(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 114 976 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.01.2017 Bulletin 2017/02

(51) Int Cl.:
A47L 9/10 *(2006.01)*

(21) Application number: **16172429.9**

(22) Date of filing: **01.06.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **06.07.2015 JP 2015134972**

(71) Applicant: **Yamabiko Corporation**
Ohme-shi
Tokyo 198-8760 (JP)

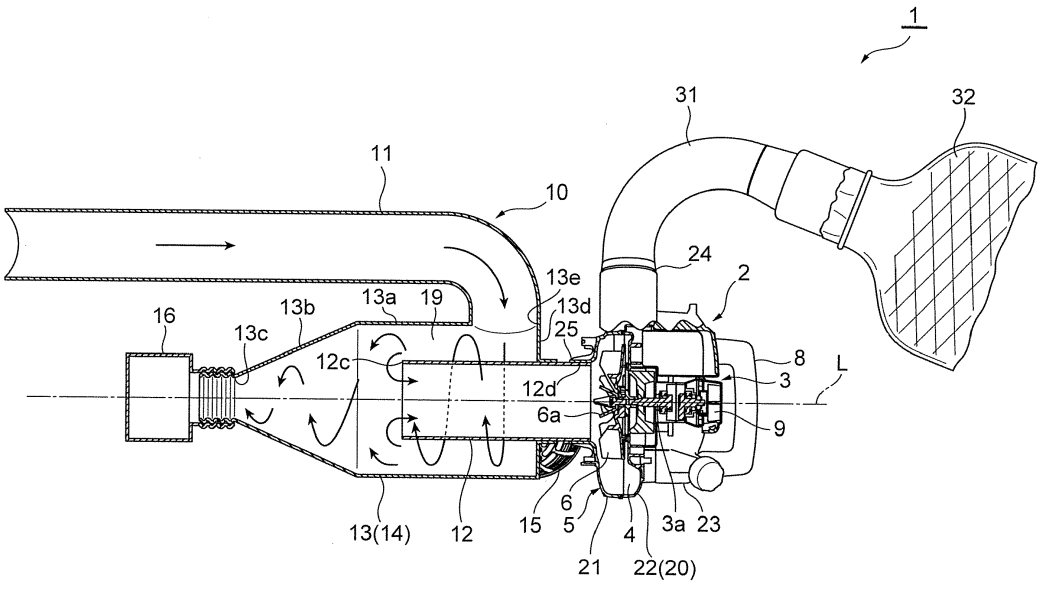
(72) Inventors:
- **KAMO, Keita**
  Ohme-Shi, Tokyo 198-8760 (JP)
- **TAKASHIMA, Masahiko**
  Ohme-shi, Tokyo 198-8760 (JP)

(74) Representative: **Dietz, Christopher Friedrich et al**
Gleiss Große Schrell und Partner mbB
Patentanwälte Rechtsanwälte
Leitzstraße 45
70469 Stuttgart (DE)

(54) VACCUM CLEANER

(57) To provide a vacuum cleaner capable of effectively preventing damage to a fan and a fan case without significantly decreasing the suction force. The vacuum cleaner includes a suction portion, a centrifugal separation portion, and a first collection portion that are provided on an upstream side of a fan stored in a fan case; and a second collection portion provided on a downstream side of the fan. The vacuum cleaner is configured to, with rotation of the fan, separate a part of air introduced into the centrifugal separation portion via the suction portion to the first collection portion side, thereby collecting sucked objects contained in the air into the first collection portion, and separate another part of the air introduced into the centrifugal separation portion to the fan side, thereby collecting sucked objects contained in the air into the second collection portion.

FIG. 1



EP 3 114 976 A1

Description

CLAIM OF PRIORITY

[0001] The present application claims priority from Japanese patent application JP 2015-134972 filed on July 6, 2015, the content of which is hereby incorporated by reference into this application.

BACKGROUND

Technical Field

[0002] The present invention relates to a vacuum cleaner used for cleaning work and the like. In particular, the present invention relates to a vacuum cleaner adapted to collect sucked objects by separating them according to weight.

Background Art

[0003] FIG. 5 shows the conventional vacuum cleaner of this type. The conventional vacuum cleaner 1' shown in the drawing has a main body portion 2, which includes an air-cooled two-cycle internal combustion engine 3 functioning as a motor and a blower 5 driven by the internal combustion engine 3, and also has a centrifugal fan for the blower 5 attached to one end of a crankshaft that is an output axis of the internal combustion engine 3. The blower 5 has a fan case 20 with a two-part configuration, which includes a front side case portion 21 and a back side case portion 22 that form a spiral volute 4, and a fan stored in the volute 4 of the fan case 20. A main body cover 23, which covers a cylinder of the internal combustion engine 3 and the like, is provided integrally and continuously with the back side of the back side case portion 22. In addition, an upper handle 7 is provided above the main body portion 2 such that it intersects at right angles with the crankshaft, while a rear handle 8 is provided on the back side of the internal combustion engine 3 of the main body portion 2 such that it intersects at right angles with the upper handle 7. Further, a cylindrical suction opening 25 is provided in the center of the front side of the fan case 20 (i.e., front side case portion 21), and a blowoff port 24 is provided at one side of the fan case 20.

[0004] A proximal end portion of a suction pipe 10, which is made of a long cylindrical pipe produced from a synthetic resin material, such as vinyl chloride, through blow molding and the like, is inserted into the suction opening 25, and is detachably secured thereto with a tightening band or the like that is looped around the outer periphery of the suction opening 25, for example. The conventional vacuum cleaner 1' shown in the drawing is configured such that it can selectively perform an operation of sucking fallen leaves, dust, and the like, and a blowing operation of sweeping them (which will be described in detail later). The suction opening 25 has a suction opening cover 15, which can cover the opening, attached thereto in such a manner that it can be opened or closed via a hinge member and is urged by a spring (not shown) in the direction to always close the opening. When the vacuum cleaner is in a state of performing an operation of sucking fallen leaves, dust, and the like, that is, when the vacuum cleaner is used as a cleaning vacuum cleaner, the suction pipe 10 is connected to the suction opening 25 with the suction opening cover 15 in an open state.

[0005] Meanwhile, a substantially L-shaped blowoff pipe 31 is detachably attached to the blowoff port 24, and a dust collection bag 32 with appropriate ventilation characteristics is attached to the downstream end of the blowoff pipe 31. An operator performs the aforementioned operation while carrying the dust collection bag 32 by slinging a portable band 33, which is attached to the dust collection bag 32, over his/her shoulder.

