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

(11) EP 0 650 688 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
15.04.1998 Bulletin 1998/16

(51) Int. Cl.[6]: **A47L 9/02**

(21) Application number: **94116688.6**

(22) Date of filing: **22.10.1994**

(54) Vacuum cleaner suction nozzle

Staubsaugermundstück

Embout d'aspirateur

(84) Designated Contracting States:
BE CH DE DK ES FR GB IT LI NL PT SE

(30) Priority: **28.10.1993 JP 270784/93**
29.10.1993 JP 272380/93
09.02.1994 JP 510/94 U
17.02.1994 JP 20402/94

(43) Date of publication of application:
03.05.1995 Bulletin 1995/18

(73) Proprietor:
SANYO ELECTRIC Co., Ltd.
Moriguchi-shi, Osaka 570 (JP)

(72) Inventors:
- **Sasada, Kimio**
  Hyogo-ken (JP)
- **Hamada, Atsuo**
  Hyogo-ken (JP)
- **Oike, Tooru**
  Hyogo-ken (JP)
- **Kobayashi, Toshinari**
  Hyogo-ken (JP)
- **Fujiyoshi, Toshiyuki**
  Hyogo-ken (JP)

(74) Representative:
Pfeifer, Hans-Peter, Dr.,
Dr. H.-P. Pfeifer Dr. P. Jany,
Patentanwälte
Beiertheimer Allee 19
76137 Karlsruhe (DE)

(56) References cited:
DE-A- 2 802 931
FR-A- 687 216
US-A- 1 601 774
US-A- 3 147 509

- **PATENT ABSTRACTS OF JAPAN vol. 17, no. 46 (C-1021) 28 January 1993 & JP-A-04 259 428**

EP 0 650 688 B1

Description

The present invention relates to improvements in suction members to be attached to vacuum cleaners for use in cleaning, for example, bedclothes and curtains.

Among conventional suction members of this type, there are known suction members of the type having a rotatable member with a multiplicity of perforations rotatably mounted on a cylindrical suction member body, as disclosed in Japanese Unexamined Patent Publication No. 158068/1979 (92(3)D101.9) and Japanese Unexamined Utility Model Publication No. 79761/1977 (92(3)D101.9). These suction members are adapted to draw in dust from an air inlet defined in a lower portion of the outer surface of the suction member body through the rotatable member and thereby to collect dust into a vacuum cleaner through a pipe connected to a side of the suction member body.

The suction member disclosed in Japanese Utility Model Publication No. 79761/1977 (92(3)D101.9) comprises a suction member body defining air inlets in a lower portion of the outer surface thereof, a suction member cover fitted around and bonded to a lateral side of the suction member body with a pipe to be connected to a vacuum cleaner being force fitted thereinto, and a rotatable member with a multiplicity of perforations rotatably covering the outer surface of the suction member body, the rotatable member being supported at the outer surface of a pipe support portion of the suction member cover so as not drop out.

The rotatable member of the suction member disclosed in Japanese Unexamined Patent Publication No. 158068/1979 comprises an annular one-piece mesh covering the entire outer surface of the suction member body. This impedes easy changes of the moving direction of the suction member body, resulting in poor cleaning operability.

Further, since the rotatable member is of a simple mesh structure, hair and waste thread are likely to be caught by the rotatable member and, hence, a difficulty exists in cleaning a surface of an object.

Still further, since the rotatable member abuts the entire outer surface of the suction member body, the rotatable member has an increased friction resistance against the suction member body and hence suffers poor mobility and poor cleaning operability.

Furthermore, the rotatable member comprises the annular one-piece mesh covering the entire outer surface of the cylindrical suction member body and an air inlet is defined by notching a portion of the cylindrical body of the suction member body. For this reason, the suction member body is likely to sink into bedclothes or curtains, thus rendering the mobility thereof poor.

Yet further, to rotatably mount the rotatable member on the suction member body, the both ends of the rotatable member are threaded, and in correspondence therewith the outer periphery of each disc provided to the lateral side of the suction member body is required to be threaded, resulting in a complicated structure.

Further still, the connection pipe of the suction member of Japanese Unexamined Patent Publication No. 158068/1979 is fixedly secured to the lateral side of the suction member body. This causes the angle of the suction member body with respect to a surface for cleaning to vary in the push-pull operation of the suction member body thereby varying the distance between the air inlet and the surface for cleaning and the angle made therebetween. This in turn causes the suction force exerted on the surface for cleaning to vary, thus resulting in nonuniform cleaning.

With the suction member disclosed in Japanese Unexamined Utility Model Publication No. 79761/1977, on the other hand, since it is impossible to separate the suction member body, suction member cover and rotatable member from each other, there might occur inconveniences such that the rotatable member cumulatively catches hair and the like at perforations thereof during long use thereby impeding smooth rotation thereof and lowering cleaning operability, or that hair lodged at the air inlet of the suction member body cumulatively attracts dust thereby lowering the suction efficiency.

Further, since the suction member is of a structure such that a connection pipe is force fitted into the suction member cover, there might be a case where the connection pipe is not securely held by the suction member cover because of errors in the production of the connection pipe and suction member cover and, hence, the suction member cover frequently comes off the connection pipe, thus degrading the cleaning operability.

Furthermore, since the overall rotatable member is formed as having an even diameter, the rotatable member will be pressed against the suction member body and any perforation of the rotatable member is caught by the air inlet, with the result that rotation of the rotatable member is impeded unfavorably to degrade the mobility of the suction member, thus raising a problem of degraded cleaning operability.

It is, therefore, an object of the present invention to provide a suction member for use with a vacuum cleaner which exhibits improved cleaning operability and cleaning performance.

Another object of the present invention is to provide a suction member having a rotatable member and suction member body of improved maintainability.

The aim is achieved by an apparatus with the features of claim 1. Further preferable embodiments are cited in the dependent claims. These and other objects, features and advantages of the present invention will be apparent from the following description.

In a first additional aspect of the present invention, there is provided a suction member for rise with a vacuum cleaner comprising a suction member body having substantially centrally thereof a connection pipe to be connected to the vacuum cleaner, air inlet defined in lower portions of the outer surface of the suction member body on both sides of the suction member body, and

rotatable members defining a multiplicity of small perforations and each rotatably provided around the outer surface of the suction member body on either side of the suction member body.

In a second additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having substantially centrally thereof a connection pipe to be connected to the vacuum cleaner, an air inlet defined over substantially entire lower portion of the outer surface of the suction member body, and rotatable members defining a multiplicity of small perforations and each rotatably provided around the outer surface of the suction member body on either side of the suction member body.

In a third additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having substantially centrally thereof a connection pipe to be connected to the vacuum cleaner, air inlets defined in lower portions of the outer surface of the suction member body on both sides of the suction member body, wheels rotatably supported at opposite ends of the suction member body, and rotatable members defining a multiplicity of small perforations and each rotatably provided around the outer surface of the suction member body on either side of the suction member body, the rotatable members being formed integrally with the respective wheels.

In a fourth additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having an air inlet in a lower portion of the outer surface thereof, a rotatable member defining a multiplicity of small perforations and rotatably provided around the outer surface of the suction member body, and an opening defined in the rotatable member for communication with the air inlet of the suction member body as the rotatable member rotates and having a hole area larger than that of each of the perforations.

Preferably, the opening defined in the rotatable member is shaped substantially similar to the air inlet of the suction member body.

Further, preferably, the air inlet and the opening are both in laterally elongated form.

In a fifth additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having an air inlet in a lower portion of the outer surface thereof, a rotatable member defining a multiplicity of small perforations and rotatably provided around the outer surface of the suction member body, and at least one rib formed on the outer surface of the suction member body and abutting the rotatable member.

In a sixth additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having an air inlet in a lower portion of the outer surface thereof, a rotatable member defining a multiplicity of small perforations and rotatably provided around the outer surface of the suction member body, and at least one annular rib formed on the inner surface of the rotatable member and abutting the suction member body.

In a seventh additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having a flat portion defining an air inlet on a bottom portion thereof and curved portions at front and rear ends thereof, a rotatable member defining a multiplicity of small perforations and rotatably provided around the outer surface of the suction member body, and a connection pipe provided to the suction member body for connection with the vacuum cleaner.

In an eighth additional aspect of the present invention, there is provided a suction member for use with a vaccum cleaner comprising a suction member body having a connection pipe for communication with the vacuum cleaner and defining an air inlet in a lower surface thereof, bearing members removably attached to end portions of the suction member body, and rotatable members defining a multiplicity of small perforations and rotatably supported by the respective bearing members as covering the outer surface of the suction member body.

In a ninth additional aspect of the present invention, there is provided a suction member for use with a vaccum cleaner comprising a suction member body having a connection pipe for communication with the vacuum cleaner and defining an air inlet in a lower surface thereof and openings in end portions thereof, bearing members removably attached to the end portions of the suction member body as closing the openings, and rotatable members defining a multiplicity of small perforations and rotatably and removably supported by the respective bearing members as covering the outer surface of the suction member body.

In a tenth additional aspect of the present invention, there is provided a suction member for use with a vaccum cleaner comprising a suction member body having a connection pipe for communication with the vacuum cleaner and defining an air inlet in a lower surface thereof, bearing members removably attached to the suction member body, and rotatable members defining a multiplicity of small perforations and rotatably supported by the respective bearing members as covering the outer surface of the suction member body, the bearing members being formed of a material of low frictional resistance.

In an eleventh additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having substantially centrally thereof a connection pipe for communication with the vacuum cleaner and defining an air inlet in a lower surface thereof, and rotatable members defining a multiplicity of small perforations and rotatably supported by the suction member

body as covering the outer surface of the suction member body on both sides of the suction member body, the suction member body comprising a tubular member which has substantially centrally thereof a support portion supporting the connection pipe and an opening adjoining the support portion, and a cover closing the opening of the tubular member, the connection pipe being held between the support portion and the cover.

In a twelfth additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having a connection pipe for communication with the vacuum cleaner and defining an air inlet in a lower surface thereof, and a rotatable member defining a multiplicity of small perforations and rotatably supported by the suction member body as covering the outer surface of the suction member body, the rotatable member having at least one projecting portion on the outer surface thereof.

In a thirteenth additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having a connection pipe for communication with the vacuum cleaner and defining an air inlet in a lower surface thereof, and a rotatable member defining a multiplicity of small perforations and rotatably supported by the suction member body as covering the outer surface of the suction member body, the rotatable member having at least one projecting portion on the outer surface thereof, the suction member body having at least one circumferentially elongated convex portion formed at a position generally opposing the projecting portion as abutting or approximating the inner surface of the rotatable member.

In a fourteenth additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having a connection pipe for communication with the vacuum cleaner and defining an air inlet in a lower surface thereof, and a rotatable member defining a multiplicity of small perforations and rotatably supported by the suction member body as covering the outer surface of the suction member body, the rotatable member having at least one projecting portion on the outer surface thereof and at least one circumferentially elongated convex portion formed on the inner surface thereof at a position generally opposing the projecting portion as abutting or approximating the outer surface of the suction member body.

In a fifteenth additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having a connection pipe for communication with the vacuum cleaner and defining an elongated air inlet in a lower surface thereof, and a rotatable member rotatably covering the outer surface of the suction member body, the rotatable member defining an opening for communication with the air inlet as the rotatable member rotates, the peripheral edge of the opening crossing that of the air inlet.

In a sixteenth additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having a connection pipe for communication with the vacuum cleaner and defining an air inlet in a lower surface thereof, rotatable members defining a multiplicity of small perforations and rotatably supported by support portions formed at opposite ends of the suction member body as covering the outer surface of the suction member body, and support members removably attached to the opposite ends of the suction member body for preventing the rotatable members from dropping out.

In a seventeenth additional aspect of the present invention, there is provided a suction member for use with a vacuum cleaner comprising a suction member body having a connection pipe for communication with the vacuum cleaner and defining an air inlet in a lower surface thereof, rotatable members defining a multiplicity of small perforations and covering the outer surface of the suction member body, and support members having support portions supporting the rotatable members and attached to opposite ends of the suction member body, the rotatable members being each rotatably supported between the suction member body and each of the support members.

With the suction member in the first additional aspect of the present invention, dust on a surface for cleaning is drawn in at the air inlets of the suction member body through small perforations of the rotatable members. When the suction member body is moved, the rotatable members rotate because of the frictional resistance thereof against the surface for cleaning. Since the rotatable members are independently rotatable on both sides of the suction member body, the moving direction of the suction member body can be changed with ease.

With the suction member in the second additional aspect of the present invention, dust on a surface for cleaning is drawn in at the air inlet defined over substantially entire lower portion of the suction member body through the small perforations of the rotatable members. When the suction member body is moved, the rotatable members rotate because of the frictional resistance thereof against the surface for cleaning. Since the rotatable members are independently rotatable on both sides of the suction member body, the moving direction of the suction member body can be changed with ease.

With the suction member in the third additional aspect of the present invention, dust on a surface for cleaning is drawn in at the air inlets of the suction member body through the small perforations of the rotatable members. When the suction member body is moved, the rotatable members rotate with the rotation of the wheels. Since the wheels as well as the rotatable mem-

bers are independently rotatable on both sides of the suction member body, the moving direction of the suction member body can be changed with ease.

With the suction member in the fourth additional aspect of the present invention, dust on a surface for cleaning is drawn in at the air inlet of the suction member body through the small perforations and opening of the rotatable member. Since the opening has a hole area larger than that of each perforation, the suction force at the opening is larger than that at each perforation and, hence, hair, waste thread and the like are drawn into the suction member body through the opening without being caught by the rotatable member.

With the suction member in the fifth additional aspect of the present invention, dust on a surface for cleaning is drawn in at the air inlet of the suction member body through the small perforations of the rotatable members. When the suction member body is moved, the rotatable member rotates because of friction against the surface for cleaning. Since the rotatable member abuts only the rib formed on the outer surface of the suction member body, the frictional resistance of the rotatable member against the suction member body is small enough to permit the rotatable member to rotate with ease and the suction member body to have improved mobility.

With the suction member in the sixth additional aspect of the present invention, dust on a surface for cleaning is drawn in at the air inlet of the suction member body through the small perforations of the rotatable member. When the suction member body is moved, the rotatable member rotates because of friction against the surface for cleaning. Since the rotatable member abuts the suction member body through the rib formed on the rotatable member, the frictional resistance of the rotatable member against the suction member body is small enough to permit the rotatable member to rotate with ease and the suction member body to have improved mobility.

With the suction member in the seventh additional aspect of the present invention, dust on a surface for cleaning is drawn in at the air inlet of the suction member body through the small perforations of the rotatable member. When the suction member body is moved, the rotatable member rotates because of the frictional resistance thereof against the surface for cleaning. Since the rotatable member is rotatable along the flat portion of the suction member body, the contact area between the suction member body and the surface (bedclothes or curtains) for cleaning is large enough to prevent the suction member body from being caught by bedclothes or curtains, thereby permitting the suction member body to move smoothly.

With the suction member in the eighth additional aspect of the present invention, when the suction member is push-pull operated, the rotatable members rotate and the suction member body moves. Dust adhering to a surface for cleaning is drawn into the suction member body through the small perforations of the rotatable members and the air inlet of the suction member body and then collected into the vacuum cleaner through the connection pipe. When hair and the like caught by the rotatable members and suction member body are to be removed, the bearing members are detached from the suction member body and the rotatable members are separated from the suction member body to allow the suction member body and rotatable members to be subjected to maintenance.

With the suction member in the ninth additional aspect of the present invention, when the suction member is push-pull operated, the rotatable members rotate and the suction member body moves. Dust adhering to a surface for cleaning is drawn into the suction member body through the small perforations of the rotatable members and the air inlet of the suction member body and then collected into the vacuum cleaner through the connection pipe. When hair and the like caught by the rotatable members and suction member body are to be removed, the rotatable members are detached from the bearing members to allow the suction member body and rotatable members to be subjected to maintenance. Further, the bearing members are detached from the suction member body to allow maintenance of the suction member body through the openings at opposite ends thereof.

With the suction member in the tenth additional aspect of the present invention, when the suction member is push-pull operated, the rotatable members rotate and the suction member body moves. Since the bearing members are formed of a material of low frictional resistance and each have a circumferentially elongated convex portion formed as approximating or abutting the inner surface of the corresponding rotatable member, the rotatable members have improved rotatability thereby facilitating a cleaning operation. Dust adhering to a surface for cleaning is drawl in from the small perforations of the rotatable members to the suction member body through the air inlet of the suction member body and then collected into the vacuum cleaner through the connection pipe. When hair and the like caught by the rotatable members and suction member body are to be removed, the bearing members are detached from the suction member body to separate the rotatable members from the suction member body thereby allowing maintenance of the rotatable members and suction member body.

With the suction member in the eleventh additional aspect of the present invention, when the suction member is push-pull operated, the rotatable members rotate and the suction member body moves. Dust adhering to a surface for cleaning is drawn in from the small perforations of the rotatable members to the suction member body through the air inlet of the suction member body and then collected into the vacuum cleaner through the connection pipe. The connection pipe is assuredly held between the support portion formed on the suction

member body and the cover and hence will never come off during cleaning. By disposing the connection pipe centrally of the suction member body and rotatable members on both sides of the suction member body, the suction member is well-balanced and improved in mobility, while the cover disposed in the lower side of the suction member body does not degrade the appearance of the suction member.

With the suction member in the twelfth additional aspect of the present invention, when the suction member is push-pull operated, the rotatable member rotates and the suction member body moves. Dust adhering to a surface for cleaning is drawn in from the small perforations of the rotatable member to the suction member body through the air inlet of the suction member body and then collected into the vacuum cleaner through the connection pipe. The projecting portion formed on the outer surface of the rotatable member makes it hard to press the rotatable member against the suction member body, whereby the peripheral edge of each small perforation of the rotatable member is prevented from engaging with the peripheral edge of the air inlet of the suction member body and, hence, rotation of the rotatable member will never be impeded. This results in the suction member of improved mobility.

With the suction member in the thirteenth additional aspect of the present invention, when the suction member is push-pull operated, the rotatable member rotates and the suction member body moves. Dust adhering to a surface for cleaning is drawn in from the small perforations of the rotatable member to the suction member body through the air inlet of the suction member body and then collected into the vacuum cleaner through the connection pipe. Since the rotatable member is spaced apart from the suction member body by the circumferentially elongated convex portion formed on the suction member body, the air inlet of the suction member body will never be covered by the surface for cleaning and, hence, the dust collecting performance of the suction member is unlikely to degrade. Further, a decreased frictional resistance between the suction member body and the rotatable member assures the suction member of improved mobility. Furthermore, since the suction member body has the circumferentially elongated convex portion formed at a position generally opposing the projectiong portion formed on the outer surface of the rotatable member as abutting or approximating the inner surface of the rotatable member, the rotatable member is hard to press against the suction member body. Therefore, rotation of the rotatable member is less likely to be impeded by engagement of the peripheral edge of each small perforation of the rotatable member with the peripheral edge of the air inlet, thereby assuring the suction member of improved mobility.

