water intruded in said engine starting device,

wherein said drainage member includes:

a torso section formed with a drainage path in the inside thereof;

a neck section to be fitted into the attachment hole provided in said machine casing;

a flange section and a claw section, which are integrally configured with said neck section, and in which when said neck section is fitted in the attachment hole provided in said machine casing, said flange section comes in contact with the inside of said machine casing and said claw section comes in contact with the outside of said machine casing, at least one section of said claw section being formed on the outside of said torso section; and

a pair of partition plates separated in parallel so as to be capable of being overlapped each other and easily deformed when said claw section is pressed from the outside to the inner periphery of said torso section at said claw section.

2. The engine starting device according to claim **1**,

wherein said partition plate has a shape formed by being bent in a chevron shape, and has end portions formed toward the drainage port side of the drainage path.

3. The engine starting device according to claim **1**,

wherein said drainage member has a tapered section formed from an insertion surface to said claw section, the insertion surface being provided for making said drainage member fit from the inside to the outside of said machine casing.

4. The engine starting device according to claim **1**,

wherein the amount of deformation of the width in a direction to be deformed in attaching said drainage member is not more than b/2.

5. The engine starting device according to claim **3**,

wherein the surface of said claw section, which faces said machine casing, is configured so that an angle α is a sharp angle.

6. The engine starting device according to claim **1**,

wherein said flange section is provided with a slit at a position to be overlapped with said claw section when seen from a direction in which said drainage member is attached to said machine casing.

7. The engine starting device according to claim **1**,

wherein said flange section and said claw section have a curved shape along a cylindrical shape of said machine casing.

8. The engine starting device according to claim **5**,

wherein said flange section is provided with a slit at a position to be overlapped with said claw section when seen from a direction in which said drainage member is attached to said machine casing.

9. The engine starting device according to claim **5**,

wherein said flange section and said claw section have a curved shape along a cylindrical shape of said machine casing.

10. The engine starting device according to claim **4**,

wherein said partition plate has a shape formed by being bent in a chevron shape, and has end portions formed toward the drainage port side of the drainage path.

11. The engine starting device according to claim **4**,

wherein said drainage member has a tapered section formed from an insertion surface to said claw section, the insertion surface being provided for making said drainage member fit from the inside to the outside of said machine casing.

12. The engine starting device according to claim **4**,

wherein said flange section is provided with a slit at a position to be overlapped with said claw section when seen from a direction in which said drainage member is attached to said machine casing.

13. The engine starting device according to claim **4**,

wherein said flange section and said claw section have a curved shape along a cylindrical shape of said machine casing.

14. The engine starting device according to claim **10**,

wherein said drainage member has a tapered section formed from an insertion surface to said claw section, the insertion surface being provided for making said drainage member fit from the inside to the outside of said machine casing.

15. The engine starting device according to claim **14**,
wherein the surface of said claw section, which faces said machine casing, is configured so that an angle α is a sharp angle.

16. The engine starting device according to claim **15**,
wherein said flange section is provided with a slit at a position to be overlapped with said claw section when seen from a direction in which said drainage member is attached to said machine casing.

17. The engine starting device according to claim **15**,
wherein said flange section and said claw section have a curved shape along a cylindrical shape of said machine casing.

18. The engine starting device according to claim **11**,
wherein the surface of said claw section, which faces said machine casing, is configured so that an angle a is a sharp angle.

19. The engine starting device according to claim **18**,
wherein said flange section is provided with a slit at a position to be overlapped with said claw section when seen from a direction in which said drainage member is attached to said machine casing.

20. The engine starting device according to claim **18**,
wherein said flange section and said claw section have a curved shape along a cylindrical shape of said machine casing.

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