[0006] When the vacuum cleaner 1' with such a configuration is used, the internal combustion engine 3 is usually started by operating a recoil starter (not shown), and the upper handle 7 and the rear handle 8 are gripped with both hands so that a tip-end opening (suction port) 10a of the suction pipe 10 is put close to the objects to be sucked, such as fallen leaves and dust. The objects sucked into the suction pipe 10 from the suction port 10a with the rotation of the fan are chopped by cutting blades that rotate integrally with the fan in the main body portion 2, so that the chopped objects are discharged with the sucked airflow (i.e., airflow generated with the rotation of the fan) from the blowoff pipe 31 via the volute 4 formed around the fan, and are then stored in the dust collection bag 32.

[0007] It should be noted that when the vacuum cleaner 1' is used as a cleaning blower for sweeping fallen leaves, dust, and the like, the suction pipe 10 is detached and the suction opening cover 15 is closed, and instead of the blowoff pipe 31 and the dust collection bag 32, a blowoff pipe with a narrow, flat tip end (not shown), for example, is attached to the blowoff port 24 so that a tip-end opening of the blowoff pipe is directed toward the ground to blow away fallen leaves and the like with the air that is blown out from the tip-end opening with the rotation of the fan (see Patent Document 1).

RELATED ART DOCUMENTS

Patent Documents

[0008] Patent Document 1: JP 3670854 B

SUMMARY

[0009] By the way, the vacuum cleaner such as the one described above is mainly intended to suck relatively light and soft objects, such as fallen leaves and cut grass, and collect them into the dust collection bag with the rotation of the fan. However, in practice, there has been a

possibility that relatively heavy and hard objects, such as stones and pieces of wood, may also be sucked, which can damage the fan and the fan case. As measures to prevent such damage to the fan and the fan case, there have been proposed methods of increasing the pipe diameter of the suction pipe to prevent heavy objects from being sucked up to the fan, reducing the number of the blades of the fan, and producing the fan and the fan case using materials with high shock resistance.

[0010] However, when the pipe diameter of the suction pipe is increased or the number of the blades of the fan is reduced, the suction force would decrease. In particular, as the vacuum cleaner combines the function of a blower for performing a blowing operation of sweeping fallen leaves, dust, and the like, if the number of the blades of the fan is reduced, the blowing performance would decrease when the vacuum cleaner is used as the blower. Further, when the fan and the like are produced using materials with high shock resistance, the production costs would inevitably increase.

[0011] The present invention has been made in view of the foregoing, and it is an object of the present invention to provide a vacuum cleaner that can effectively prevent damage to a fan and a fan case without significantly decreasing the suction force.

[0012] In order to achieve the above object, a vacuum cleaner in accordance with the present invention includes a suction portion, a centrifugal separation portion, and a first collection portion that are provided on an upstream side of a fan stored in a fan case; and a second collection portion provided on a downstream side of the fan. The vacuum cleaner is configured to, with rotation of the fan, separate a part of air introduced into the centrifugal separation portion via the suction portion to the first collection portion side, thereby collecting sucked objects contained in the air into the first collection portion, and separate another part of the air introduced into the centrifugal separation portion to the fan side, thereby collecting sucked objects contained in the air into the second collection portion.

[0013] In a preferred embodiment, a suction opening provided in the fan case has connected thereto a suction pipe, the suction pipe including the suction portion and the centrifugal separation portion.

[0014] In another preferred embodiment, the centrifugal separation portion includes an inner pipe and an outer pipe, the inner pipe having a proximal end portion connected to a suction opening provided in the fan case, and the outer pipe being arranged around an outer periphery of the inner pipe such that a tip-end-side opening of the outer pipe projects to a tip end side beyond a tip-end-side opening of the inner pipe. The suction portion communicates with a space formed between the inner pipe and the outer pipe, and the first collection portion is provided at the tip-end-side opening of the outer pipe.

[0015] In another preferred embodiment, the vacuum cleaner further includes an adjustment mechanism for adjusting a position of the tip-end-side opening of the inner pipe with respect to the outer pipe in an axial line direction.

[0016] In further another preferred embodiment, the adjustment mechanism includes at least one of a slide structure adapted to move the inner pipe and the outer pipe relative to each other in the axial line direction, a slide structure adapted to move a plurality of members relative to each other in the axial line direction, the plurality of members forming at least one of the inner pipe or the outer pipe, or a bellows structure formed in at least one of the inner pipe or the outer pipe, the bellows structure being adapted to expand and contract in the axial line direction.

[0017] In another preferred embodiment, the proximal end portion of the inner pipe projects to a proximal end side beyond a proximal end portion of the outer pipe, and the proximal end portion of the outer pipe around the inner pipe is closed.

[0018] In a further preferred embodiment, the suction portion is provided continuously with the proximal end portion of the outer pipe.

[0019] In another preferred embodiment, the vacuum cleaner further includes an opening/closing member provided at the first collection portion or the tip-end-side opening of the outer pipe, the opening/closing member being adapted to be urged so as to close the tip-end-side opening of the outer pipe.

[0020] The first collection portion is preferably adapted to automatically or manually dispose sucked objects that have been collected.

[0021] An inside of the first collection portion is preferably visible.

[0022] In another preferred embodiment, the second collection portion is provided at a downstream-side opening of a blowoff pipe, the blowoff pipe communicating with a volute formed around the fan in the fan case.

[0023] According to the present invention, a suction portion, a centrifugal separation portion, and a first collection portion are provided on an upstream side of a fan stored in a fan case, and a second collection portion is provided on a downstream side of the fan. With the rotation of the fan, a part of air introduced into the centrifugal separation portion via the suction portion is separated to the first collection portion side, so that sucked objects contained in the air are collected into the first collection portion, while another part of the air introduced into the centrifugal separation portion is separated to the fan side, so that sucked objects contained in the air are collected into the second collection portion.