With the suction member in the fourteenth additional aspect of the present invention, when the suction member is push-pull operated, the rotatable member rotates and the suction member body moves. Dust adhering to a surface for cleaning is drawn in from the small perforations of the rotatable member to the suction member body through the air inlet of the suction member body and then collected into the vacuum cleaner through the connection pipe. Since the rotatable member is spaced apart from the suction member body by the circumferentially elongated convex portion formed on the inner surface of the rotatable member, the air inlet of the suction member body will never be covered by the surface for clearing and, hence; the dust collecting performance of the suction member is unlikely to degrade. Further, a decreased frictional resistance between the suction member body and the rotatable member assures the suction member of improved mobility. Furthermore, since the rotatable member has the circumferentially elongated convex portion formed on the inner surface thereof at a position generally opposing the projecting portion formed on the outer surface thereof as abutting or approximating the outer surface of the suction member body, the rotatable member is hard to press against the suction member body. Therefore, rotation of the rotatable member is less likely to be impeded by engagement of the peripheral edge of each small perforation of the rotatable member with the peripheral edge of the air inlet, thereby assuring the suction member of improved mobility.

With the suction member in the fifteenth additional aspect of the present invention, when the suction member is push-pull operated, the rotatable member rotates and the suction member body moves. The rotatable member is pressed by a surface for cleaning and deformed radially inwardly during a cleaning operation. However, since the peripheral edge of the opening is made to cross that of the air inlet, they will never engage with each other, so that the rotatable member rotates smoothly.

With the suction member in the sixteenth additional aspect of the present invention, when the suction member is push-pull operated, the rotatable members rotate and the suction member body moves. Dust adhering to a surface for cleaning is drawn in from the small perforations of the rotatable members to the suction member body through the air inlet and then collected into the vacuum cleaner through the connection pipe. When the suction member is to undergo a maintenance operation such as removing hair or the like caught by the rotatable members or suction member body, the support members are detached from the suction member body to separate the rotatable members from the suction member body.

With the suction member in the seventeenth additional aspect of the present invention, when the suction member is push-pull operated, the rotatable members rotate and the suction member body moves. Dust adhering to a surface for cleaning is drawn in from the small perforations of the rotatable members to the suction member body through the air inlet and then collected into the vacuum cleaner through the connection

pipe. When the suction member is to undergo a maintenance operation such as removing hair or the like caught by the rotatable members or suction member body, the support members are detached from the suction member body to separate the rotatable members from the suction member body. Since the support portions are formed in the corresponding support members, the suction member is simplified in structure.

Fig. 1 is a partially exploded perspective view of one embodiment of the present invention;
Fig. 2 is a perspective view of the embodiment;
Fig. 3 is a bottom view of the embodiment in a state where one of rotatable members is detached;
Fig. 4 is a sectional view of the embodiment;
Fig. 5 is a sectional view of the embodiment as viewed from another direction;
Fig. 6 is a sectional view showing a wheel and rotatable member of the embodiment;
Fig. 7 is a sectional view of another embodiment of the present invention, corresponding to Fig. 5;
Fig. 8 is a sectional view of another embodiment of the present invention, corresponding to Fig. 4;
Fig. 9 is a perspective view of another embodiment of the present invention;
Fig. 10 is a sectional view showing a wheel and rotatable member of another embodiment;
Fig. 11 is a perspective view of still another embodiment of the present invention;
Fig. 12 is a sectional view taken along the line A-A of Fig. 11;
Fig. 13 is a sectional view taken along the line B-B of Fig. 11;
Fig. 14 is a bottom view of the embodiment shown in Fig. 11;
Fig. 15 is a sectional view of yet another embodiment of the present invention wherein the left-hand fragmentary portion is rotated by 90° ;
Fig. 16 is an exploded view showing components of the embodiment shown in Fig. 15;
Fig. 17 is a bottom view of the embodiment shown in Fig. 15 wherein a rotatable member and bearing member on the left-hand side are removed;
Fig. 18 is an exploded bottom view of the suction member body of the embodiment shown in Fig. 15;
Fig. 19 is a sectional view taken along the line A-A of Fig. 15;
Fig. 20 is a sectional view taken along the line B-B of Fig. 15;
Fig. 21 is a sectional view taken along the line C-C of Fig. 15;
Fig. 22 is a sectional view of another embodiment of the present invention, corresponding to Fig. 19;
Fig. 23 is a sectional view of another embodiment of the present invention wherein the left-hand fragmentary portion is rotated by 90° ;
Fig. 24 is a sectional view of another embodiment of the present invention wherein the left-hand fragmentary portion is rotated by 90° ;
Fig. 25 is a sectional view of another embodiment of the present invention wherein the left-hand fragmentary portion is rotated by 90° ;
Fig. 26 is a sectional view taken along the line D-D of Fig. 25;
Fig. 27 is a sectional view of another embodiment of the present invention wherein the left-hand fragmentary portion is rotated by 90° ;
Fig. 28 is a sectional view of another embodiment of the present invention wherein the left-hand fragmentary portion is rotated by 90° ;
Fig. 29 is a sectional view of another embodiment of the present invention wherein the left-hand and right-hand fragmentary portions are rotated by 90° ;
Fig. 30 is an exploded view showing components of the embodiment shown in Fig. 29;
Fig. 31 is a sectional view taken along the line E-E of Fig. 29;
Fig. 32 is a sectional view of another embodiment of the present invention wherein the left-hand and right-hand fragmentary portions are rotated by 90° ;
Fig. 33 is a plan view of the suction member body of another embodiment of the present invention;
Fig. 34 is an exploded view showing components of the embodiment shown in Fig. 33; and
Fig. 35 is a bottom view of another embodiment of the present invention wherein a rotatable member and bearing member on the left-hand side are removed.

Some aspects and embodiments of the present invention will now be described in detail with reference to the drawings.

Referring to Figs. 1 to 6 showing a suction member according to one embodiment of the present invention, the suction member includes a suction member body 1 of a synthetic resin comprising a substantially T-shaped connection pipe 2 and a pair of substantially cylindrical tubes 3 each fusion-bonded at one open end thereof to the peripheral edge of each opening of the conneciton pipe 2. The connection pipe 2 has a plurality of air inlets 4 defined in a lower portion of the outer surface thereof, while each of the tubes 3 has a multiplicity of air inlets 5 defined in a lower portion of the outer surface thereof. Each tube 3 is formed with annular ribs 6 at the opposite ends thereof and at a central portion thereof, which have a diameter larger than the outer diameter of the tube 3.

To the opposite ends of the suction member body 1 are attached wheels 7 of a synthetic resin which are each rotatably supported by fitting a shaft hole 11 thereof around a support portion 10 formed as projecting from each end of the suction member body 1 and which are each prevented from dropping out by the washer of a screw 12 serving as a holding member to be threadingly fixed to the support portion 10. As shown in Fig. 6, each wheel 7 is formed integrally with each

rotatable member 8 to be described later by insert molding the end portion of the rotatable member 8 and the wheel 7 or inserting the end portion of the rotatable member 8 into a groove defined in the wheel 7 and fixing them with adhesive. Accordingly, each rotatable member 8 is adapted to rotate as the corresponding wheel 7 rotates.

The mesh-like rotatable members 8 are free fitted around the outer surface of the tubes 3 of the suction member body 1 and are formed of a flexible material having a large frictional resistance against a surface for cleaning such as a synthetic resin, for example, polypropylene, polyethylene or the like, or rubber. The rotatable members 8, when free fitted around the tubes 3, abut the ribs 6 of the tubes 3 and thereby are kept spaced apart from the outer surface of the tubes 3. Each rotatable member 8 defines a plurality of openings 9 for communication with the air inlets 5 defined in a lower portion of the outer surface of each tube 3 of the suction member body 1.

The suction member thus arranged is connected to a vacuum cleaner (not shown) at the connection pipe 2 and used to clean a surface for cleaning such as bedclothes. When the suction member body 1 is moved forwardly and rearwardly on the surface for cleaning, the wheels 7 and rotatable members 8 in contact with the surface for cleaning rotate because of the friction therebetween. Since the rotatable members 8 rotate while contacting the annular ribs 6 formed as circumferentially projecting from the outer surface of the suction member body 1, the rotatable members 8 have a decreased frictional resistance against the suction member body 1, so that the mobility of the suction member body 1 is enhanced. On both sides of the suction member body 1 are independently rotatably supported rotatable member-wheel pairs. This permits the moving direction of the suction member body 1 to be changed easily. Further, since each wheel 7, which is larger in diameter than each rotatable member 8, covers one end of each rotatable member 8, the mobility of suction member is prevented from degrading because such an end of each rotatable member 8 will never be caught by the surface for cleaning.

The suction force of the vacuum cleaner collects dust and dirt on the surface for cleaning from the air inlets 5 defined in a lower portion of the outer surface of each tube 3 of the suction member body 1. The suction member according to this embodiment is able to keep its satisfactory dust collecting capability since the rotatable members 8 kept spaced apart from the outer surface of the tubes 3 by the ribs 6 prevent the surface for cleaning from blocking up the air inlets 5 of the suction member body 1 by the suction force of the vacuum cleaner.

The rotatable members 8 define the openings 9 for communication with the air inlets 5 of the suction member body 1. Hence, it is possible to assuredly collect relatively large dust such as hair or waste thread at positions where the openings 9 come to coincide with the air inlets 5 as the rotatable members 8 rotate.

Further, since the suction member body 1 defines the plurality of air inlets 4 in a lower portion of the outer surface of the connection pipe 1, the overall lower portion of the suction member body 1 is used to collect dust, thus resulting in no occurrence of uneven cleaning.

Where the multiplicity of small perforations of the rotatable members 8 catch hair and the like, it is possible to detach the rotatable members 8 from the suction member body 1 by removing the screws 12 for washing the rotatable members 8 and suction member body 1 separately with water or the like.

It should be noted that each rib 6 is shaped annular and formed around the outer surface of each tube 3 of the suction member body 1 in this embodiment, the rib 6 might be shaped arcuate and provided in a lower portion of the outer surface of the suction member 1 as shown in Fig. 7. This arrangement also allows the rotatable members 8 to be kept spaced apart from the tubes 3 of the suction member body 1 while reducing the frictional resistance between the rotatable members 8 and the tubes 3. Alternatively, ribs 6 in annular shape might be formed integrally with each rotatable member 8 as shown in Fig. 8.

Further, one end portion of each rotatable member 8 might be fusion-bonded or bonded with adhesive to the outer periphery of each wheel 7 as shown in Fig. 9, or otherwise, each rotatable member 8 and the corresponding wheel 7 might be integrally molded together as shown in Fig. 10.

Next, description is made on another embodiment of the present invention with reference to Figs. 11 to 14.

A suction member according to this embodiment includes a suction member body 101 of a synthetic resin, and a connection pipe assembly 102 comprising two opposite connection pipes 103,104, an interconnecting pipe 105 in communication with the pipes 103,104 and a connection pipe 106 extending centrally of the interconnecting pipe 105 for connection with a vacuum cleaner, the connection pipe assembly being pivotally supported on opposite walls 107,108 of the suction member body 101. The suction member body 101 defines a plurality of air inlets 109,109 • • • in the bottom thereof. A mesh-like rotatable member 110 is free fitted around the outer surface of the suction member body 101, and is formed of a flexible material having a large frictional resistance against a surface for cleaning such as a synthetic resin, for example, polypropylene or polyethylene, or rubber. Front wheels 111 and rear wheels 112 are each rotatably supported on the opposite walls 107,108 of the suction member body 101. The rotatable member 110 defines a plurality of air inlets 113,113 • • • each having a sufficiently large hole area relative to each small perforation. The suction member body 101 has curved portions 114,114 forming front and rear parts thereof. The mesh-like rotatable

member 110 is adapted to slide on the bottom 115 of the suction member body 101 and outer surfaces of curved portions 114,114 thereof for rotation.

The suction member thus arranged is connected to a vacuum cleaner (not shown) at the connection pipe assembly 102 thereof and used in cleaning a surface for cleaning such as bedclothes. When the suction member body 101 is moved forward and backward, the wheels 111,112 and rotatable member 110 in contact with the surface for cleaning rotate because of the friction against the surface for cleaning. The rotatable member 110 rotates while sliding on the outer surface of the suction member body 101. The wheels 111,112 are rotatably supported on opposite sides of the suction member body 101 independently of each other and, hence, permit the suction member body 101 to change its moving direction easily. Since the outer diameter of two wheels 111,112 is made larger than that of the curved portions 114 of the rotatable member 110 and the peripheral edges of the rotatable member 110 are covered with the wheels 111,112, it is less likely that the mobility of the suction member is degraded by the peripheral edges of the rotatable member caught by the surface for cleaning. In addition, such arrangement also serves to prevent the rotatable member 110 from dropping out of the suction member body 101.

With forward and rearward movements of the suction member body 101, the connection pipe assembly 102 pivots with respect to the suction member body 101. Accordingly, the air inlets 109,109 • • • of the suction member body 101 always keeps an angle with respect to the surface for cleaning (always parallel thereto) thereby keeping the dust collectability of the suction member satisfactory.

Further, since the rotatable member 110 defines the openings 113 for communication with the air inlets 109 of the suction member body 101, it is possible to assuredly collect relatively large dust including hair and waste thread at positions where the openings 113 come to coincide with the air inlets 109 of the suction member body 101 as the rotatable member 110 rotates.

To be described next with reference to Figs. 15 to 21 is another embodiment of the present invention.

A suction member according to this embodiment includes a suction member body 201 comprising a tubular member 202, connection pipe 204, cover 210 and bearing members 215. The tubular member 202 is formed of a synthetic resin such as ABS resin and shaped substantially cylindrical as having openings on opposite ends thereof. The tubular member 202 defines in a lower central portion thereof an opening 203 and has a support portion 205 formed inside an upper central portion thereof as adjoining the opening 203 for supporting the connection pipe 204 which is removably connected to a vacuum cleaner (not shown) for communication therewith. The connection pipe 204 is supported by the support portion 205 in a direction generally perpendicular to the longitudinal axis of the tubular member 202 and is pivotable within a predetermined range, specifically within the range of about 60° in this embodiment.

The tubular member 202 also defines in the lower face thereof a plurality of air inlets 206 which are each elongated substantially parallel to the longitudinal axis of the tubular member 202. The tubular member 202 is formed with first annular convexes 207 extending around the outer surface of the tubular member 202 at opposite end portions thereof, second convexes 208 extending around the outer surface of portions of the tubular member 202 at locations adjacent the opening 203, and third annular convexes 209 each formed between each first convex 207 and each second convex 208. The first, second and third convexes 207, 208 and 209 together with fourth convexes 214 to be described later approximate or abut rotatable members 219 to support them while serving to keep the inner surfaces of the rotatable members 219 spaced apart from the outer surface of the suction member body 201.

The cover 210 closing the opening 203 of the tubular member 202 is formed of a synthetic resin such as ABS resin and includes a support portion 211 which, in cooperation with the aforementioned support portion 205, supports the connection pipe 204 for rotation. One side of the cover 210 facing the support portion 211 is fitted into the peripheral edge of the opening 203 and secured to bosses 212 integrally formed with the tubular member 202 with screws. The bosses 212 are located adjacent both sides of the support portion 205 so as not to interfere with the air flow from the air inlets 206 toward the connection pipe 204. The cover 210 defines a plurality of air inlets 213 elongated substantially parallel to extension lines of the longitudinal axes of the air inlets 206 defined in the tubular member 202. The fourth convexes 214 are formed integrally with the cover 210 and each extend in continuation to each of the second convexes 208 to form annular convexes cooperatively with the second convexes 208.

Bearing members 215 which close the opposite open ends of the tubular member 202 are formed of a synthetic resin such as ABS resin and each have a pair of claws 217 detachably engaging with a pair of engagement holes 216 defined in each end portion of the tubular member 202 from the inside of the tubular member 202. The bearing members 215 are removably attached to the opposite ends of the tubular member 202 by such claws 217 engaging with the engagement holes 216. Each bearing member 215 has a support portion 218 formed centrally thereof to support a shaft portion 220 (to be described later) of each rotatable member 219 for rotation. The support portion 218 is made relatively long along the longitudinal axis of the tubular member 202 to prolong the length of the shaft portion 220 received in the support portion 218, whereby the rotatable member 219 is supported thereon with minimized irregular rotation.

The rotatable members 219 in cylindrical form

define a multiplicity of small perforations and cover the outer surface of the tubular member 202 on both sides thereof and are formed of a synthetic resin, such as a polypropylene resin, which is different from the materials (for example, ABS resin) of the tubular member 202, cover 210, bearing members 215 and support members 224 to be described later. The shaft portion formed at one end of each rotatable member 219 is rotatably supported on the outer periphery of the support portion 218 of each bearing member 215. The other end of the rotatable member 219 approximates each lateral side of a bulged portion 221 formed as circumferentially outwardly bulging in central portions of the tubular member 202 and cover 210 so as to avoid the entry of dust or the like from the space between the aforesaid other end of the rotatable member 219 and the corresponding lateral side of the bulged portion 221 into the space between each rotatable member 219 and the tubular member 202. In this way the rotatable members 219 are prevented from faulty rotation or from generating abnormal noise due to friction. The rotatable members 219 each define a plurality of elongated openings 222 of which the longitudinal axes extend substantially parallel to that of the tubular member 202 and of which the circumferential pitch is made larger than that of the air inlets 206 whereby the openings 222 have a reduced hole area in total and, hence, a decrease in the strength of the rotatable members 219 is alleviated. A pair of annular projections 223 are formed integrally with each rotatable member 219 at the opposite ends of the outer periphery thereof and located adjacent and correspondingly to each first convex 207 and each annular convex comprising second convex 208 and fourth convex 214, each of the annular projections 223 being larger in diameter than the bulged portion 221 of the tubular member 202.

The support members 224 are formed of a synthetic resin such as ABS resin and each threadingly engaged with each support portion 218 to prevent each rotatable member 219 from dropping out. Each support member 224 is formed with an annular projection 225 which is adapted to abut or approximate the corresponding rotatable member 219 to reduce the frictional resistance between the support member 224 and the rotatable member 219, thereby supporting the rotatable member 219 for easy rotation Further, each support member 224 is formed with a manipulation knob 226 which is adapted to be held with fingers to rotate the support member 224 and thereby permits the support member 224 to be detached from or attached to the corresponding bearing member 215.

The suction member thus arranged is connected to a vacuum cleaner at the connection pipe 204 through a suction hose and an extension pipe and is then used in cleaning a surface for cleaning such as bedclothes or curtains by actuating the vacuum cleaner and push-pull operating the suction member. Since the connection pipe 204 is pivotable within a predetermined range, specifically within the range of about 60° in this embodiment, a cleaning operation can be achieved with the connection pipe 204 even slanted, so that the suction member offers improved cleaning operability. In addition, since the suction member body 201 will never be inverted, there is no possibility of erroneous use of the suction member such as cleaning with the air inlets 205 oriented upward.