[0024] More specifically, the centrifugal separation portion includes an inner pipe and an outer pipe, the inner pipe having a proximal end portion connected to the suction opening provided in the fan case, and the outer pipe being arranged around an outer periphery of the inner pipe such that a tip-end-side opening of the outer pipe projects to a tip end side beyond a tip-end-side opening of the inner pipe. The suction portion is allowed to communicate with a space formed between the inner pipe

and the outer pipe, and the first collection portion is provided at the tip-end-side opening of the outer pipe. Air that contains sucked objects, such as fallen leaves, which have been sucked into the suction portion with the rotation of the fan, is introduced into the space between the inner pipe and the outer pipe of the centrifugal separation portion so that, while the air is swirled in the space toward the tip end side, a part of the air that swirls in the space (i.e., air that swirls on the relatively outer peripheral side and that contains relatively heavy sucked objects) is discharged to the tip-end-side opening of the outer pipe, and the sucked objects contained in the air are thus collected into the first collection portion. Meanwhile, the other part of the air that swirls in the space (i.e., air that swirls on the relatively inner peripheral side and that contains relatively light sucked objects) is passed through the inner pipe from the tip-end-side opening of the inner pipe, and is sucked into the fan case via the suction opening to which the proximal end portion of the inner pipe is connected so that the sucked objects contained in the air are collected into the second collection portion after having passed through the fan case incorporating the fan. As described above, only the air that contains relatively light sucked objects, such as fallen leaves and cut grass, is separated from the air sucked into the suction portion by the centrifugal separation portion provided on the upstream side of the fan, and then is sucked into the fan case. Thus, it is possible to effectively prevent damage to the fan and the fan case without significantly decreasing the suction force.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a cross-sectional view schematically showing an embodiment of a vacuum cleaner in accordance with the present invention.

FIGS. 2A to 2C are partially enlarged cross-sectional views each schematically showing an example of an adjustment mechanism (i.e., slide structure) of the vacuum cleaner in accordance with the present invention.

FIGS. 3A and 3B are partially enlarged cross-sectional views each schematically showing an example of an adjustment mechanism (i.e., bellows structure) of the vacuum cleaner in accordance with the present invention.

FIG. 4 is a partially enlarged cross-sectional view schematically showing another example of the vacuum cleaner in accordance with the present invention.

FIG. 5 is a perspective view showing the conventional vacuum cleaner.

DETAILED DESCRIPTION OF THE EMBODIMENT(S)

[0026] Hereafter, embodiments of a vacuum cleaner in accordance with the present invention will be described with reference to the drawings. Although an example shown below is a hand-held vacuum cleaner having handles to be gripped by an operator, it is needless to mention that the present invention can also be applied to a back-carried vacuum cleaner having bands and the like that allow an operator to perform cleaning work while carrying a main body portion including a blower on his/her back.

[0027] Portions of a vacuum cleaner 1 in this embodiment shown below that correspond to the portions of the conventional vacuum cleaner 1' shown in FIG. 5 are assigned the same reference numerals. Thus, the detailed description thereof will be omitted and the differences will be mainly described hereinafter.

[0028] FIG. 1 is a cross-sectional view schematically showing an embodiment of the vacuum cleaner 1 in accordance with the present invention. In the vacuum cleaner 1 of the embodiment shown in the drawing, the rear handle 8 is provided in parallel with the upper handle (i.e., at right angles to a crankshaft 3a of the internal combustion engine 3). However, the basic portions, such as the main body portion 2 and the blowoff pipe 31, other than the suction pipe 10 have the same configurations as those of the conventional vacuum cleaner 1' shown in FIG. 5.

[0029] The suction pipe 10 of the vacuum cleaner 1 in this embodiment includes a suction portion 11 made of an approximately L-shaped pipe, and a centrifugal separation portion 14 with a double-pipe structure including an inner pipe 12 and an outer pipe 13.

[0030] The inner pipe 12 has a cylindrical shape with the same diameter as that of the suction opening 25 of the fan case 20, and the outer pipe 13 includes, from the proximal end side (i.e., main body portion 2 side) thereof, a cylindrical portion 13a with a larger diameter than that of the inner pipe 12 and a truncated cone portion 13b whose diameter decreases from the cylindrical portion 13a toward the tip end side. The outer pipe 13 is secured by being arranged around the outer periphery of the inner pipe 12 such that a tip-end-side opening 13c of the outer pipe 13 (or the truncated cone portion 13b thereof) projects to the tip end side beyond a tip-end-side opening 12c of the inner pipe 12, while a proximal end portion 12d of the inner pipe 12 projects to the proximal end side beyond a proximal end portion 13d of the outer pipe 13 (or the cylindrical portion 13a thereof). In the example shown in the drawing, the tip-end-side opening 12c of the inner pipe 12 is located on the proximal end side than the boundary portion between the cylindrical portion 13a and the truncated cone portion 13b of the outer pipe 13. However, the tip-end-side opening 12c of the inner pipe 12 may also be located on the tip end side than the boundary portion. In addition, the proximal end portion 13d of the outer pipe 13 around the inner pipe 12 is closed, and an inlet port 13e, which opens laterally into a space (i.e., swirl space) 19 formed between the inner pipe 12 and the outer pipe 13 (or the cylindrical portion 13a thereof), is formed in the outer peripheral portion of the proximal

end portion 13d of the outer pipe 13 (in other words, a portion on the most proximal end side of the outer pipe 13), and further, a downstream-side opening of the suction portion 11 is provided continuously with the inlet port 13a. Herein, the suction portion 11 communicates with the space 19 so that, in order to allow the air sucked into the suction portion 11 to smoothly swirl in the space 19, the air is introduced at a position off the axial line L of the centrifugal separation portion 14 (i.e., at a twisted position with respect to the axial line L). In the example shown in the drawing, the introducing direction of the suction portion 11 and the direction of the axial line L of the centrifugal separation portion 14 intersect at right angles with each other in a plan view. However, the introducing direction of the suction portion 11 and the direction of the axial line L need not intersect at right angles with each other.

[0031] A collection box (i.e., first collection portion) 16 is detachably attached to the tip-end-side opening 13c of the outer pipe 13, and the proximal end portion 12d of the inner pipe 12 is detachably attached to the suction opening 25 of the fan case 20. It should be noted that the attachment structure of the collection box 16 with respect to the outer pipe 13 and the attachment structure of the inner pipe 12 with respect to the fan case 20 are not limited to those shown in the drawing, and appropriate attachment structures may be adopted.

[0032] In this embodiment, as shown in the drawing, the crankshaft 3a rotatably supported in a crank case of the internal combustion engine 3, a fan 6 attached to the crankshaft 3a, the suction opening 25 provided in the fan case 20 that stores the fan 6, the inner pipe 12 connected to the suction opening 25, the outer pipe 13 provided around the inner pipe 12, and the like are concentrically arranged along the same axial line L, and cutting blades 6a that rotate integrally with the fan 6 are attached to the crankshaft 3a together with the fan 6.