When the suction member is push-pull operated on the surface for cleaning, the rotatable members 219 rotate thereby moving the suction member body 201. Since the suction member body 201 has the connection pipe 204 in a central portion thereof and supports the rotatable members 219 for rotation, the suction member is improved in balance and mobility and hence enjoys improved cleaning operability.

When a relatively hard surface for cleaning is to be cleaned, only the projections formed on the opposite ends of each rotatable member 219 are brought into contact with the surface for cleaning. Accordingly, there is no possibility that the rotatable members 219 are radially inwardly deformed and contact the suction member body 201 thereby increasing the frictional resistance therebetween, or that the peripheral edge of each small perforation or each opening 222 is caught by the peripheral edge of any air inlets 206 of the suction member body 201 to cause faulty rotation of the rotatable members 219. Further, the annular projections 223 of the rotatable members 219 are made larger in outer diameter than the bulged portion 221 of the suction member body 201, with the result that the friction between the bulged portion 221 of the suction member body 201 and the surface for cleaning is made small thereby keeping the improved mobility of the suction member. Furthermore, since the rotatable members 219 are supported by the first, second, third and fourth convexes 207, 208, 209 and 214, there is a reduced frictional resistance between the rotatable members 219 and the suction member body 201 and, hence, the rotatable members 219 rotate with ease thereby assuring the suction member of improved mobility and cleaning operability.

Although the projections 223 formed in opposite end portions of each rotatable member 219 intend to deform toward the suction member body 201 when they are pressed against the surface for cleaning, the provision of the first and fourth convexes 207 and 214 abutting or approximating the inner surface of each rotatable member 219 at positions substantially opposing the projections 223 of the suction member body 201 prevents the inner surface of each rotatable member 219 from contacting the outer surface of the suction member body 201, so that the rotatability of each rotatable member 219 is kept satisfactory.

Dust adhering to the surface for cleaning is drawn into the suction member body 201 through a multiplicity of perforations and a plurality of openings 222 of the rotatable members 219 and collected into the vacuum cleaner through the connection pipe 204, extension pipe and suction hose.

Since each rotatable member 219 defines the openings for communication with the air inlets 206 of the suction member body 201, relatively large dust including hair and waste thread can assuredly collected at positions where the openings 222 come to coincide with the air inlets 206 of the suction member body 201 as the rotatable members 219 rotate.

When a relatively soft surface such as curtain or bed sheet is to be cleaned, the suction force of the vacuum cleaner causes the surface for cleaning to be attracted by a lower portion of the rotatable members 219, namely the portion opposite to the air inlets 206 of the suction member body 201. However, since the rotatable members 219 are kept spaced apart from the outer surface of the suction member body 201 by the first, second, third and fourth convexes 207, 208, 209 and 214, there is no possibility that the air inlets 206 are covered with the surface for cleaning and, hence, the dust collectability of the suction member can be maintained. Further, although the surface for cleaning attracted to the rotatable members 219 might be drawn in from any opening 219 of the rotatable members 219 to any air inlet 206 of the suction member body 201, the space provided between the suction member body 201 and the rotatable members 219 prevents the surface for cleaning from penetrating into any air inlet 206. Therefore, the rotatability of the rotatable members 219 will never be degraded.

Where the multiplicity of perforations of the rotatable members 219 catch hair and the like, it is possible to remove the support members 224 from the bearing members 215 to detach the rotatable members 219 from the suction member body 201 for washing the rotatable members 219 with water or the like. Alternatively, where hair or the like is caught between adjacent air inlets 206 and dust cumulatively adhering to the hair turns into a mass within the suction member body 201, a screw driver or the like is inserted into each engagement hole 216 of the suction member body 201 to disengage the corresponding engagement claw 217 of the bearing member 215 from the engagement hole 216 thereby detaching the bearing member 215 from the suction member body 201. Thus, the inside of the suction member body 201 can be cleaned. In this way the bearing members 215 attached to the opposite ends of the suction member body 201 can be detached with ease and, hence, the maintenability of the suction member body 201 is improved.

The cover 210 of the embodiment shown in Figs. 15 to 21 is formed of a synthetic resin such as ABS resin. Since the cover 210 contacts the surface for cleaning and might be degraded in mobility due to the frictional resistance therebeween, it is desired that the cover 210 be formed of a material of low frictional resistance such as a polyacetal resin or an olefin resin. The pressing force of the suction member against the surface for cleaning generated by the user push-pull operating the suction member during cleaning is the strongest in the vicinity of the connection pipe 204 and, therefore, the contacting force between the fourth convexes 214 and the rotatable members 219 becomes the strongest. Accordingly, the fourth convexes 214 are likely to be abraded during long time use. However, by forming the cover 210 with the material of low frictional resistance, the frictional resistance between the fourth convexes 214 of the cover 210 and the rotatable members 219 are reduced thereby improving the mobility of the suction member.

Although the first, second, third and fourth annular convexes 207, 208, 209 and 214 are formed on the outer surface of the suction member body 201 as approximating or abuttingly supporting the rotatable members 219 to reduce the friction resistance of the rotatable members 219 against rotation, convexes 227 might be formed only on lower surfaces of the suction member body 201 as shown in Fig. 22. With this arrangement, it is possible to assuredly provide a space between the rotatable members 219 and the suction member body 201 thereby keeping the dust collectability of the suction member satisfactory, and to reduce the contact area between the rotatable members 219 and the convexes thereby decreasing the frictional resistance of the rotatable members 219 against rotation. Thus, the suction member offers improved mobility and cleaning operability.

Although the first, second, third and fourth convexes 207, 208, 209 and 214 are formed integrally with the outer periphery of the suction member body 201, first, third and fourth convexes 228, 229 and 230 together with second convexes (not shown) might be formed of a material of low frictional resistance, for example, a low frictional resistance resin such as a polyacetal resin or an olefin resin and bonded to the suction member body 201 as shown in Fig. 23. This arrangement allows the rotatable members 219 to have a low frictional resistance against rotation, thereby improving the mobility and cleaning operability of the suction member.

Alternatively, instead of the first, second, third and fourth convexes 207, 208, 209 and 214 formed on the outer surface of the suction member body 201, annular convexes 231, 232 and 233 might be formed on the inner surfaces of the rotatable members 219 as abutting the outer surface of the suction member body 201 as shown in Fig. 24.

Further, although the embodiment shown in Fig. 15 to 21 is of the arrangement wherein the engagement claws 217 of each bearing member 215 can be disengaged from the engagement holes 216 of the tubular member 202 with use of a screw driver or the like, a pair of projecting portions 234 adapted to disengange the engagement claws 217 from the engagement holes 216 might be formed on the inner surface of each rotatable member 219 at positions corresponding to the engagement holes 216. Each of the projecting portions 234 is shaped semicircular, and each engagement claw 217

defines a recess 235 into which the tip of the corresponding projecting portion 234 is adapted to fit and has slopes 236 on opposite sides of the recess 235, while each engagement hole 216 has slopes 237 on the outer periphery side of the suction member body 201 along the circumferential direction thereof. With this arrangement, each rotatable member 219 is rotated to a position where each projecting portion 234 coincides with the corresponding engagement hole 216 and is inwardly deformed to disengage the engagement claw 217 from the engagement hole 216, followed by further rotating the rotatable member 219. Since the tip of the projecting portion 234 is being fitted into the recess 235 of the engagement claw 217 at this time, the hearing member 215 rotates as the corresponding rotatable member 219 rotates and, accordingly, one of the slopes 236 of the engagement claw 217 is guided onto the peripheral edge of the engagement hole 216 to deform the engagement claw 217 inwardly of the tubular member 202 while the projecting portion 234 is guided onto one of the slopes 237 to disengage from the recess 235 of the engagement claw 217. In this condition, by pulling the rotatable member 219 longitudinally of the suction member body 201 while pressing the rotatable member 219 inwardly, the bearing member 215, rotatable member 219 and support member 224 in assembled condition can be removed from the suction member body 201, thus assuring improved mainteinability of the suction member body 201 and rotatable members 219.

Although each of the bearing members 215 is formed of a synthetic resin such as ABS resin, it might be formed of a material of low frictional resistance, for example, a low frictional resistance synthetic resin such as a polyacetal resin or an olefin resin to reduce the frictional resistance between the support member 218 of each bearing member 215 and the shaft portion 220 of each rotatable member 219, thereby improving the mobility and cleaning operability of the suction member.

As in the embodiment shown in Fig. 27, each bearing member might be formed of a material of low frictional resistance, for example, a low frictional resistance synthetic resin such as a polyacetal resin or an olfin resin while being formed with an annular convex 239 abutting or approximating a portion adjacent the projection 223 at one end of the corresponding rotatable member 219. This allows the frictional resistance between the bearing members and the rotatable members 219 to decrease thereby improving the mobility and cleaning operability of the suction member.

Further, although the first, second, third and fourth convexes 207, 208, 209 and 214 are formed on the outer surface of the suction member body 201 as approximating or abutting the inner surfaces of the rotatable members 219, each rotatable member 219 might be formed with an annular convex 240 on the inner surface thereof as approximating or abutting the outer surface of the corresponding bearing member 215 and annular convexes 241 and 242 on the inner surface thereof as approximating or abutting the outer surface of the suction member body 201, as in the embodiment shown in Fig. 28.

In the embodiment shown in Fig. 28, each bearing member 215 is preferably made of a material of low frictional resistance, for example, a low frictional resistance synthetic resin such as a polyacetal resin or an olefin resin to decrease the frictional resistance between the bearing member 215 and the corresponding rotatable member 219, thereby improving the mobility and cleaning operability of the suction member.

To be described with reference to Figs. 29 to 31 is another embodiment of the present invention. It is to be noted that in these figures the parts corresponding to those in the foregoing embodiments are denoted by like numerals as used in the foregoing embodiments and description on such parts are omitted herein. The suction member shown includes bearing portions 243 formed on the outer surface of a tubular member 202 at opposite ends thereof and each having a diameter smaller than the outer diameter of the tubular member 202, each bearing portion 243 supporting a shaft portion 244 formed at one end portion of the corresponding rotatable member for rotation. A closing plate 245 of a synthetic resin such as ABS resin closes each open end of the tubular member 202 and has a pair of engagement claws 247 which disengageably engages a pair of engagement holes 246 defined in each of the opposite end portion of the tubular member 202 from the inside of the tubular member 202. Thus, the closing plate 245 is removably attached to each open end of the tubular member 202 by the engagement of the engagement claws 247 with the engagement holes 246. When the closing plate 245 is attached to each end portion of the tubular member 202, the corresponding rotatable member 219 is adapted to be rotatably supported on the bearing portion 244. The closing plate 245 is made larger in outer diameter than the projection 260 formed at one end of each rotatable member 219 so as not to contact a surface for cleaning and thereby not to impede a movement of the suction member.

Each of the engagement claw 247 defines a recess 248 into which the tip of a projecting portion 250 to be described later is fitted and has slopes 249 on opposite sides thereof. A pair of projecting portions 250 each shaped substantially arcuate are formed on the inner surface of each rotatable member 219 at positions coincident with the engagement holes 246 so as to serve as disengaging portions.

When each rotatable member 219 is to be removed, the rotatable member 219 is rotated to a position where the projecting portions come to coincide with the engagement holes 246 and is inwardly deformed to disengage the engagement claws 247 from the engagement holes 246, and is further rotated while being inwardly deformed. Since the tip of each projecting portion 250 is being fitted into the recess 248 of the corresponding engagement claw 247 at this time, the closing

plate 245 rotates as the corresponding rotatable member 219 rotates and, accordingly, one of the slopes 236 of the engagement claw 247 is guided onto the peripheral edge of the engagement hole 246 to deform the engagement claw 247 inwardly of the tubular member 202 while the projecting portion 250 is guided onto one of the slopes 251 to disengage from the recess 248. In this condition, by pulling the rotatable member 219 longitudinally of the suction member body 201 while pressing the rotatable member 219 inwardly, the closing plate 245 and the rotatable member 219 can be removed from the suction member body 201.

The embodiment shown in Figs. 29 to 31 can be constructed of a reduced number of parts as compared to the foregoing embodiments and hence can be simplified in structure.

Although each bearing portion 243 is provided to the tubular member 202, it might be provided to each closing plate 245 as in the embodiment shown in Fig. 32.

To be described with reference to Figs. 33 to 35 is still another embodiment of the present invention. It is to be noted that in these figures the parts corresponding to those in the foregoing embodiments are denoted by like numerals as used in the foregoing embodiments and description on such parts are omitted herein.

The suction member shown includes rotatable members 319 covering the outer periphery of a tubular member 302 on both sides thereof, each of the rotatable members 319 having at one end thereof a shaft portion (not shown in Figs. 33 to 35 but refer to numeral 220 in Fig. 15) rotatably supported around the outer surface of a support portion (not shown in Figs. 33 to 35 but refer to numeral 218 in Fig. 15) of a bearing member 315. The rotatable members 319 are formed of a synthetic resin such as a polypropylene resin which is different from the materials (for example, ABS resin) of the tubular member 302, cover 310 and bearing members 315, and contains an antibacterial agent. In this embodiment the antibacterial agent is contained in an amount of 0.1 to 0.2 % by weight, taking account for its antibaterial activity and a decrease in the strength of the synthetic resin due to the admixture of the antibacterial agent. The other end of each rotatable member 319 approximates a lateral side of a bulged portion 321 bulged circumferentially outwardly of central portions of the tubular member 302 and cover 310, thereby preventing dust from penetrating between the aforesaid other end of the rotatable member 319 and the lateral side of the bulged portion to cause faulty rotation of the rotatable member 319 or to generate abnormal noise due to friction. Each of the rotatable members 319 defines a plurality of elongated openings 322 so that the longitudinal axes thereof cross the rotational axis, i.e., the longitudinal axis of the suction member body 301. The length of each opening 322 in the rotational direction of the rotatable member 319 is made larger than the circumferential pitch of air inlets 306 defined in the suction member body 301 so that the openings 322 are always in communication with the air inlets 306 to assuredly collect hair, waste thread and the like. Each rotatable member 319 has a pair of annular projections 323 formed integrally therewith on the outer periphery at opposite ends thereof. The projections 323 are located at positions adjacent and corresponding to first convex 307 and the combination of second convex 308 and fourth convex 314, each of the projections 323 being made larger in diameter than the bulged portion 321 of the tubular member 302.

Since the peripheral edge of each opening 322 defined in each rotatable member 319 is formed as crossing the peripheral edge of each air inlet 306 defined in the suction member body 301, the peripheral edge of each opening 322 will never be caught by the peripheral edge of each air inlet 306 and, hence, the rotatable member 319 enjoys improved rotatability. In cleaning a surface of an soft and relatively thick object such as bedclothes or blanket, each rotatable member 319 is pressed against the surface for cleaning and hence is inwardly deformed, with the result that the inner periphery of the rotatable member 319 contacts a lower portion of the outer periphery of the suction member body 301. At this time, where the peripheral edges of the openings 322 are parallel to the peripheral edges of the air inlets 306, the peripheral edges of the openings 322 is likely to be caught by the peripheral edges of the air inlets 306 over a large area with the rotation of the rotatable member 319, whereby the rotation of the roatable member 319 is impeded to degrade the mobility of the suction member. In this embodiment, however, the peripheral edges of the openings 322 of each rotatable member 319 are formed as crossing those of the air inlets 306 of the suction member body 301 thereby minimizing the possibility of the openings 322 being caught by the air inlets 306. Thus, the suction member according to this embodiment offers improved mobility.

Further, since the openings 322 of each rotatable member 319 and the air inlets 306 of the suction member body 301 are formed in elongated shape and the longitudinal axes of the openings 322 and those of the air inlets 306 cross each other, the openings 322 continuously communicate with the air inlets 306 to enable continuous collection of hair, waste thread and the like.

Although in the embodiment shown in Figs. 33 and 34 the longitudinal axis of each air inlet 306 of the suction member body 301 extends substantially parallel to the longitudinal axis of the suction member body 301 while the longitudinal axis of each opening 322 crosses that of each air inlet 306, such an arrangement might be employed that the longitudinal axis of each air inlet 306 of the suction member body 301 crosses the longitudinal axis of the suction member body 301 while the longitudinal axis of each opening 322 of the rotatable members 319 extends substantially parallel to that of the suction member body 301, so that the longitudinal axis of the opening 322 and that of the air inlet 306

cross each other.

As has been described, the present invention provides a suction member for use with a vacuum cleaner which exhibits improved cleaning operability and cleaning performance. Further, the present invention makes it possible to improve the mainteinability of the rotatable members and suction member body. Furthermore, the connecting pipe of the suction member is securely held by the suction member body thereby improving the cleaning operability of the suction member.

While only certain presently preferred embodiments have been described in detail, as will be apparent with those familiar with the art, certain changes and modifications can be made without departing from the scope of the invention as defined by the following claims.

Claims

1. Suction member for use with a vacuum cleaner comprising a suction member body (1,101,201,301) having an air inlet (4,109,206,306) in a lower portion of the outer surface thereof and a rotatable member (8,110,219,319) rotatably provided around the outer surface of the suction member body (1,101,201,301), characterized in that a multiplicity of elongated openings (9,113,222,322) are defined in the rotatable member (8,110,219,319).

2. Suction member according to claim 1, characterized in that it comprises space holding means (6,207,208, 209,214,227,228,229,230,231,232,233,239,240,241,242) for holding a space which is formed between a lower surface of the suction member body (1,201) and an inner surface of the rotatable member (8,219).

3. Suction member according to claim 1 or 2, characterized in that the rotatable member (8,110,219,319) is removably attached to the suction member body (1,101,201,301).

4. Suction member according to one of claims 1 to 3, wherein the suction member body (1,201) has substantially centrally thereof a connection pipe (2,204) to be connected to the vacuum cleaner, and the rotatable member (8,219) is rotatably provided around the outer surface of the suction member body (1,201) on both sides of the suction member body (1,201).

5. Suction member according to one of the preceding claims, wherein a wheel (7) is formed integrally with the rotatable member (8).

6. Suction member according to one of the preceding claims, wherein the openings (9,113,222) defined in the rotatable member (8,110,206) are shaped substantially similar to the air inlet (4,109,206) of the suction member body (1,101,201).

7. Suction member according to one of the preceding claims, wherein the air inlet (4,109,206) and the openings (9,113,222) defined in the rotatable member (8,110,206) are both in laterally elongated form.

8. Suction member according to one of the preceding claims, wherein ribs (6,207,208,209,214,227,228,229, 230,239) abutting the inner surface of the rotatable member (8,219) are formed around the outer surface of the suction member body (1,201).

9. Suction member according to one of claims 1-7, wherein annular ribs (231,232,233,240, 241,242) abutting around the outer surface of the suction member body (1,201) are formed on the inner surface of the rotatable member (8,219).

10. Suction member according to claim 1, wherein the suction member body (101) has a flat portion (115) defining an air inlet (109) on a bottom portion thereof and curved portions (114) at front and rear ends thereof to be shaped with oval section.

11. Suction member according to claim 1, wherein bearing members (215,238) are removably attached to end portions of the suction member body (201), and the rotatable member (219) is rotatably supported by the respective bearing member (215,238).

12. Suction member according to claim 11, wherein the rotatable member (219) is removably supported by the respective bearing member (215,238).

13. Suction member according to claim 11, wherein the bearing member (215,238) is formed of a material of low frictional resistance.

14. Suction member according to claim 1, wherein the suction member body (201) comprises a tubular member (202) which has substantially centrally thereof a support portion (205) supporting a connection pipe (204) and an opening (203) on which the support portion (205) faces, and a cover (210) closing the opening (203) of the tubular member (202), the connection pipe (204) being held between the support portion (205) and the cover (210).

15. Suction member according to claim 1, wherein the rotatable member (8,219) has at least one projecting portion (7,223) on the outer surface thereof.

16. Suction member according to claim 1, wherein the peripheral edge of the opening (322) of the rotatable member (319) crosses that of the air inlet (306).

17. Suction member according to claim 1, wherein a support member (12,224,245) is removably attached to the end of the suction member body (1,201) for preventing the rotatable member (8,219) from dropping out.

18. Suction member according to claim 17, wherein the rotatable member (8,219) is rotatably supported between the suction member body (1,201) and the support member (12,224).

Patentansprüche

1. Saugdüse für einen Staubsauger, umfassend einen Saugdüsenkörper (1, 101, 201, 301), der in einem unteren Bereich seiner Außenfläche eine Lufteintrittsöffnung (4, 109, 206, 306) aufweist, und einen Drehkörper (8, 110, 219, 319), der die Außenfläche des Saugdüsenkörpers (1, 101, 201, 301) drehbar umgibt, **dadurch gekennzeichnet,** daß in dem Drehkörper (8, 110, 219, 319) eine Vielzahl länglicher Öffnungen (9, 113, 222, 322) ausgebildet ist.

2. Saugdüse nach Anspruch 1, **dadurch gekennzeichnet,** daß sie Abstandshaltemittel (6, 207, 208, 209, 214, 227, 228, 229, 230, 231, 232, 233, 239, 240, 241, 242) zum Beibehalten eines zwischen einer unteren Fläche des Saugdüsenkörpers (1, 201) und einer Innenfläche des Drehkörpers (8, 219) gebildeten Abstands aufweist.

3. Saugdüse nach Anspruch 1 oder 2, **dadurch gekennzeichnet,** daß der Drehkörper (8, 110, 219, 319) an dem Saugdüsenkörper (1, 101, 201, 301) abnehmbar befestigt ist.

4. Saugdüse nach einem der Ansprüche 1 bis 3, bei der der Saugdüsenkörper (1, 201) an einer im wesentlichen zentralen Stelle ein an den Staubsauger anschließbares Verbindungsrohr (2, 204) aufweist und der Drehkörper (8, 219) die Außenfläche des Saugdüsenkörpers (1, 201) auf beiden Seiten des Saugdüsenkörpers (1, 201) drehbar umgibt.

5. Saugdüse nach einem der vorhergehenden Ansprüche, bei der ein Rad (7) in den Drehkörper (8) integriert ist.

6. Saugdüse nach einem der vorhergehenden Ansprüche, bei der die in dem Drehkörper (8, 110, 206) ausgebildeten Öffnungen (9, 113, 222) im wesentlichen ähnlich zu der Lufteintrittsöffnung (4, 109, 206) des Saugdüsenkörpers (1, 101, 201) geformt sind.

7. Saugdüse nach einem der vorhergehenden Ansprüche, bei der sowohl die Lufteintrittsöffnung (4, 109, 206) als auch die in dem Drehkörper (8, 110, 206) ausgebildeten Öffnungen (9, 113, 222) eine in Querrichtung verlaufende längliche Form aufweisen.

8. Saugdüse nach einem der vorhergehenden Ansprüche, bei der um die Außenfläche des Saugdüsenkörpers (1, 201) herum Rippen (6, 207, 208, 209, 214, 227, 228, 229, 230, 239) ausgebildet sind, die an die Innenfläche des Drehkörpers (8, 219) angrenzen.

9. Saugdüse nach einem der Ansprüche 1 bis 7, bei der an der Innenfläche des Drehkörpers (8, 219) ringförmige Rippen (231, 232, 233, 240, 241, 242) ausgebildet sind, die um die Außenfläche des Saugdüsenkörpers (1, 201) herum an die Außenfläche angrenzen.

10. Saugdüse nach Anspruch 1, bei der der Saugdüsenkörper (101) an seinem Boden einen flachen Bereich (115), in dem eine Lufteintrittsöffnung (109) ausgebildet ist, und an seinem vorderen Ende und seinem hinteren Ende gekrümmte Bereiche (114) aufweist, so daß er im Querschnitt eine ovale Form hat.

11. Saugdüse nach Anspruch 1, bei der an den Enden des Saugdüsenkörpers (201) Lagerelemente (215, 238) abnehmbar befestigt sind und der Drehkörper (219) mittels des jeweiligen Lagerelements (215, 238) drehbar gelagert ist.

12. Saugdüse nach Anspruch 11, bei der der Drehkörper (219) mittels des jeweiligen Lagerelements (215, 238) abnehmbar gelagert ist.

13. Saugdüse nach Anspruch 11, bei der das Lagerelement (215, 238) aus einem Material mit einem geringen Reibungswiderstand gebildet ist.

14. Saugdüse nach Anspruch 1, bei der der Saugdüsenkörper (201) einen röhrenförmigen Körper (202), der an einer im wesentlichen zentralen Stelle einen Halter (205) zum Halten eines Verbindungsrohrs (204) und eine an den Halter (205) angrenzende Öffnung (203) umfaßt, und eine die Öffnung (203) des röhrenförmigen Körpers (202) verschließende Abdeckung (210) aufweist, wobei das Verbindungsrohr (204) zwischen dem Kalter (205) und der Abdeckung (210) festgehalten wird.

15. Saugdüse nach Anspruch 1, bei der der Drehkörper (8, 219) an seiner Außenfläche mindestens einen vorspringenden Teil (7, 223) aufweist.

16. Saugdüse nach Anspruch 1, bei der der Rand der Öffnung (322) des Drehkörpers (319) den Rand der Lufteintrittsöffnung (306) kreuzt.

17. Saugdüse nach Anspruch 1, bei der an dem Ende des Saugdüsenkörpers (1, 201) ein Halteelement (12, 224, 245) abnehmbar befestigt ist, um zu verhindern, daß der Drehkörper (8, 219) abfällt.

18. Saugdüse nach Anspruch 17, bei der der Drehkörper (8, 219) zwischen dem Saugdüsenkörper (101, 201) und dem Halteelement (12, 224) drehbar gelagert ist.

Revendications

1. Elément d'aspiration pour aspirateur, comprenant un corps (1, 101, 201, 301) ayant une entrée d'air (4, 109, 206, 306) dans une partie inférieure de sa surface extérieure, et un élément rotatif (8, 110, 219, 319) prévu tournant autour de la surface extérieure de ce corps (1, 101, 201, 301), caractérisé par le fait qu'un grand nombre d'ouvertures allongées (9, 113, 222, 322) sont faites dans l'élément rotatif (8, 110, 219, 319).

2. Elément d'aspiration selon la revendication 1, caractérisé par le fait qu'il comprend des moyens (6, 207, 208, 209, 214, 227, 228, 229, 230, 231, 232, 233, 239, 240, 241, 242) pour le maintien d'un espace formé entre une surface inférieure du corps (1, 201) et une surface intérieure de l'élément rotatif (8, 219).

3. Elément d'aspiration selon l'une des revendications 1 et 2, caractérisé par le fait que l'élément rotatif (8, 110, 219, 319) est fixé de manière amovible au corps (1, 101, 201, 301).

4. Elément d'aspiration selon l'une des revendications 1 à 3, dont le corps (1, 201) a sensiblement en son centre un tuyau de jonction (2, 204) destiné à être joint à l'aspirateur, et l'élément rotatif (8, 219) est prévu rotatif autour de la surface extérieure du corps (1, 201) sur les deux côtés de celui-ci.

5. Elément d'aspiration selon l'une des revendications précédentes, dans lequel une roue (7) fait corps avec l'élément rotatif (8).

6. Elément d'aspiration selon l'une des revendications précédentes, dans lequel les ouvertures (9, 113, 222) faites dans l'élément rotatif (8, 110, 206) sont de forme semblable à celle de l'entrée d'air (4, 109, 206) du corps (1, 101, 201).

7. Elément d'aspiration selon l'une des revendications précédentes, dans lequel l'entrée d'air (4, 109, 206) et les ouvertures (9, 113, 222) faites dans l'élément rotatif (8, 110, 206) sont de forme allongée latéralement.

8. Elément d'aspiration selon l'une des revendications précédentes, dans lequel des nervures (6, 207, 208, 209, 214, 227, 228, 229, 230, 239) s'appuyant sur la surface intérieure de l'élément rotatif (8, 219) sont faites autour de la surface extérieure du corps (1, 201).

9. Elément d'aspiration selon l'une des revendications 1 à 7, dans lequel des nervures annulaires (231, 232, 233, 240, 241, 242) s'appuyant autour de la surface extérieure du corps (1, 201) sont faites sur la surface intérieure de l'élément rotatif (8, 219).

10. Elément d'aspiration selon la revendication 1, dont le corps (101) a sur sa partie inférieure une partie plate (115) présentant une entrée d'air (109) et, à ses extrémités avant et arrière, des parties courbes (114) de section ovale.

11. Elément d'aspiration selon la revendication 1, à des parties d'extrémité du corps (201) duquel sont fixés de manière amovible des éléments paliers (215, 238), et dans lequel l'élément rotatif (219) est supporté pour sa rotation par l'élément palier respectif (215, 238).

12. Elément d'aspiration selon la revendication 11, dans lequel l'élément rotatif (219) est supporté de manière amovible par l'élément palier respectif (215, 238).

13. Elément d'aspiration selon la revendication 11, dans lequel l'élément palier (215, 238) est fait d'une matière à faible résistance de frottement.

14. Elément d'aspiration selon la revendication 1, dont le corps (201) comprend un élément tubulaire (202) qui a sensiblement en son centre une partie de support (205) qui supporte un tuyau de jonction (204) et une ouverture (203) à laquelle la partie de support (205) fait face, et un couvercle (210) qui ferme l'ouverture (203) de l'élément tubulaire (202), le tuyau de jonction (204) étant tenu entre la partie de support (205) et le couvercle (210).

15. Elément d'aspiration selon la revendication 1, dans lequel l'élément rotatif (8, 219) a sur sa surface extérieure au moins une partie saillante (7, 223).

16. Elément d'aspiration selon la revendication 1, dans lequel le bord périphérique de l'ouverture (322) de l'élément rotatif (319) croise celui de l'entrée d'air (306).

17. Elément d'aspiration selon la revendication 1, à l'extrémité du corps (1, 201) duquel est fixé de manière amovible un élément de support (12, 224, 245) destiné à empêcher l'élément rotatif (8, 219) de tomber.

18. Elément d'aspiration selon la revendication 17, dans lequel l'élément rotatif (8, 219) est supporté pour sa rotation entre le corps (1, 201) et l'élément de support (12, 224).