[0033] In the vacuum cleaner 1 with such a configuration, a recoil starter 9 is operated to start the internal combustion engine 3, and the fan 6 and the cutting blades 6a are rotated. Then, sucked airflow is generated in the suction pipe 10 with the rotation of the fan 6. The air containing sucked objects, such as fallen leaves, which has been sucked into the suction portion 11 of the suction pipe 10, is introduced into the space 19 between the inner pipe 12 and the outer pipe 13 of the centrifugal separation portion 14 via the inlet port 13e formed in the outer pipe 13, and thus, the air swirls in the space 19 toward the tip end side (i.e., downward in the usual usage state). During the swirling, due to the centrifugal force, relatively heavy sucked objects contained in the sucked air are guided to the outer peripheral side, while relatively light sucked objects contained in the sucked air are guided to the inner peripheral side. Then, a part of the air swirling in the space 19 (i.e., air that swirls on the relatively outer peripheral side and that contains relatively heavy sucked objects) is discharged toward the tip-end-side opening 13c of the outer pipe 13, so that the sucked objects contained in the air are collected into the collection box 16. Meanwhile, the other part of the air swirling in the space 19 (i.e., air that swirls on the relatively inner peripheral side and that contains relatively light sucked objects) passes through the inner pipe 12 from the tip-end-side opening 12c of the inner pipe 12 (i.e., upward in the usual usage state), and is sucked into the fan 6 in the fan case 20 via the suction opening 25 to which the proximal end portion 12d of the inner pipe 12 is connected, so that the sucked objects contained in the air are chopped by the cutting blades 6a that rotate integrally with the fan 6, and the chopped objects are discharged with the sucked air from the blowoff pipe 31 via the volute 4 formed around the fan 6, and are then collected into the dust collection bag (i.e., second collection portion) 32 provided at the downstream-side opening of the blowoff pipe 31.

[0034] As described above, the vacuum cleaner 1 in accordance with this embodiment is adapted to separate only the air containing relatively light sucked objects, such as fallen leaves and dust, from the air sucked into the suction portion 11 by the centrifugal separation portion 14 of the suction pipe 10, and cause the separated air to be sucked into the fan case 20. Thus, it is possible to effectively prevent damage to the fan 6 and the fan case 20 without significantly decreasing the suction force.

[0035] It should be noted that in the above embodiment, the inner pipe 12, in particular, the tip-end-side opening 12c thereof is arranged at a fixed position with respect to the outer pipe 13. However, it is also possible to provide an adjustment mechanism for adjusting the relative position of the tip-end-side opening 12c of the inner pipe 12 with respect to the outer pipe 13 (in particular, the distance between the inner wall surface of the truncated cone portion 13b of the outer pipe 13 and the tip-end-side opening 12c of the inner pipe 12) to allow for adequate suction settings in accordance with the preference of the operator, the circumstances of the operation and the targets to be operated, for example. Examples of such an adjustment mechanism include a slide structure 17A that moves the inner pipe 12 and the outer pipe 13 relative to each other in the axial line L direction (see FIG. 2A), a slide structure 17B or 17C that moves a plurality of members, which form the inner pipe 12 and/or the outer pipe 13 (or the cylindrical portion 13a thereof), relative to each other in the axial line L direction so as to adjust the relative position of the tip-end-side opening 12c of the inner pipe 12 with respect to the outer pipe 13 (see FIGS. 2B and 2C), and a bellows structure 18A or 18B including a flexible member and the like formed at the tip end of the inner pipe 12 or in the outer pipe 13 (see FIGS. 3A and 3B). It should be noted that when such an adjustment mechanism is provided, a stopper mechanism that defines the amount of movement of the tip-end-side opening 12c of the inner pipe 12 with respect to the outer pipe 13 is preferably provided to surely prevent relatively heavy sucked objects, such as stones and pieces of wood, from being sucked into the

fan 6.

[0036] In addition, in order to increase the suction force of the fan 6 or prevent a backflow of the sucked objects, which have been collected in the collection box 16, into the outer pipe 13, it is also possible to provide, as shown in FIG. 4, an opening/closing member 13A, which is urged by a spring or the like so as to close the tip-end-side opening 13c of the outer pipe 13, at the collection box 16 or the tip-end-side opening 13c of the outer pipe 13. In such a case, the urged opening/closing member 13A is preferably configured to be usually closed by the suction force generated with the rotation of the fan 6, for example, and is configured to, when heavy sucked objects, such as stones and pieces of wood, are discharged with airflow to the tip-end-side opening 13c, open upon collision with the sucked objects. In addition, if such an opening/closing member 13A is provided, it is also possible to omit the collection box 16 and configure the urged opening/closing member 13A such that it opens when a predetermined amount of sucked objects have accumulated on or around the opening/closing member 13A.

[0037] In addition, the collection box 16 is preferably configured such that sucked objects that have been collected can be automatically or manually disposed at appropriate timing. For example, the collection box 16 is desirably produced from a transparent material or provided with a window for checking so that the inside of the box can be visible.

[0038] Although the internal combustion engine 3 is used as the drive source of the fan 6 in the aforementioned embodiment, it is needless to mention that an electric motor and the like may also be adopted as the drive source, for example. In addition, although the suction pipe 10 (or the inner pipe 12 thereof) and the fan case 20 (or the front side case portion 21 thereof) are provided as separate components in the aforementioned embodiment, it is needless to mention that such components may be integrally molded if the vacuum cleaner need not combine the function of a blower.