FIG. 1

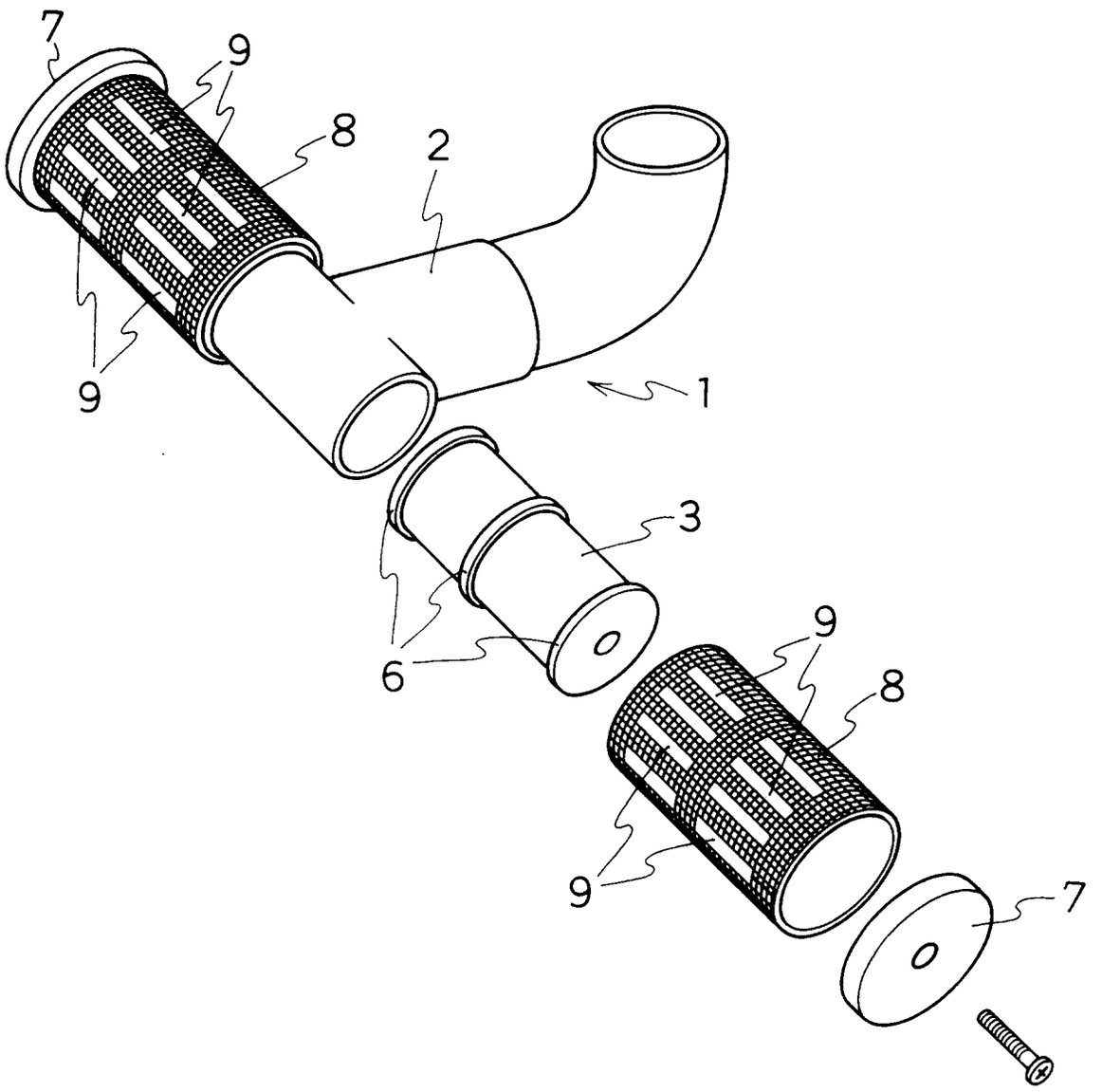

FIG. 2

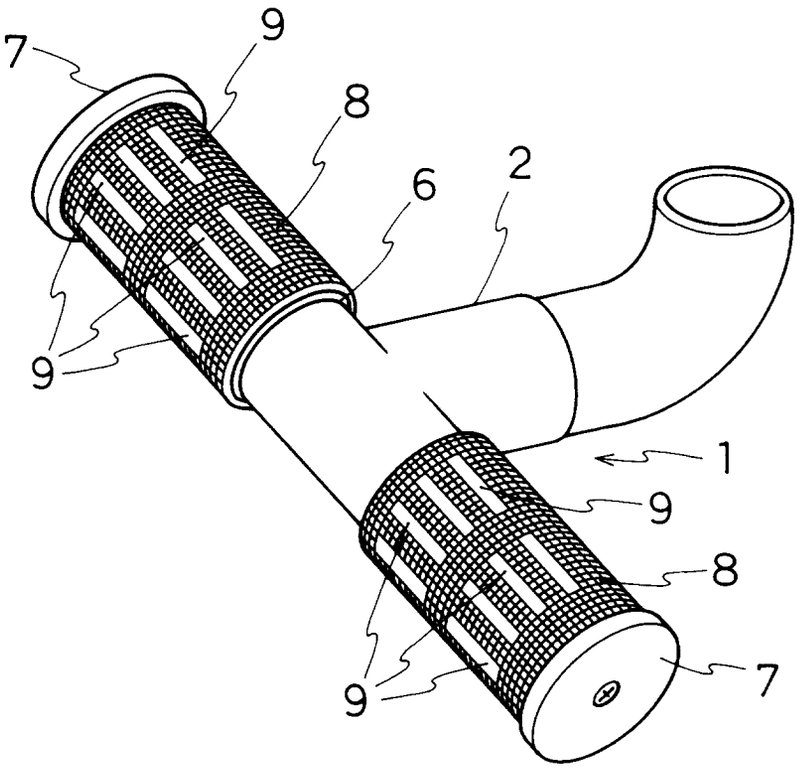

FIG. 3

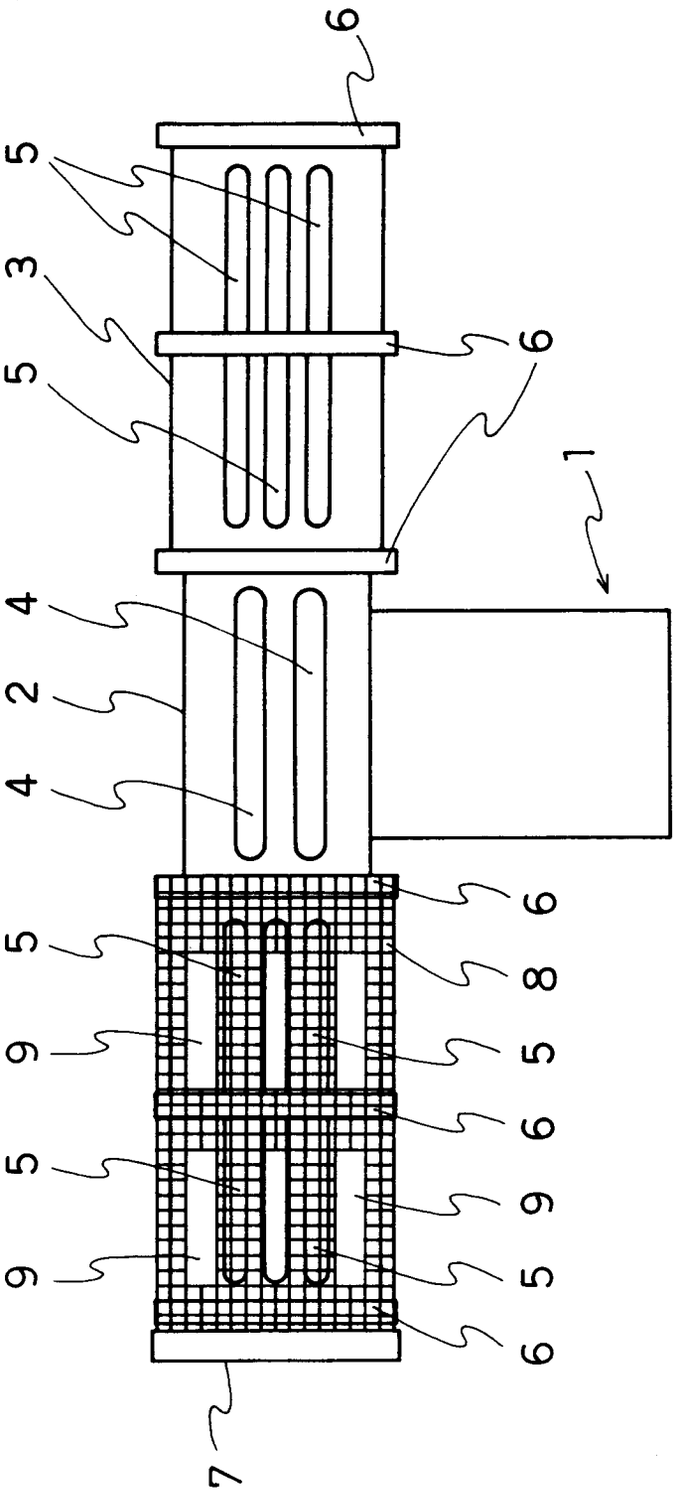

FIG. 4

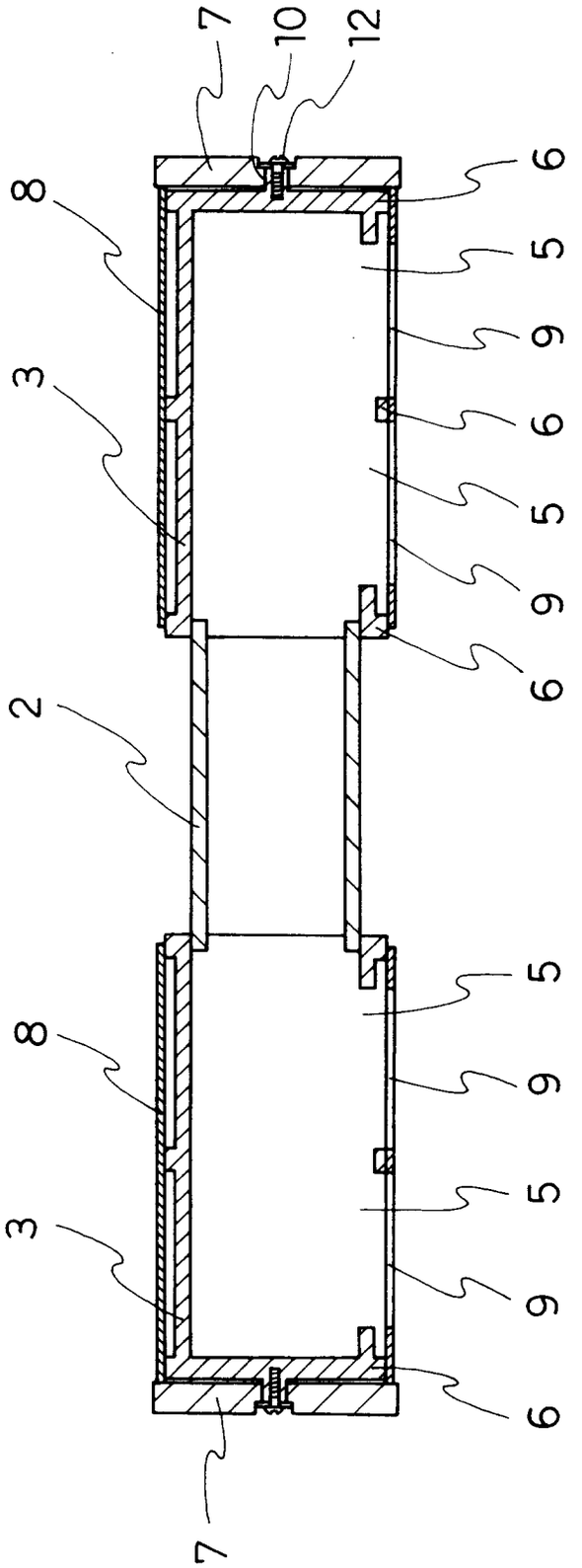

FIG. 5

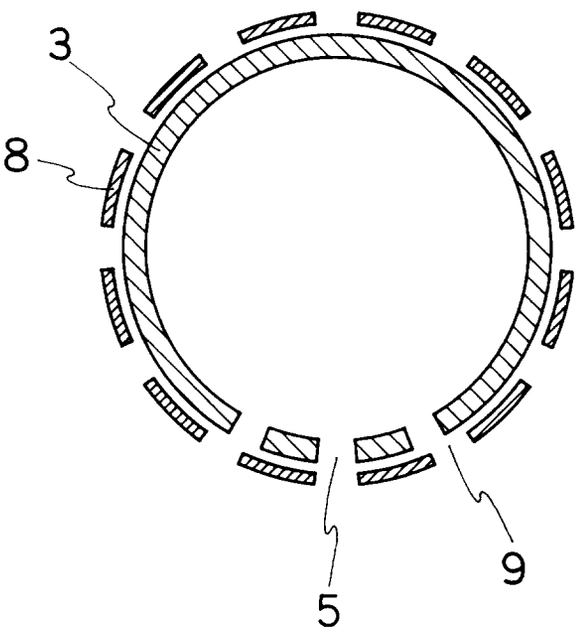

FIG. 6

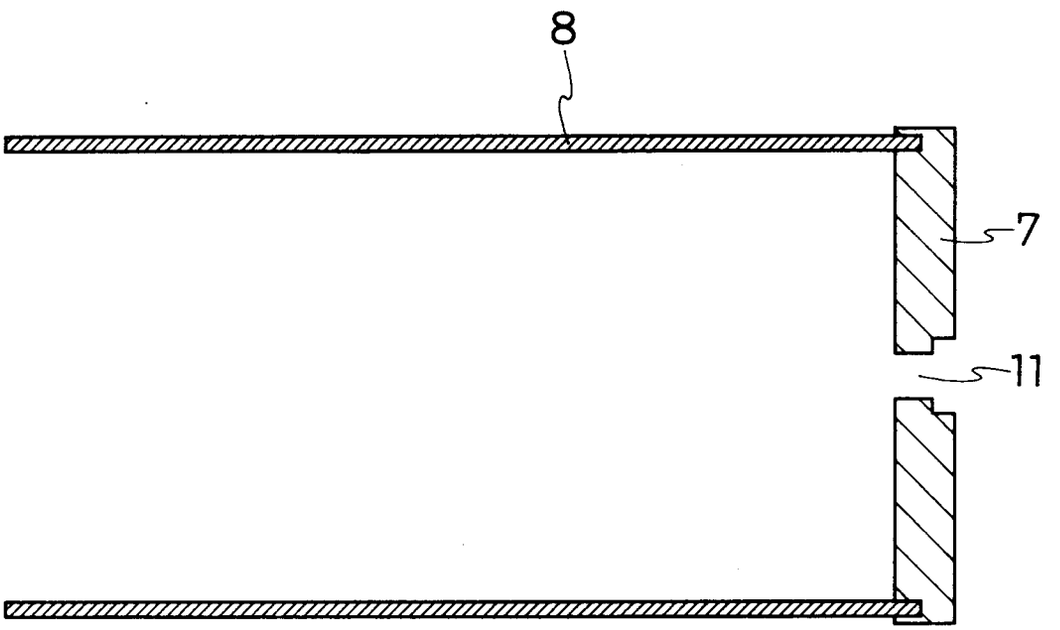

FIG. 7

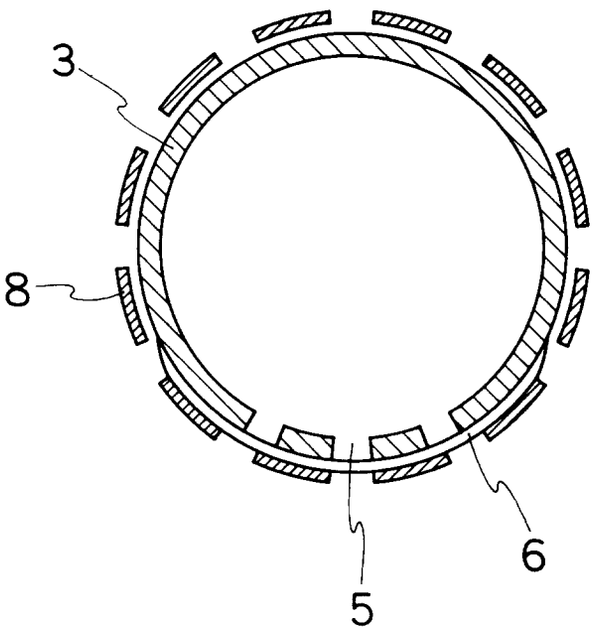

FIG. 8

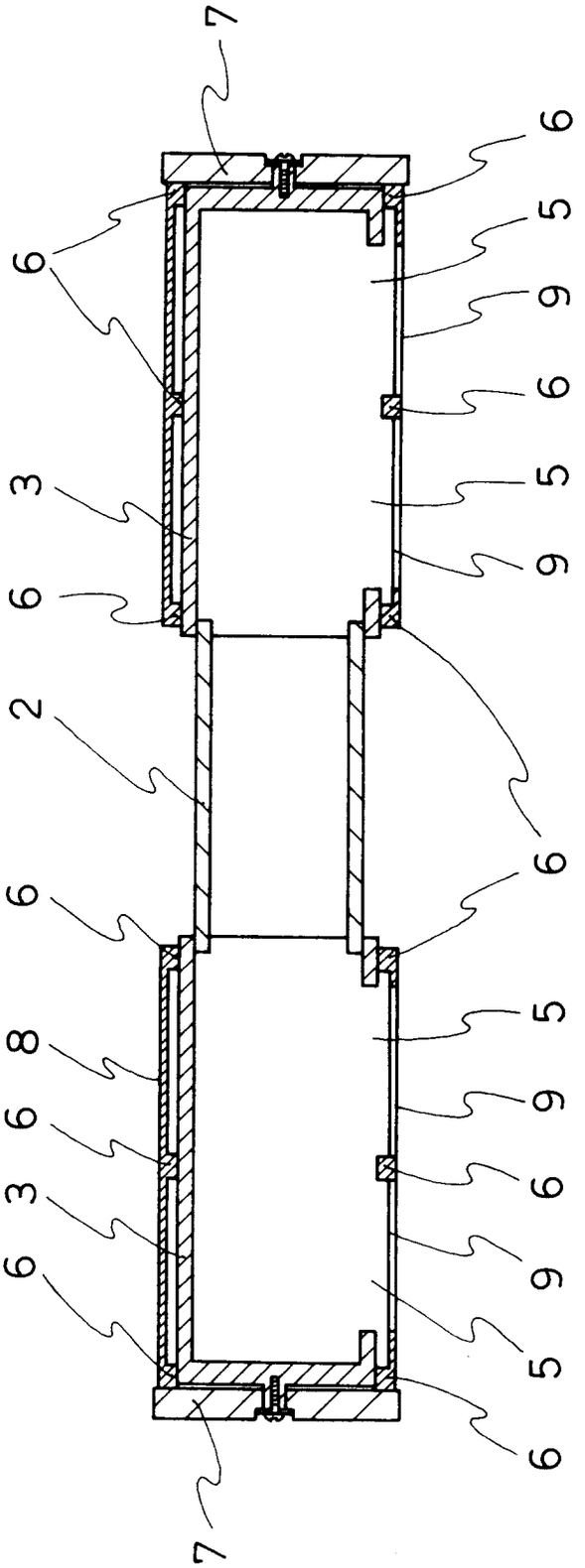

FIG. 9

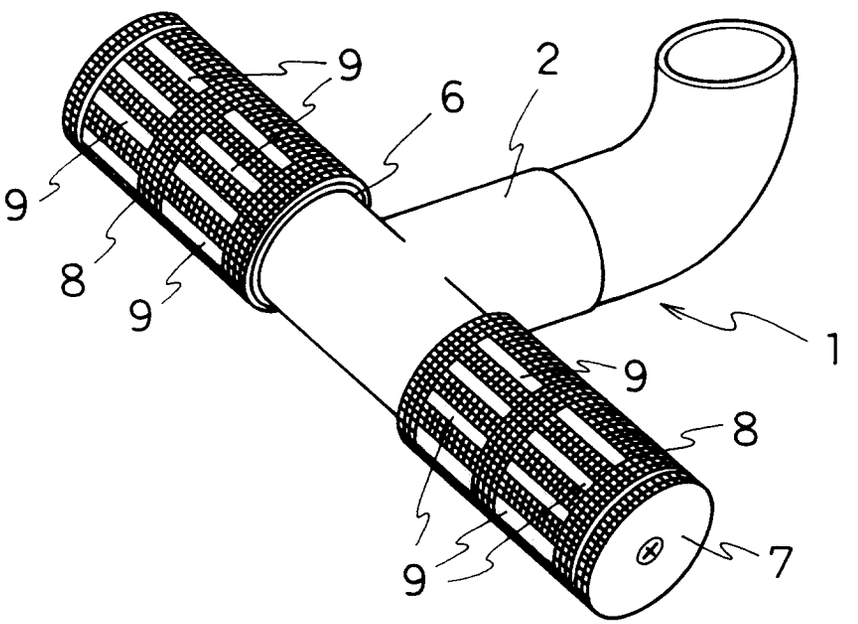

FIG. 10

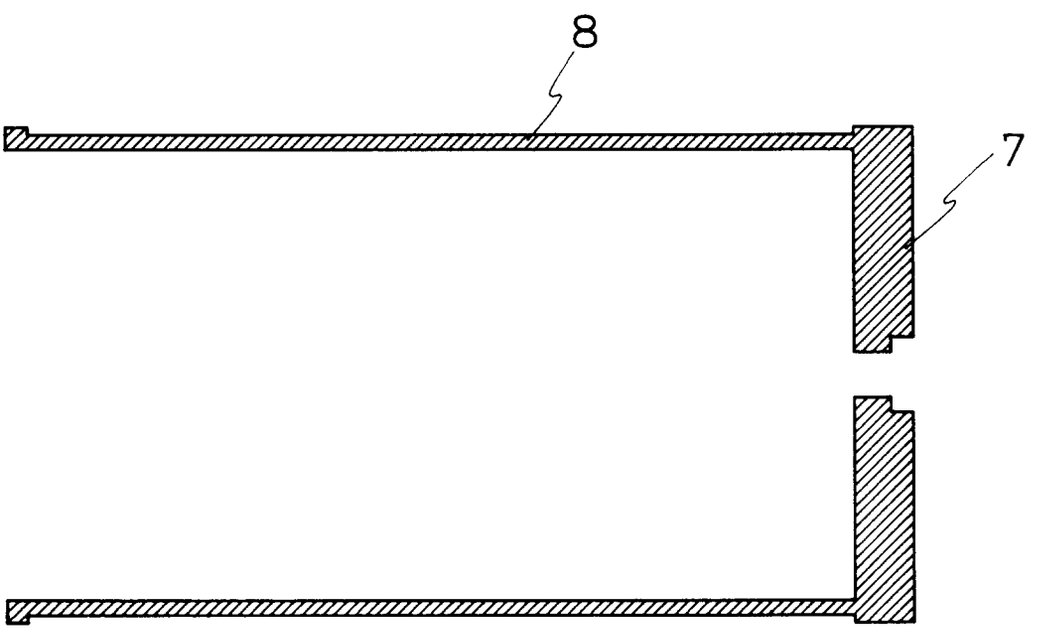

FIG. 11