DESCRIPTION OF SYMBOLS

[0039]

1	Vacuum cleaner
2	Main body portion
3	Internal combustion engine
3a	Crankshaft
4	Volute
5	Blower
6	Fan
6a	Cutting blade
10	Suction pipe
11	Suction portion
12	Inner pipe
12c	Tip-end-side opening of inner pipe
12d	Proximal end portion of inner pipe
13	Outer pipe
13a	Cylindrical portion
13b	Truncated cone portion
13c	Tip-end-side opening of outer pipe
13d	Proximal end portion of outer pipe
13e	Inlet port
13A	Opening/closing member
14	Centrifugal separation portion
15	Suction opening cover
16	Collection box (first collection portion)
17A to 17C	Slide structure
18A and 18B	Bellows structure
19	Space (swirl space)
20	Fan case
21	Front side case portion
22	Back side case portion
23	Main body cover
24	Blowoff port
25	Suction opening
31	Blowoff pipe
32	Dust collection bag (second collection portion)

Claims

1. A vacuum cleaner comprising:

   a suction portion, a centrifugal separation portion, and a first collection portion that are provided on an upstream side of a fan stored in a fan case; and
   a second collection portion provided on a downstream side of the fan, wherein
   the vacuum cleaner is configured to, with rotation of the fan, separate a part of air introduced into the centrifugal separation portion via the suction portion to the first collection portion side, thereby collecting sucked objects contained in the air into the first collection portion, and separate another part of the air introduced into the centrifugal separation portion to the fan side, thereby collecting sucked objects contained in the air into the second collection portion.

2. The vacuum cleaner according to claim 1, wherein a suction opening provided in the fan case has connected thereto a suction pipe, the suction pipe including the suction portion and the centrifugal separation portion.

3. The vacuum cleaner according to claim 1 or 2, wherein
   the centrifugal separation portion includes an inner pipe and an outer pipe, the inner pipe having a proximal end portion connected to a suction opening provided in the fan case, and the outer pipe being arranged around an outer periphery of the inner pipe such that a tip-end-side opening of the outer pipe

projects to a tip end side beyond a tip-end-side opening of the inner pipe,
the suction portion communicates with a space formed between the inner pipe and the outer pipe, and
the first collection portion is provided at the tip-end-side opening of the outer pipe.

4. The vacuum cleaner according to claim 3, further comprising an adjustment mechanism for adjusting a position of the tip-end-side opening of the inner pipe with respect to the outer pipe in an axial line direction.

5. The vacuum cleaner according to claim 4, wherein the adjustment mechanism includes at least one of
a slide structure adapted to move the inner pipe and the outer pipe relative to each other in the axial line direction,
a slide structure adapted to move a plurality of members relative to each other in the axial line direction, the plurality of members forming at least one of the inner pipe or the outer pipe, or
a bellows structure formed in at least one of the inner pipe or the outer pipe, the bellows structure being adapted to expand and contract in the axial line direction.

6. The vacuum cleaner according to any one of claims 3 to 5, wherein
the proximal end portion of the inner pipe projects to a proximal end side beyond a proximal end portion of the outer pipe, and
the proximal end portion of the outer pipe around the inner pipe is closed.

7. The vacuum cleaner according to claim 6, wherein the suction portion is provided continuously with the proximal end portion of the outer pipe.

8. The vacuum cleaner according to any one of claims 3 to 7, further comprising an opening/closing member provided at the first collection portion or the tip-end-side opening of the outer pipe, the opening/closing member being adapted to be urged so as to close the tip-end-side opening of the outer pipe.

9. The vacuum cleaner according to any one of claims 1 to 8, wherein the first collection portion is adapted to automatically or manually dispose sucked objects that have been collected.

10. The vacuum cleaner according to any one of claims 1 to 9, wherein an inside of the first collection portion is visible.

11. The vacuum cleaner according to any one of claims 1 to 10, wherein the second collection portion is provided at a downstream-side opening of a blowoff pipe, the blowoff pipe communicating with a volute formed around the fan in the fan case.

FIG. 1

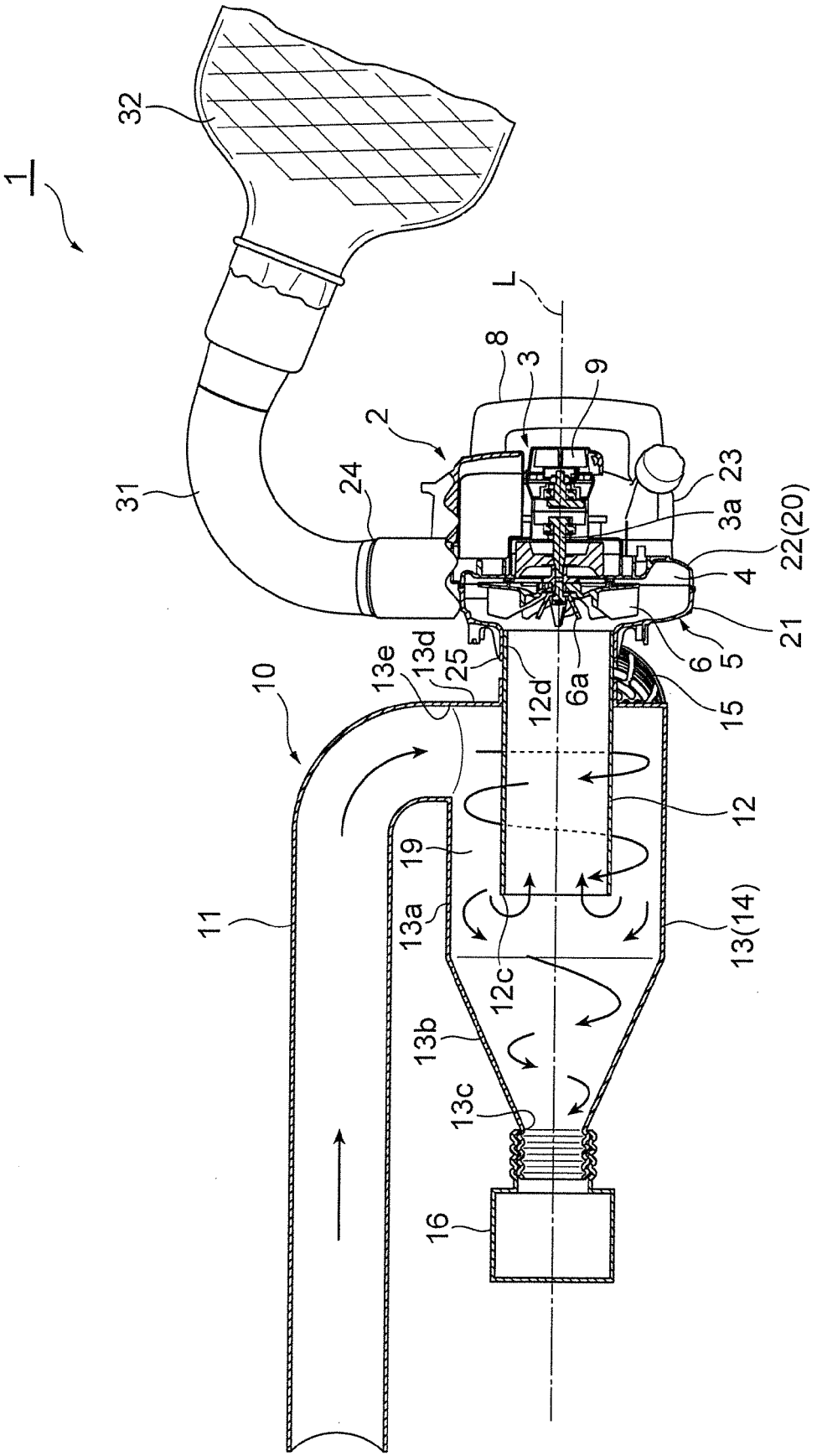

1
32
31
L
8
3
9
2
24
23
3a
22(20)
4
21
6
5
15
10
13e
13d
25
12d
6a
12
19
13a
11
13(14)
12c
13b
13c
16