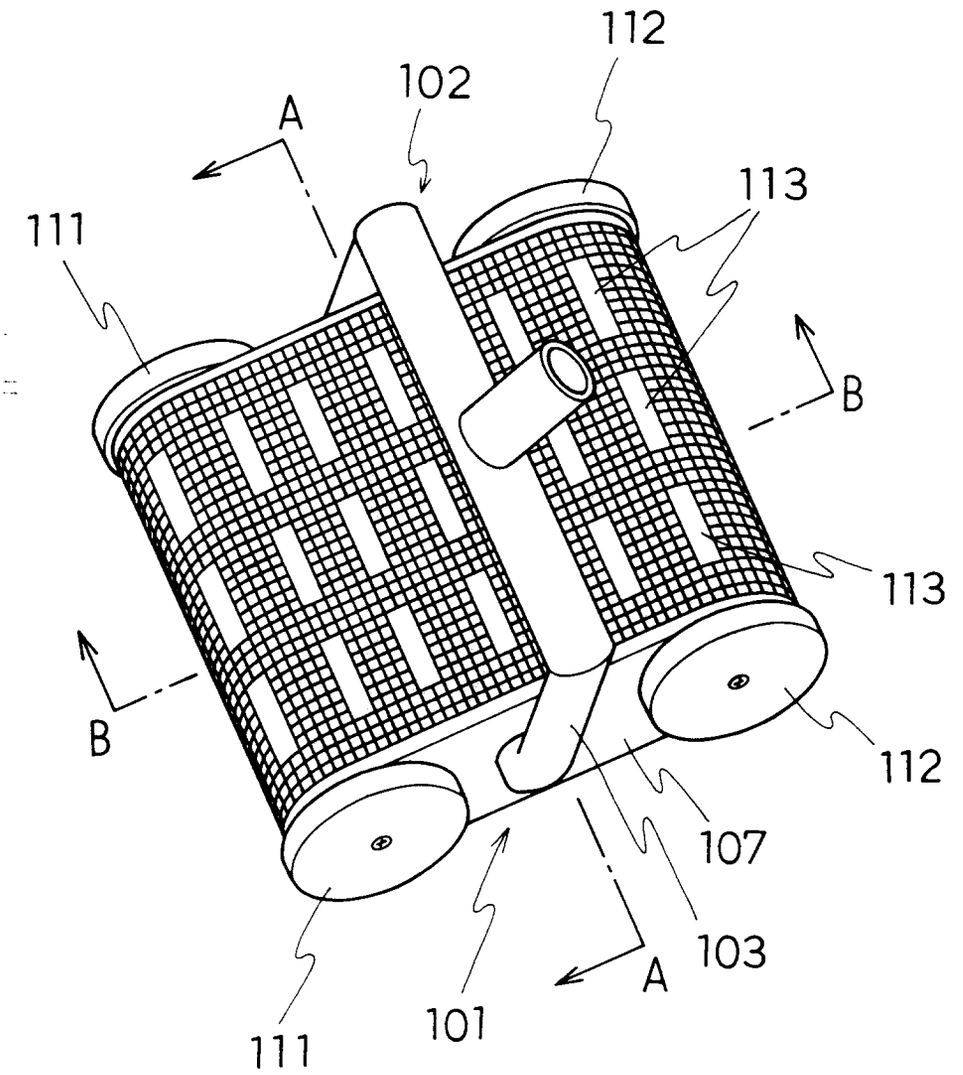

FIG. 12

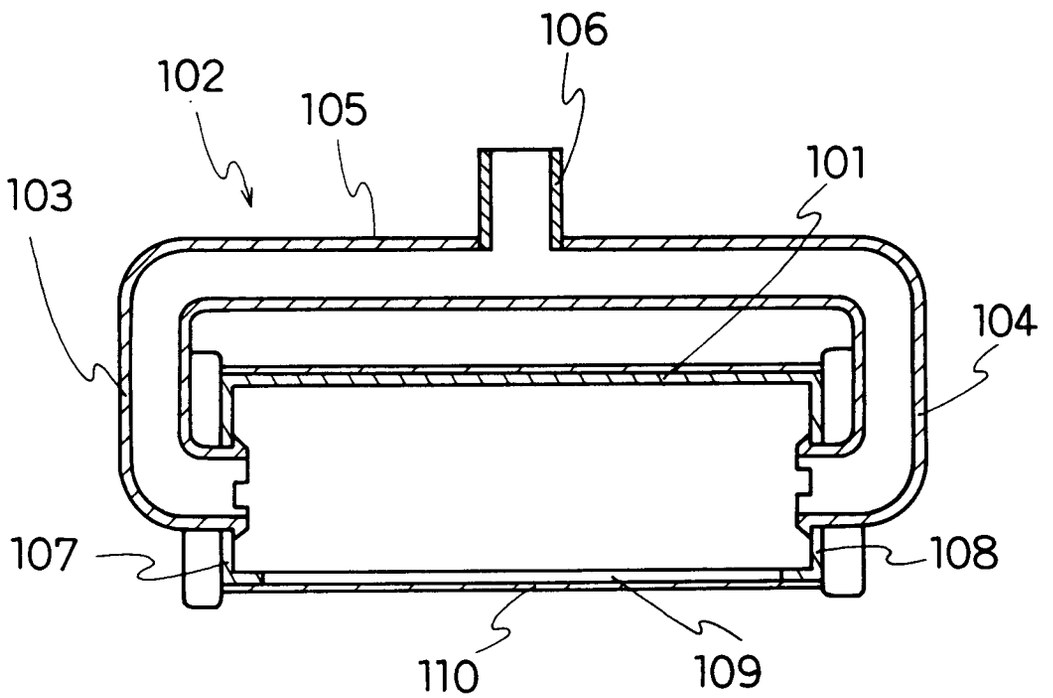

FIG. 13

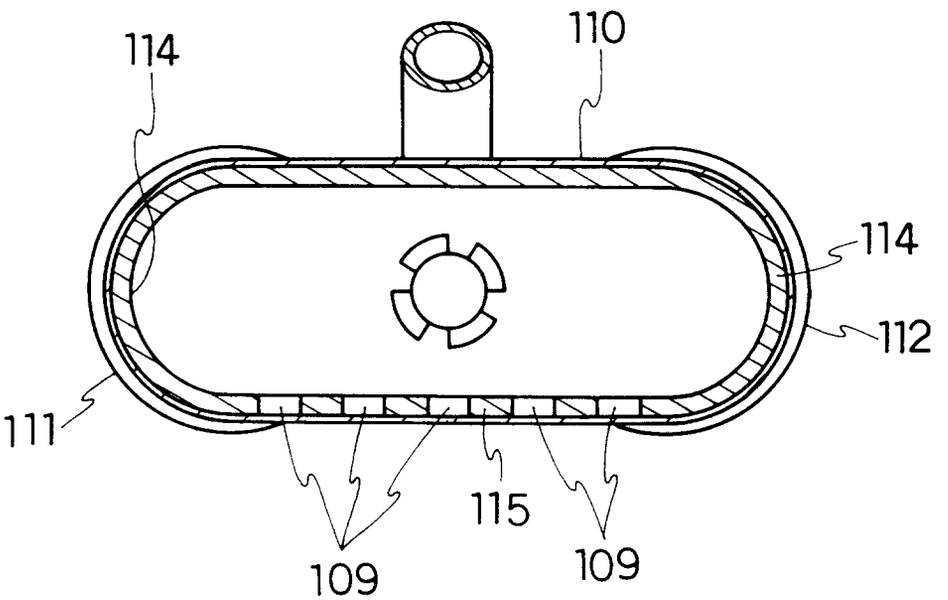

FIG. 14

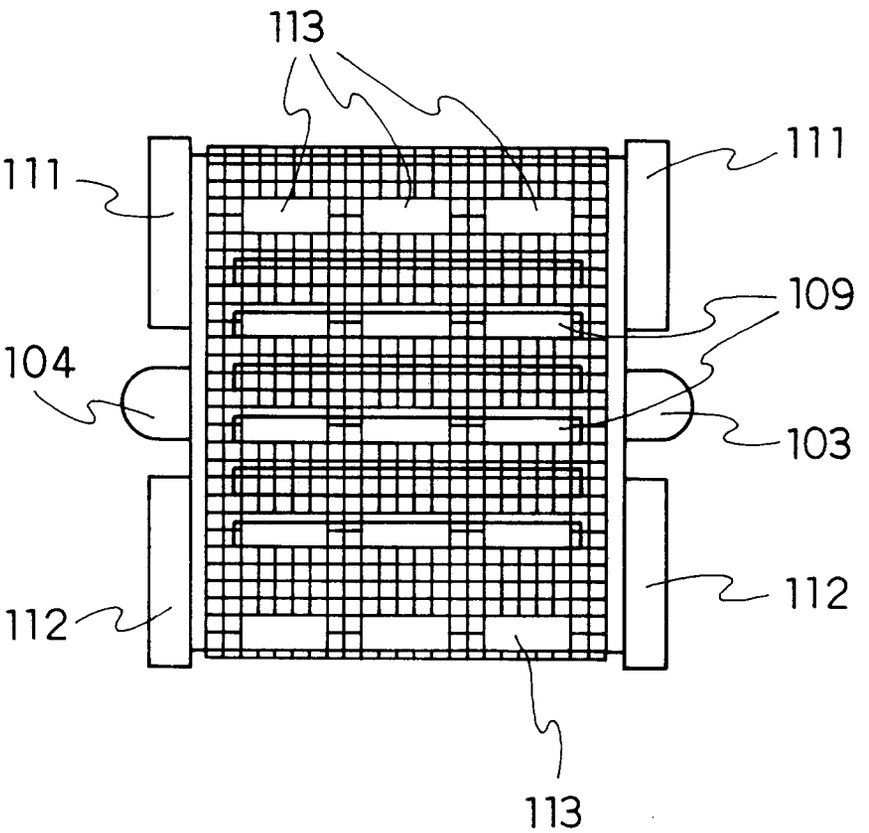

FIG. 15

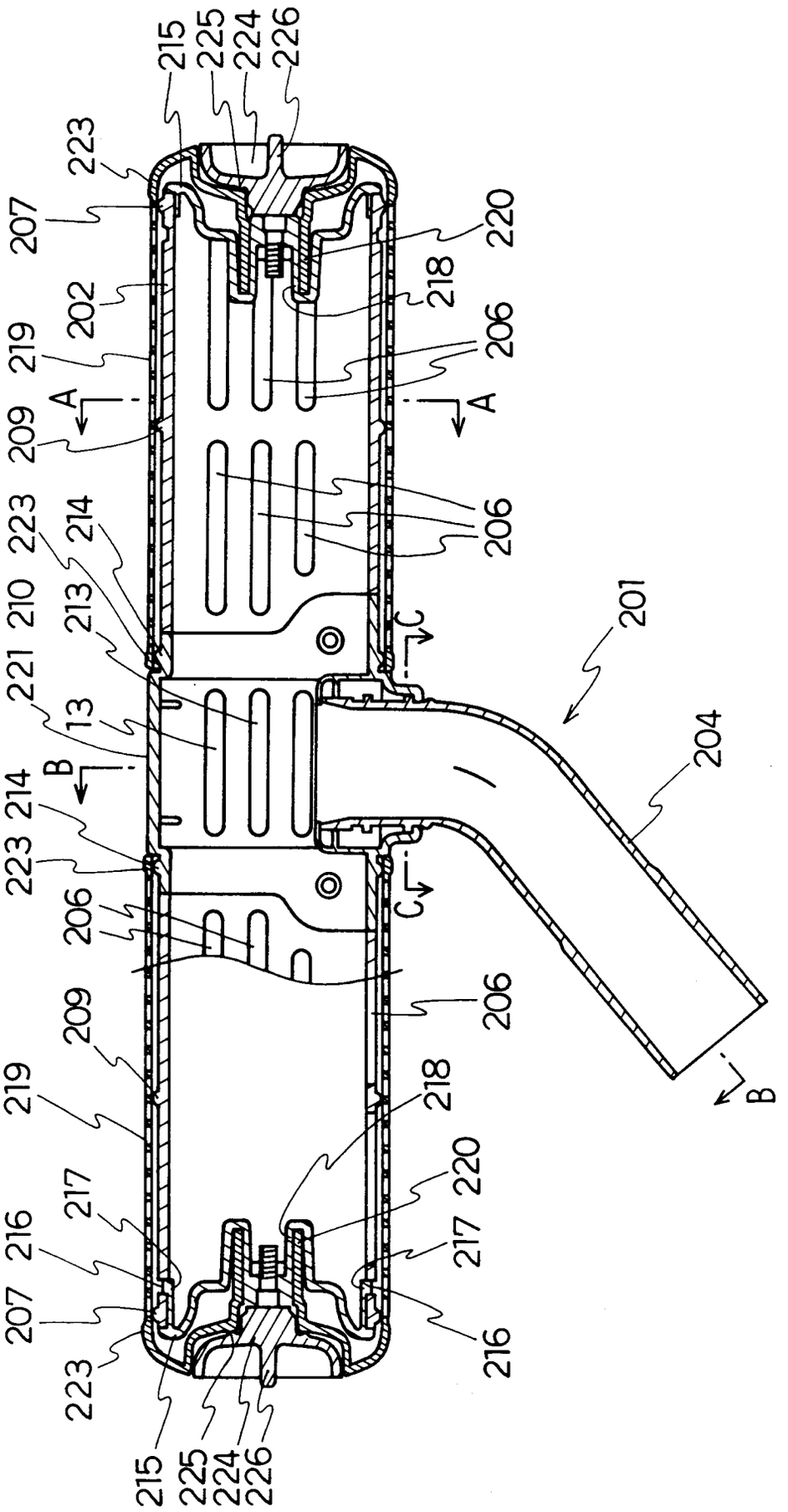
215
225
224
226
223
207
220
218
202
206
219
209
A
A
214
213
210
221
13
B
B
C
C
201
204
216
217

FIG. 16

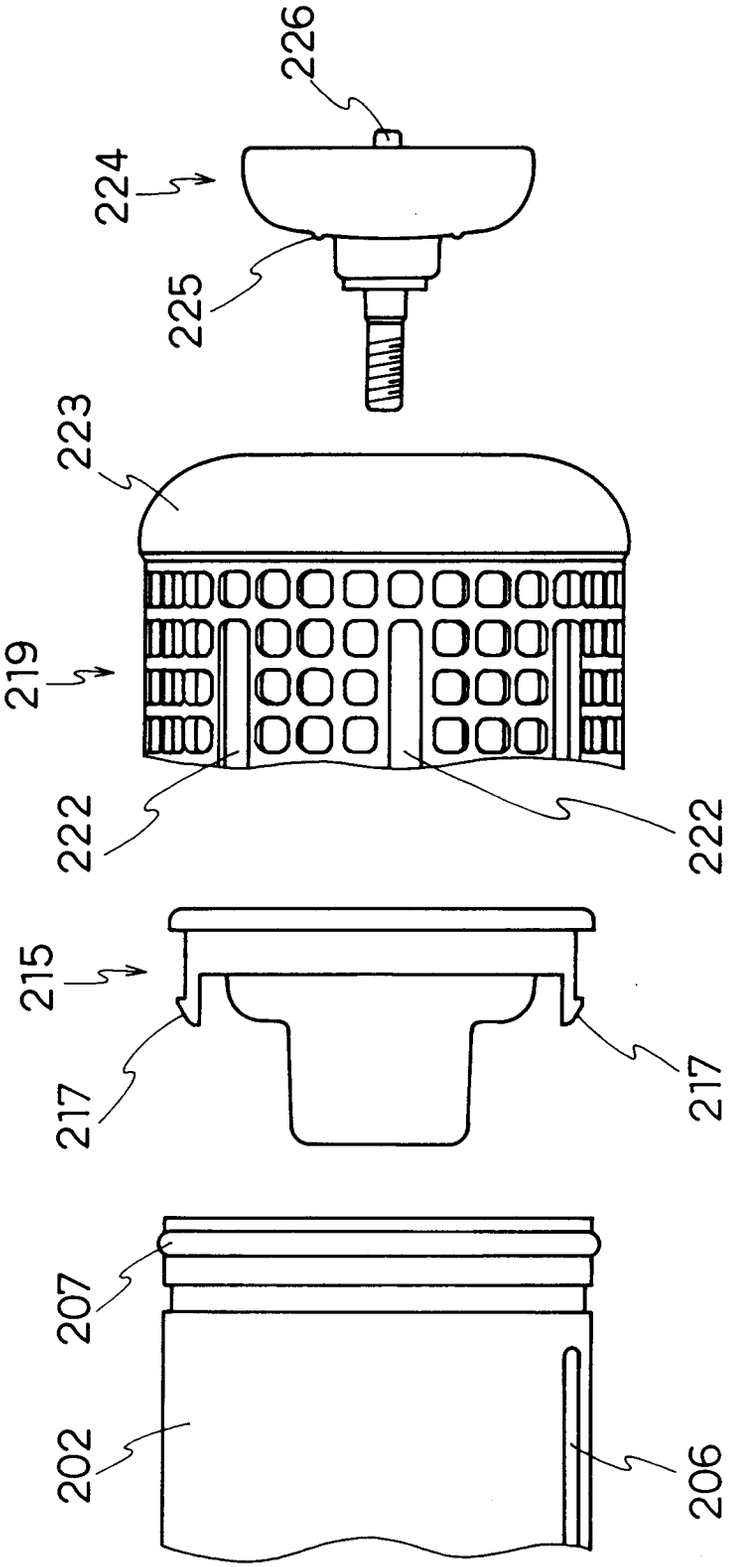

FIG. 17

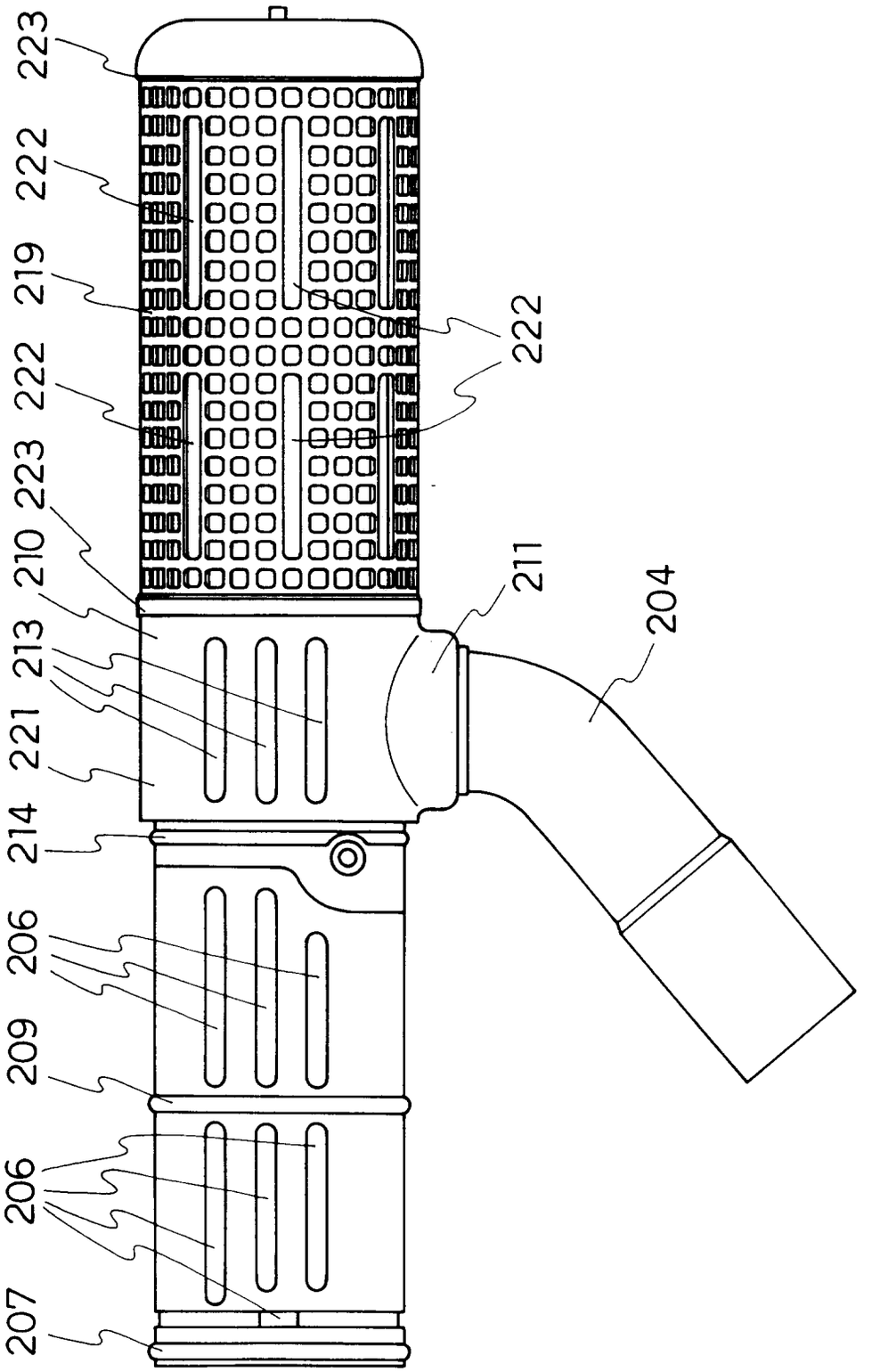
223
222
219
222
222
223
210
213
221
214
206
209
206
207
222
211
204

FIG. 18

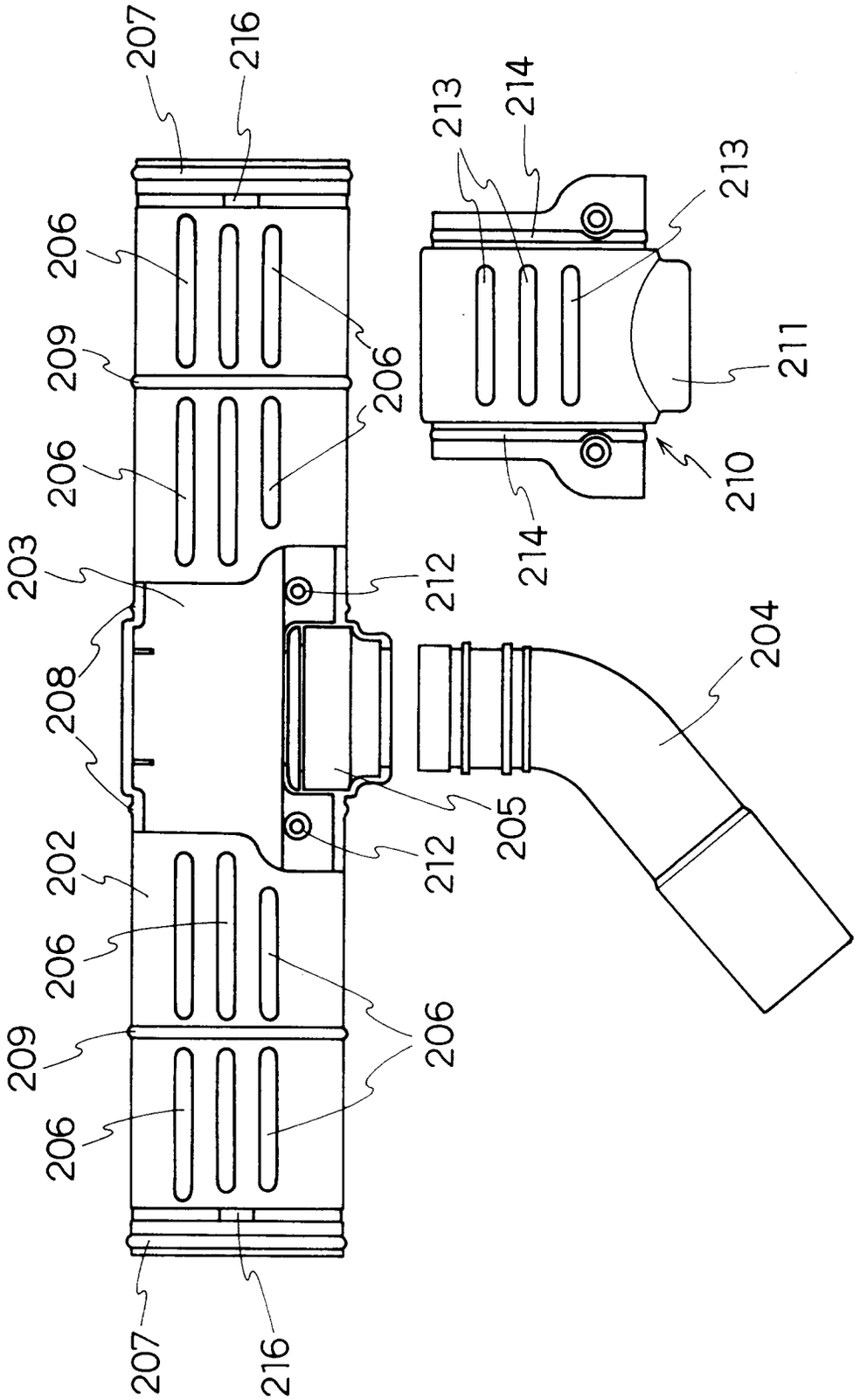
207
216
213
214
213
206
209
206
211
206
206
210
214
203
212
204
208
205
202
212
206
209
206
206
207
216

FIG. 19

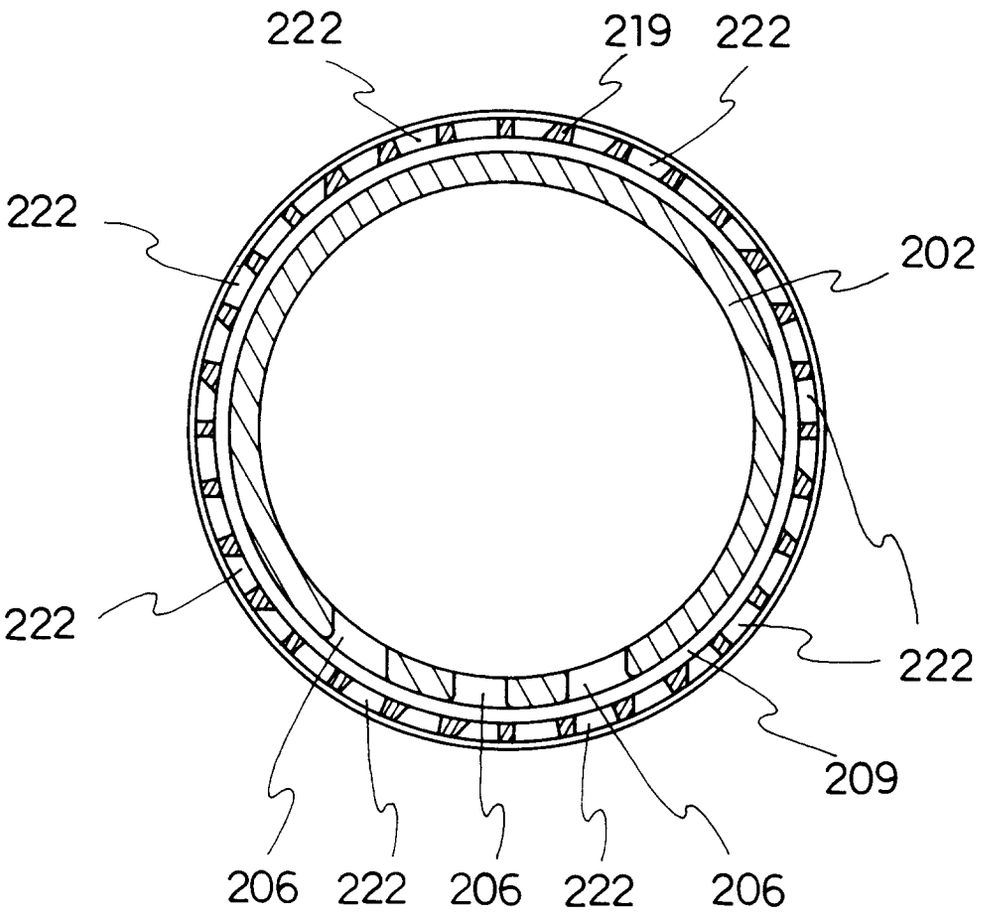

FIG. 20

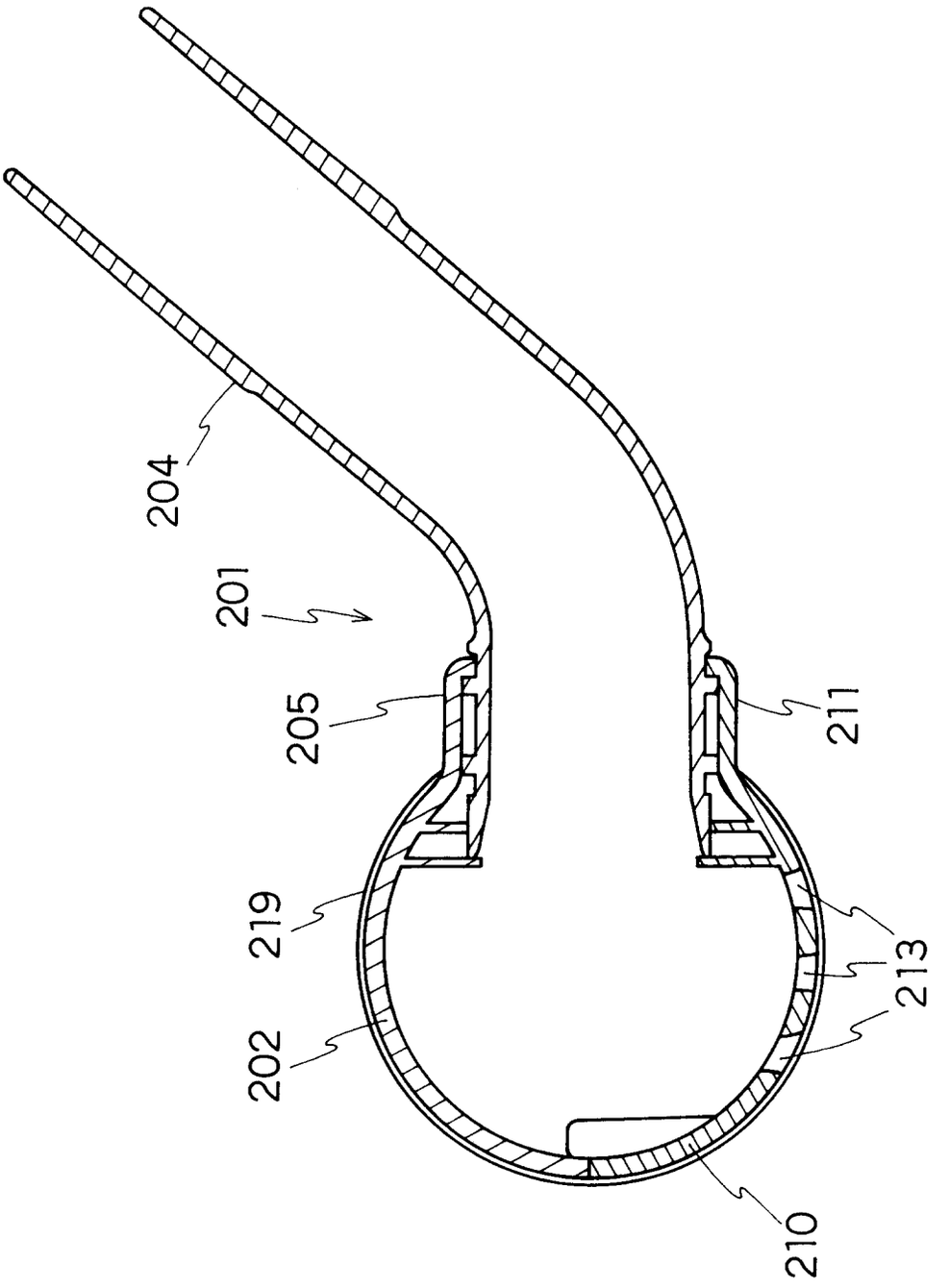

FIG. 21

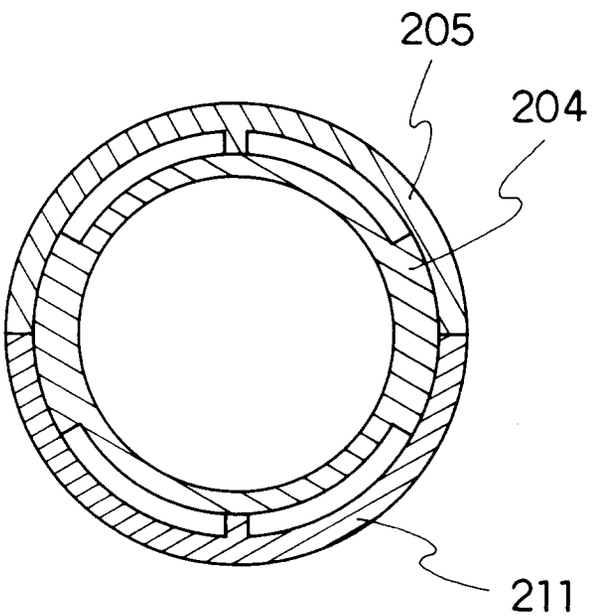

FIG.22

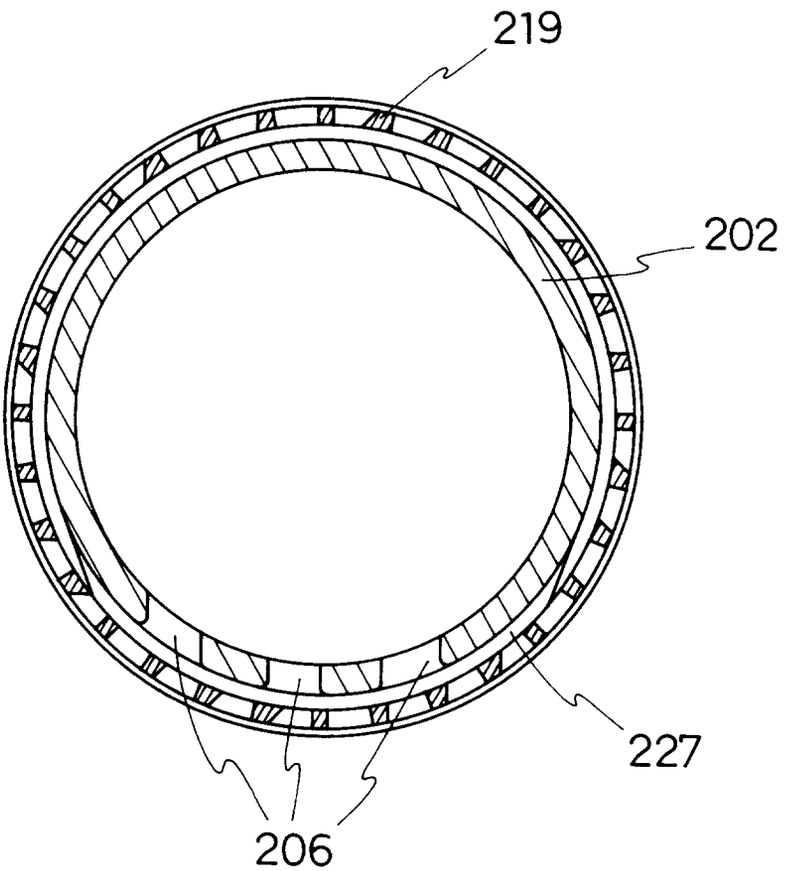

FIG. 23

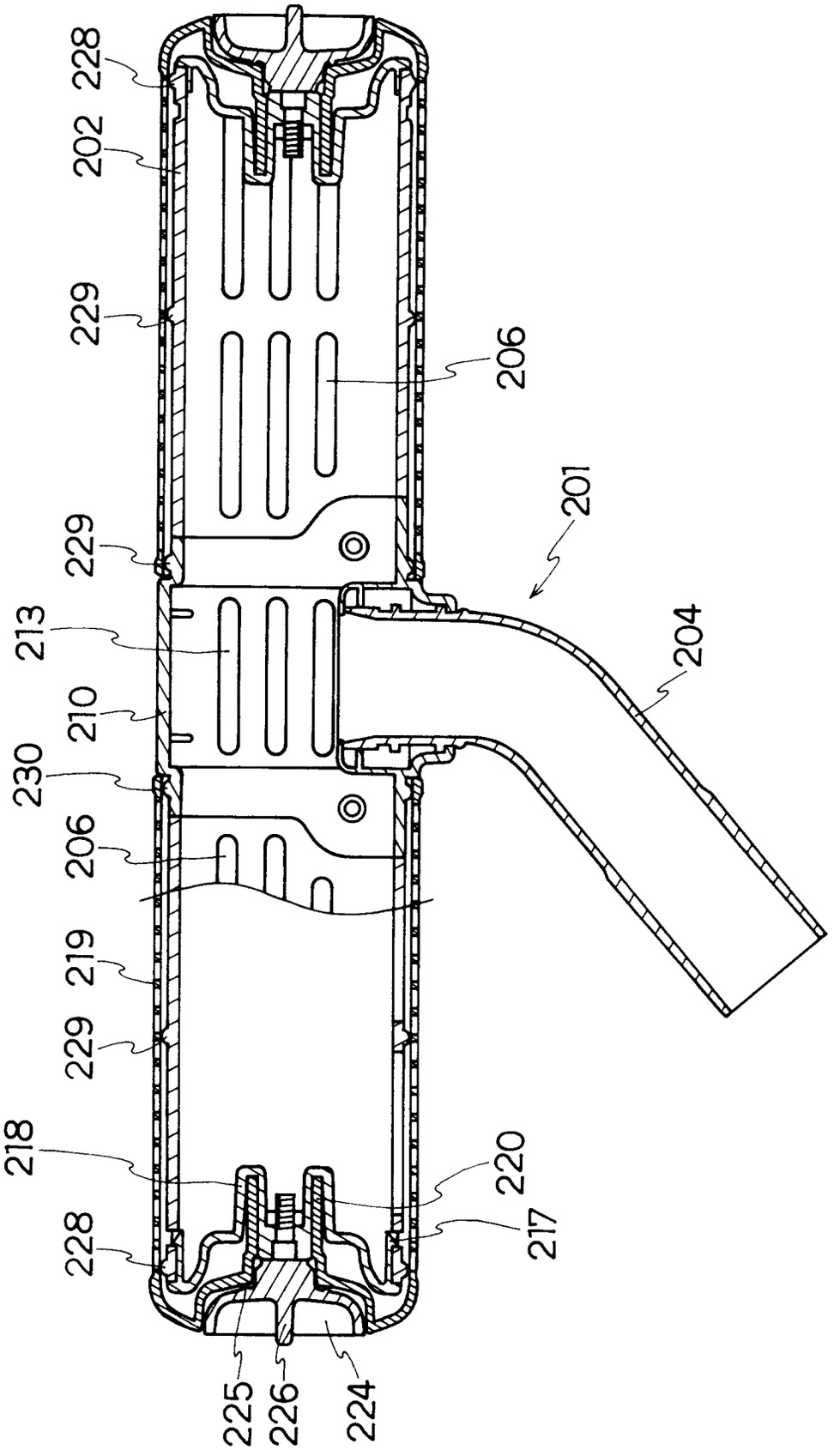
228
202
229
206
201
229
213
204
210
230
206
219
229
218
220
228
217
225
226
224

FIG. 24

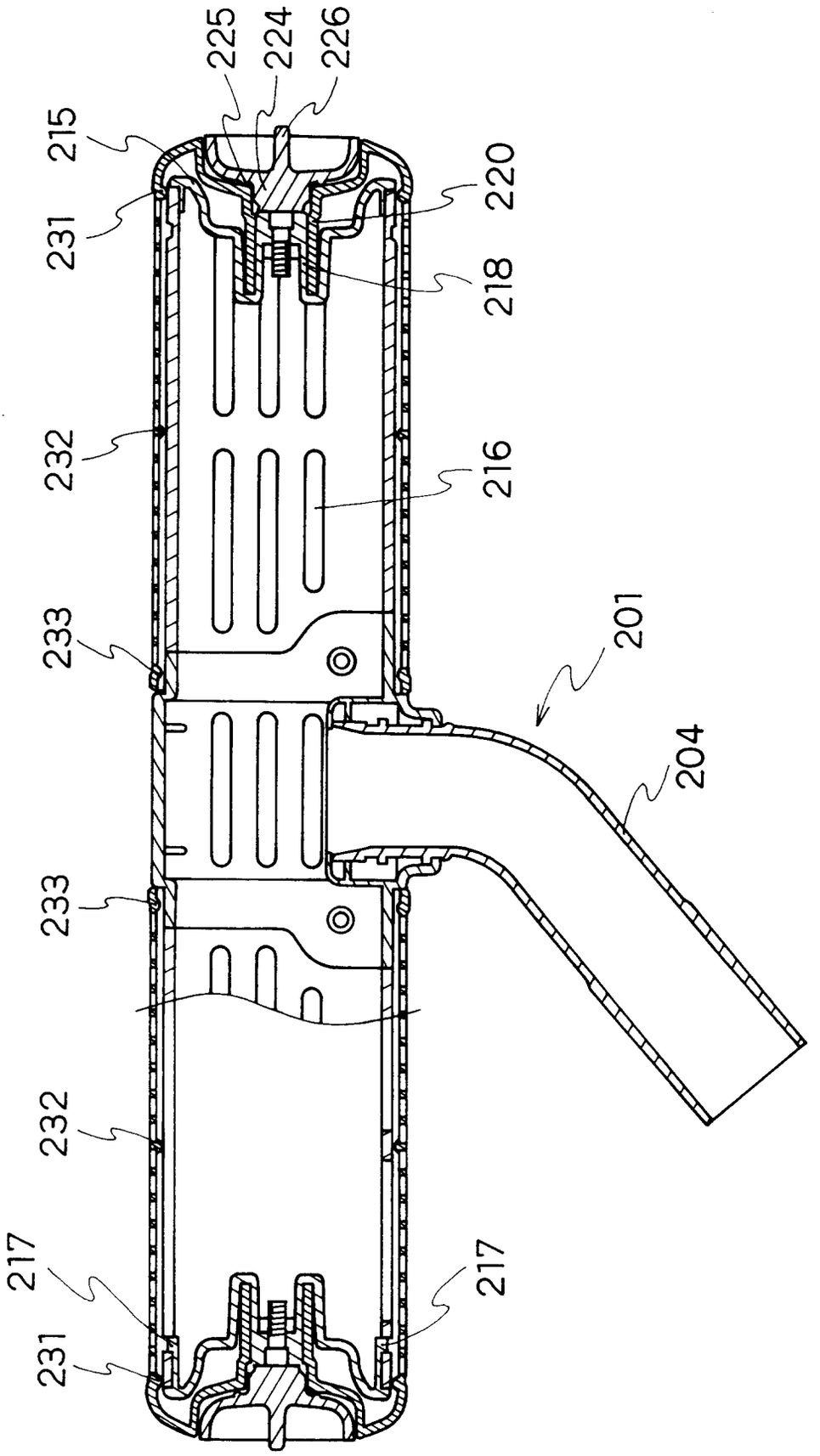
225
224
226
215
231
220
218
232
216
233
201
204
233
232
217
231
217