FIG. 2A

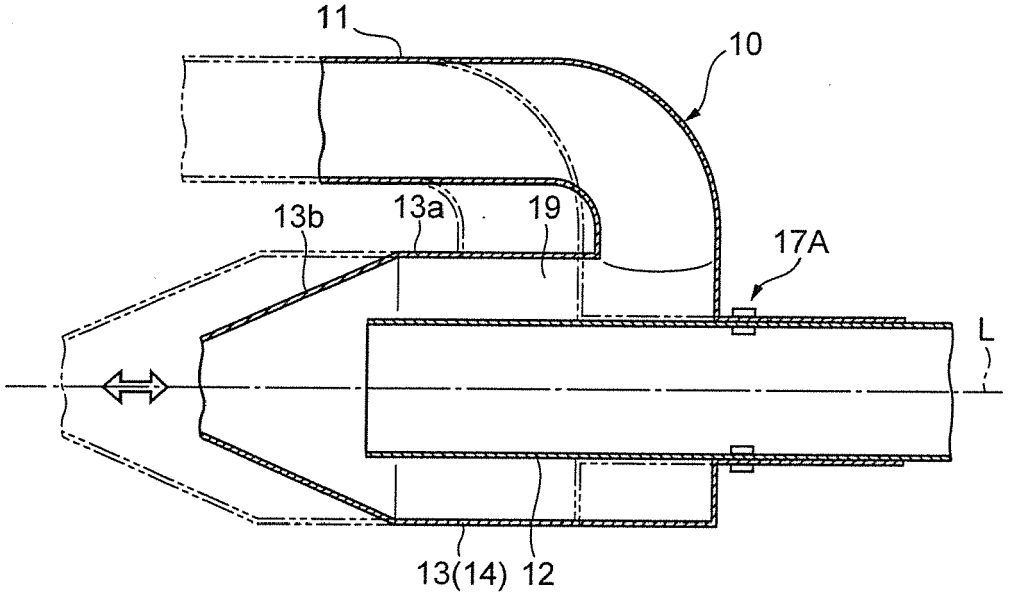


FIG. 2B

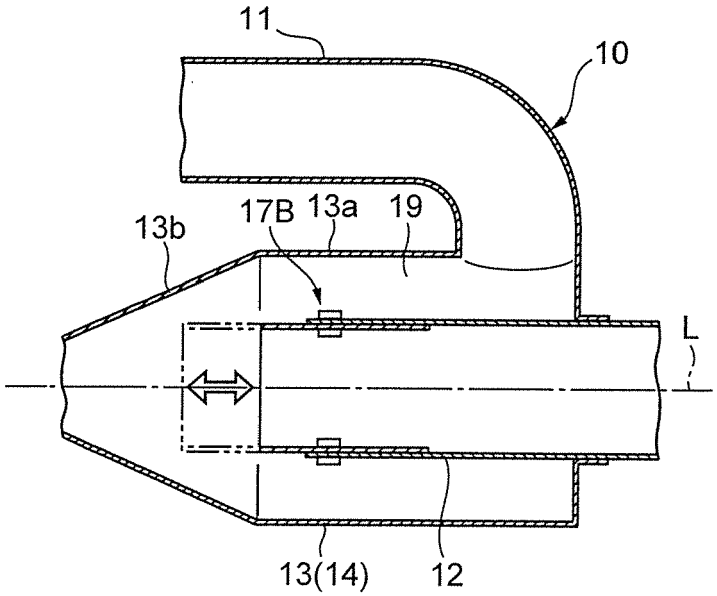


FIG. 2C

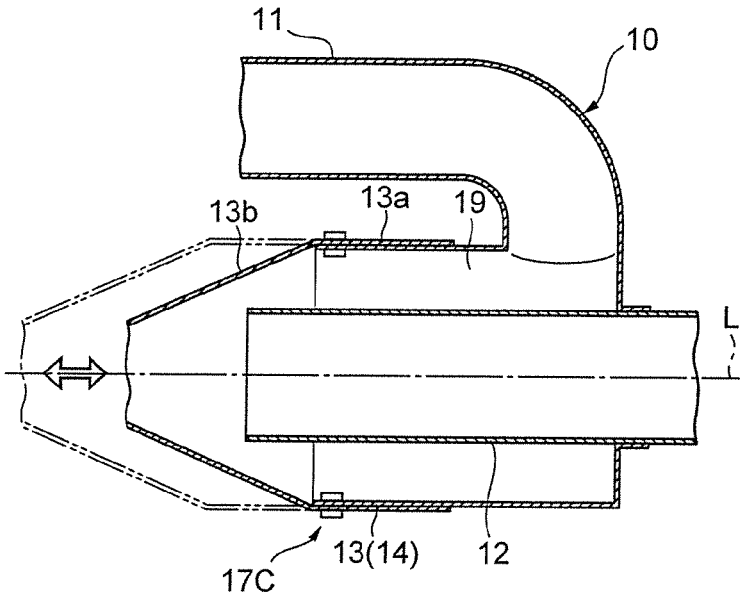


FIG. 3A

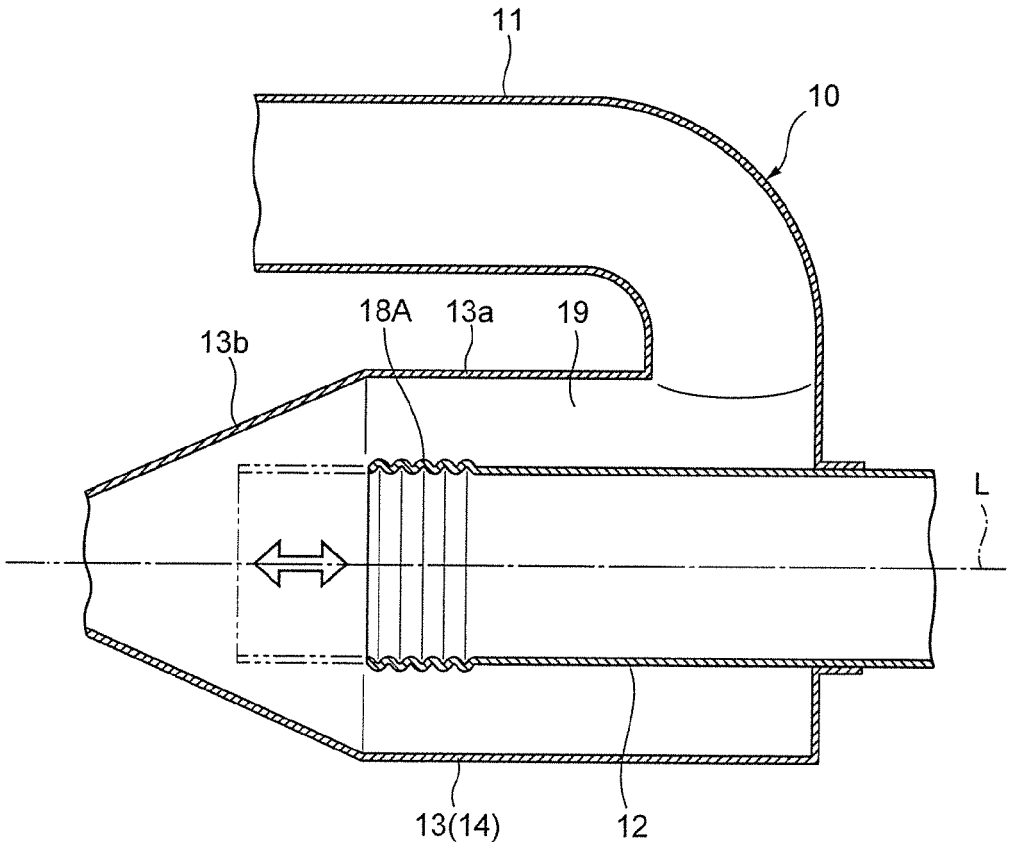


FIG. 3B

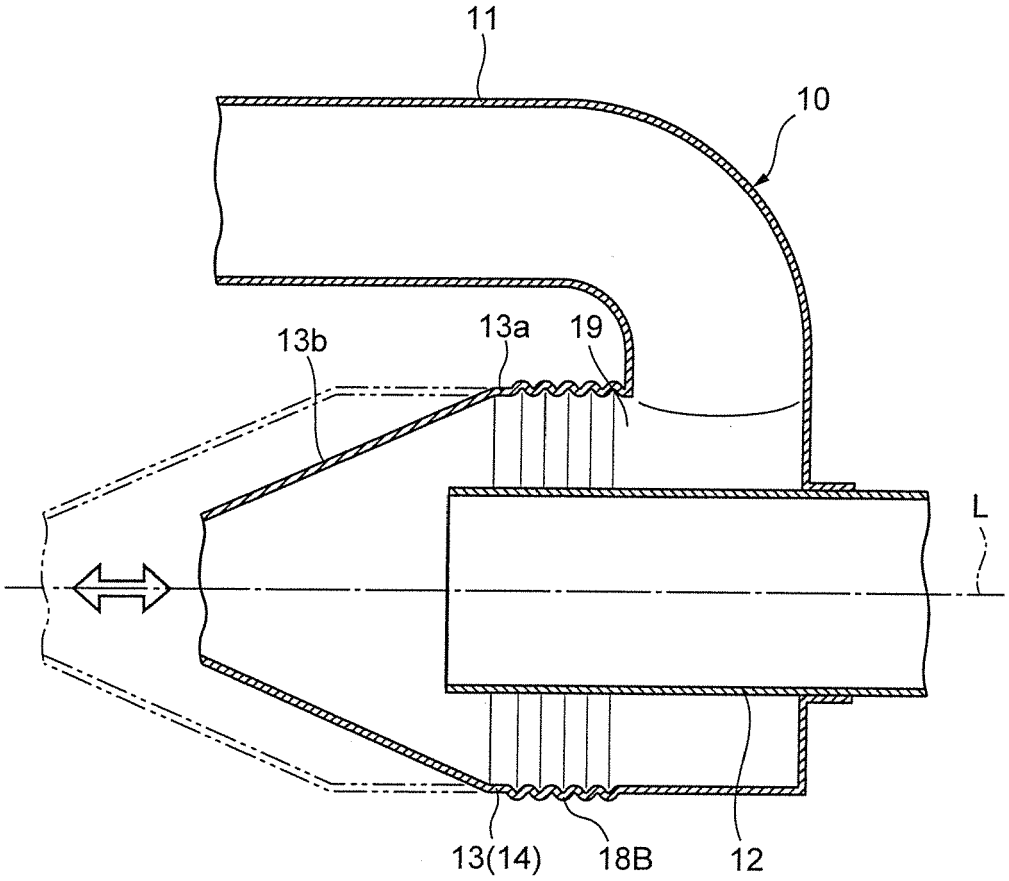


FIG. 4

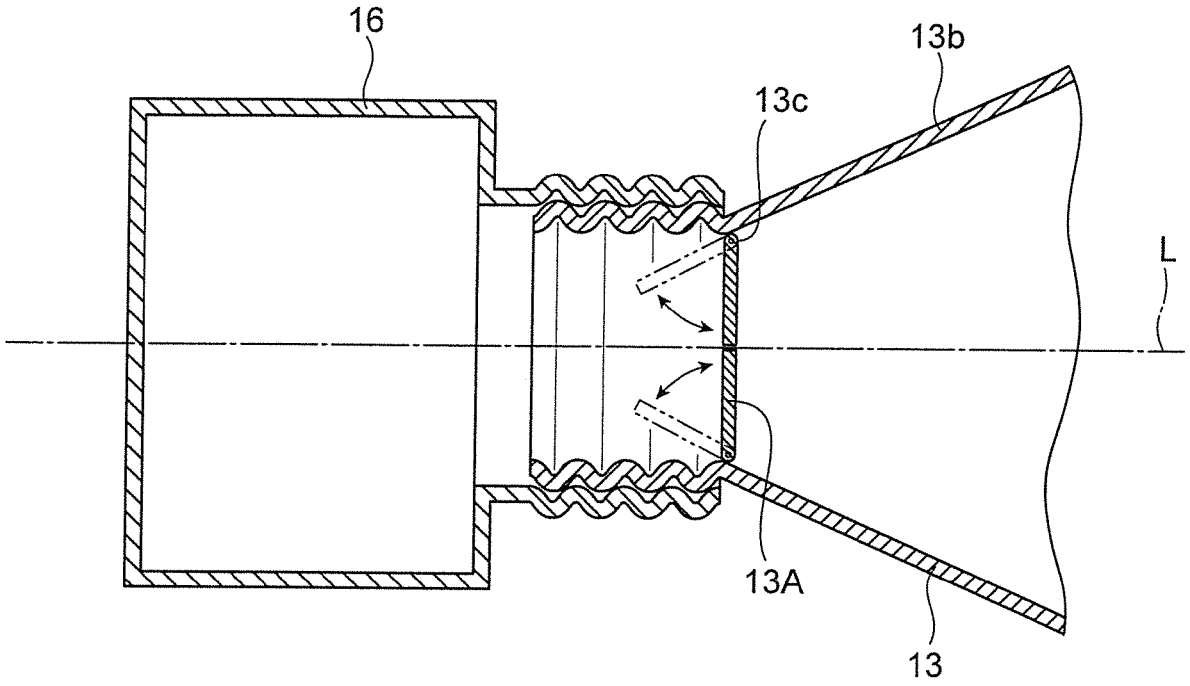
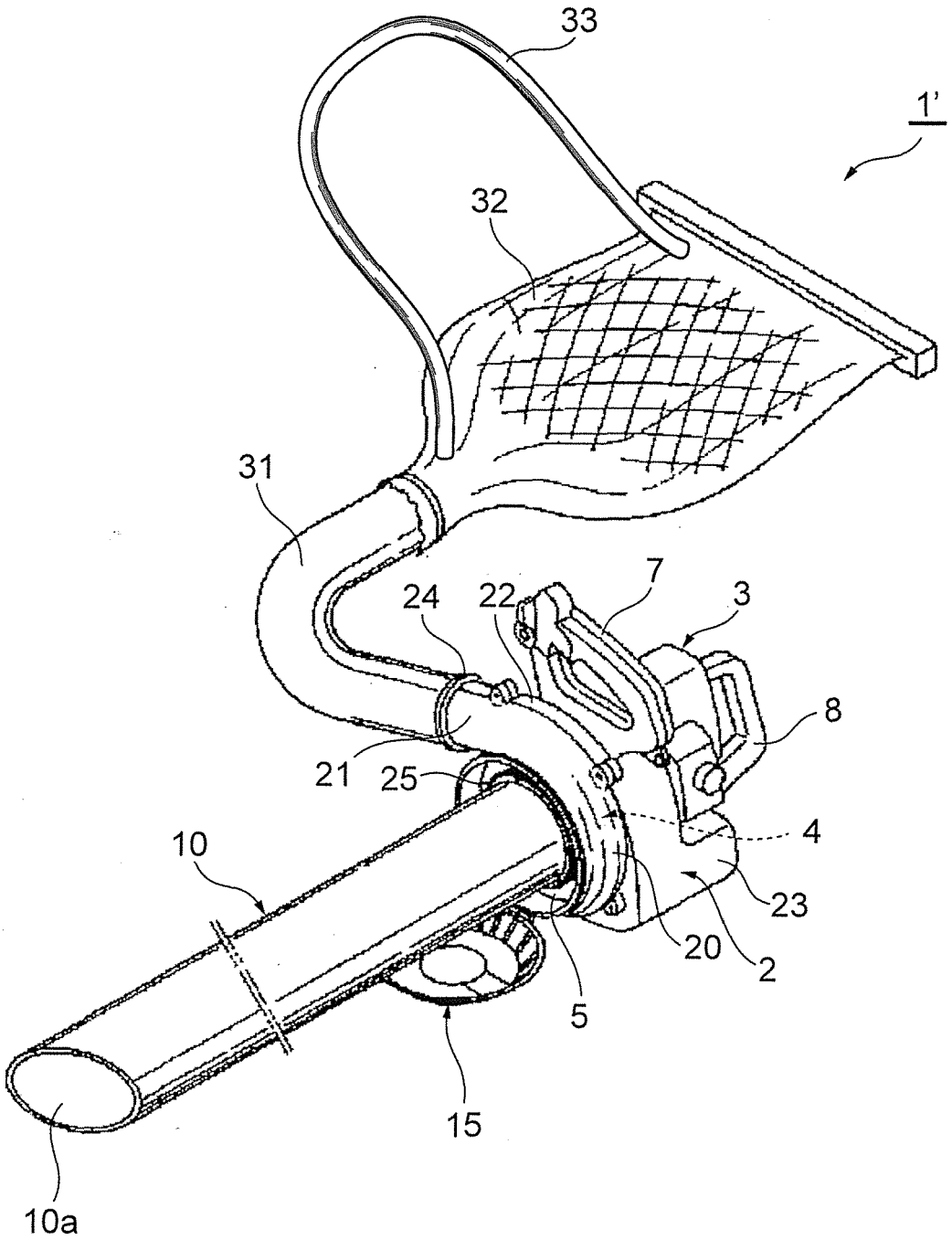


FIG. 5

Conventional Art



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 17 2429

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 992 266 A2 (SAMSUNG KWANGJU ELECTRONICS CO [KR]) 19 November 2008 (2008-11-19) * figure 1 *	1-11	INV. A47L9/10
A	US 2006/117520 A1 (CHOI JONG S [KR]) 8 June 2006 (2006-06-08) * figure 1 *	1-11	

TECHNICAL FIELDS SEARCHED (IPC)

A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	31 October 2016	Trimarchi, Roberto

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 17 2429

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

31-10-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1992266 A2	19-11-2008	NONE	
US 2006117520 A1	08-06-2006	KR 200377056 Y1	10-03-2005
		US 2006117520 A1	08-06-2006

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2015134972 A **[0001]**
- JP 3670854 B **[0008]**