FIG. 25

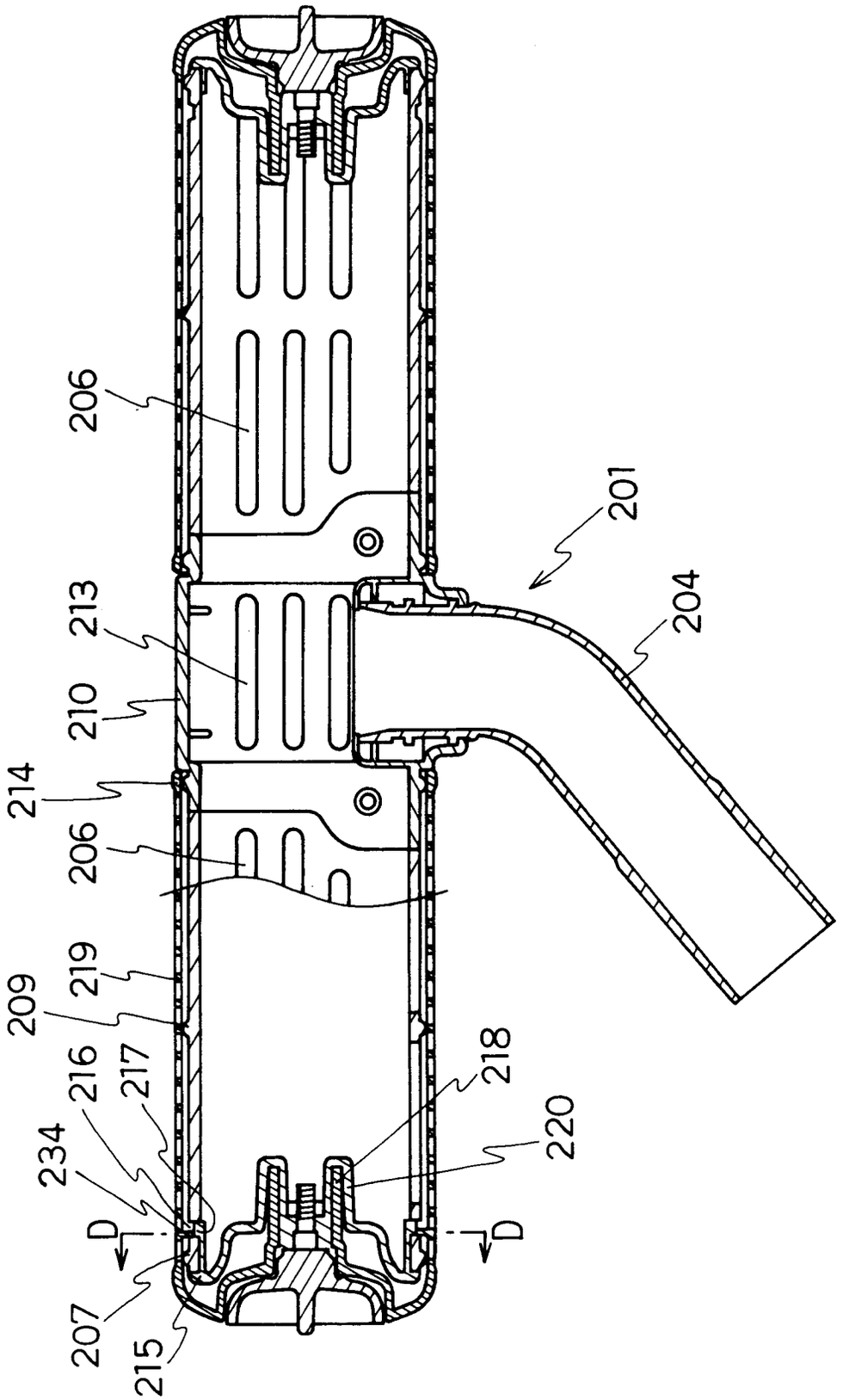
206
201
213
204
210
214
206
209
219
216
217
218
234
220
D
D
207
215

FIG. 26

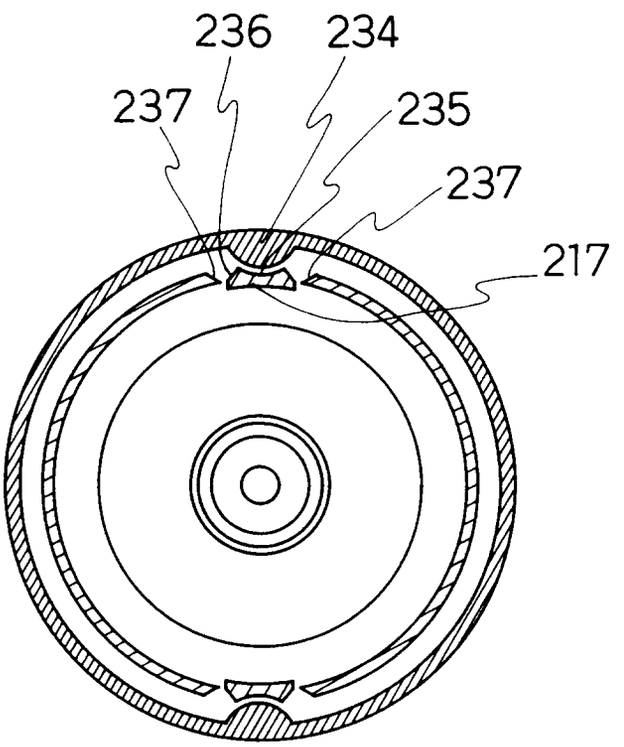

FIG. 27

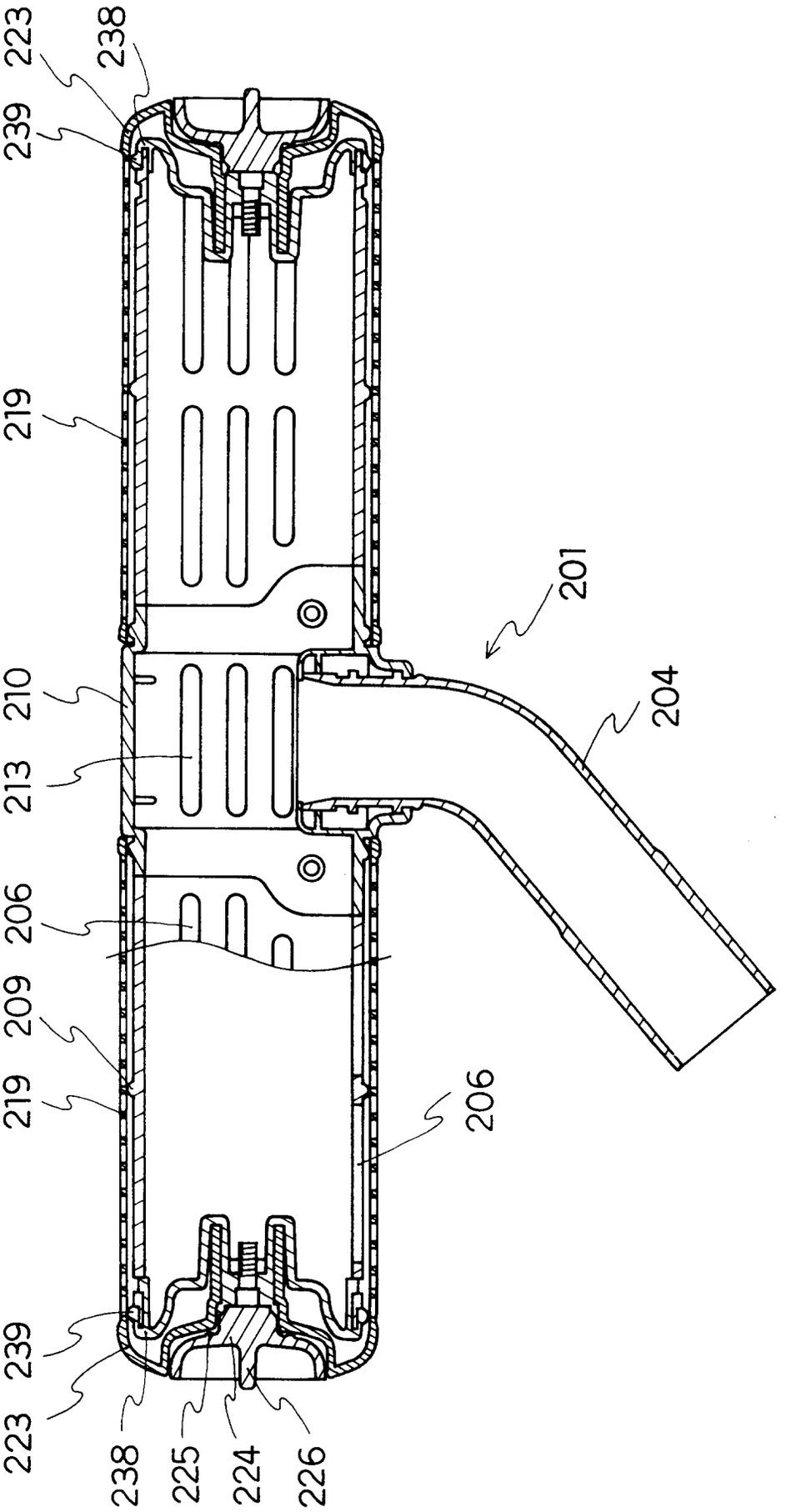
223
238
239
219
201
210
204
213
206
209
219
206
239
223
238
225
224
226

FIG. 28

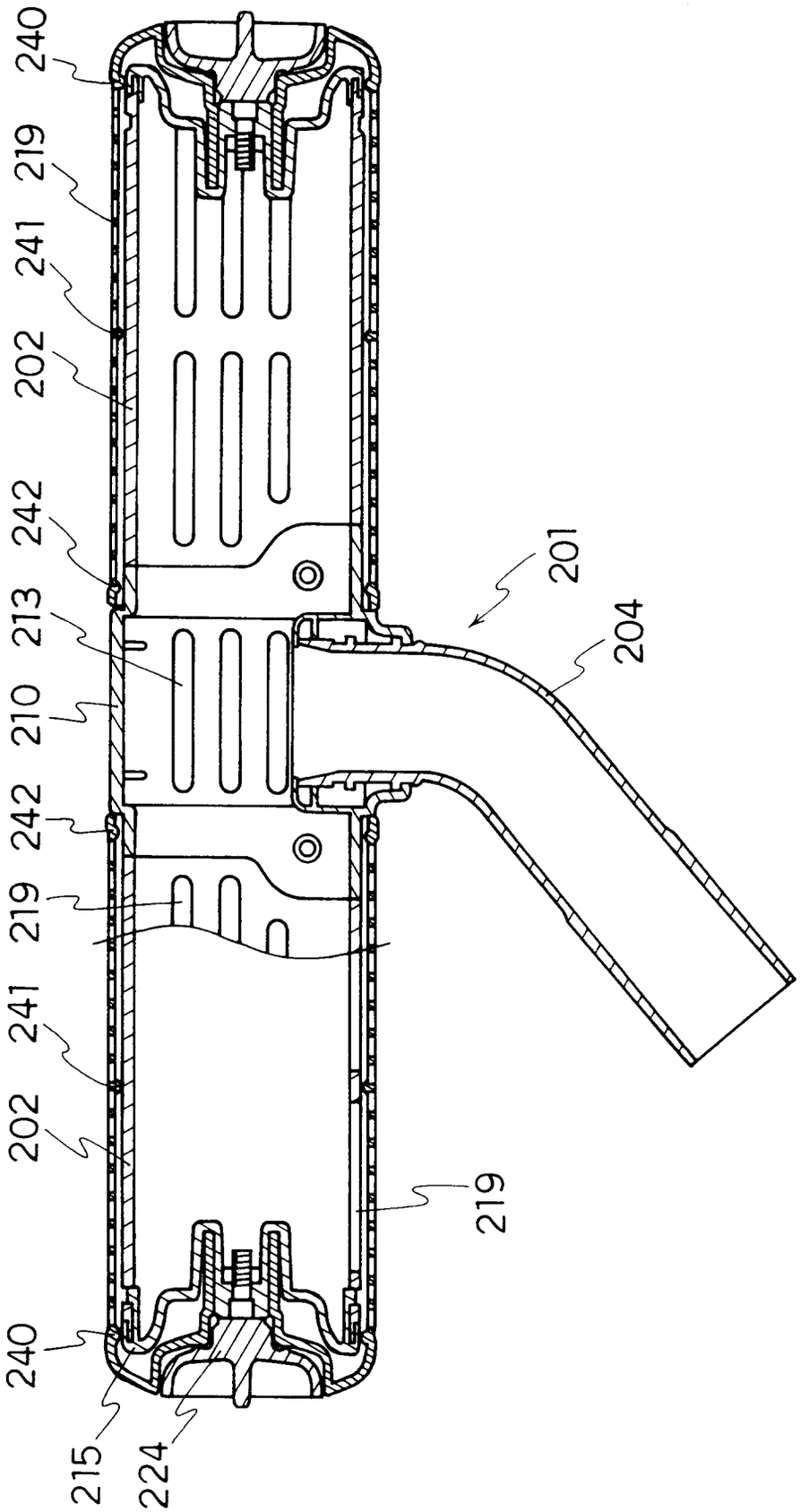
240
219
241
202
242
213
210
242
219
241
202
240
215
224
201
204
219

FIG. 29

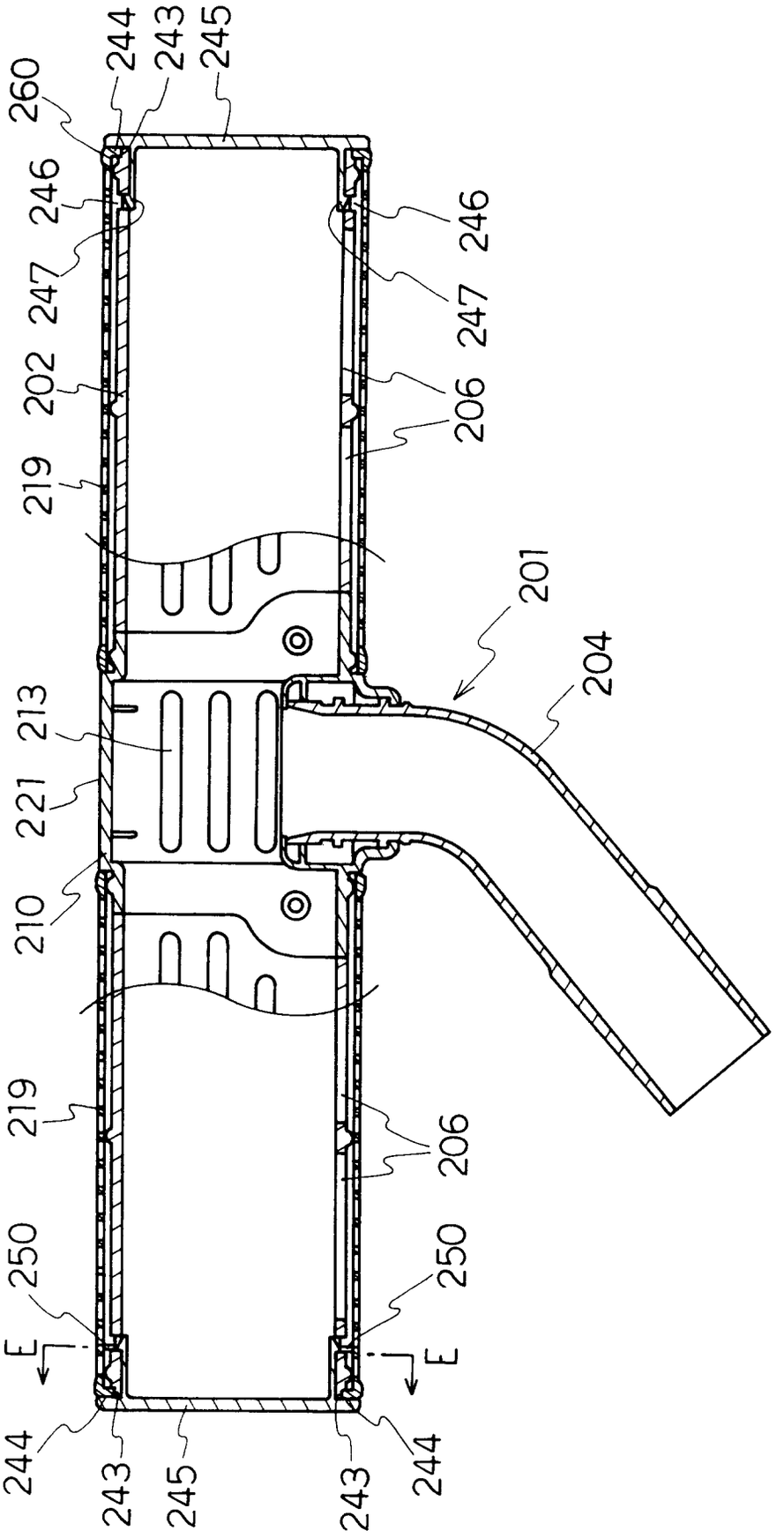

FIG. 30

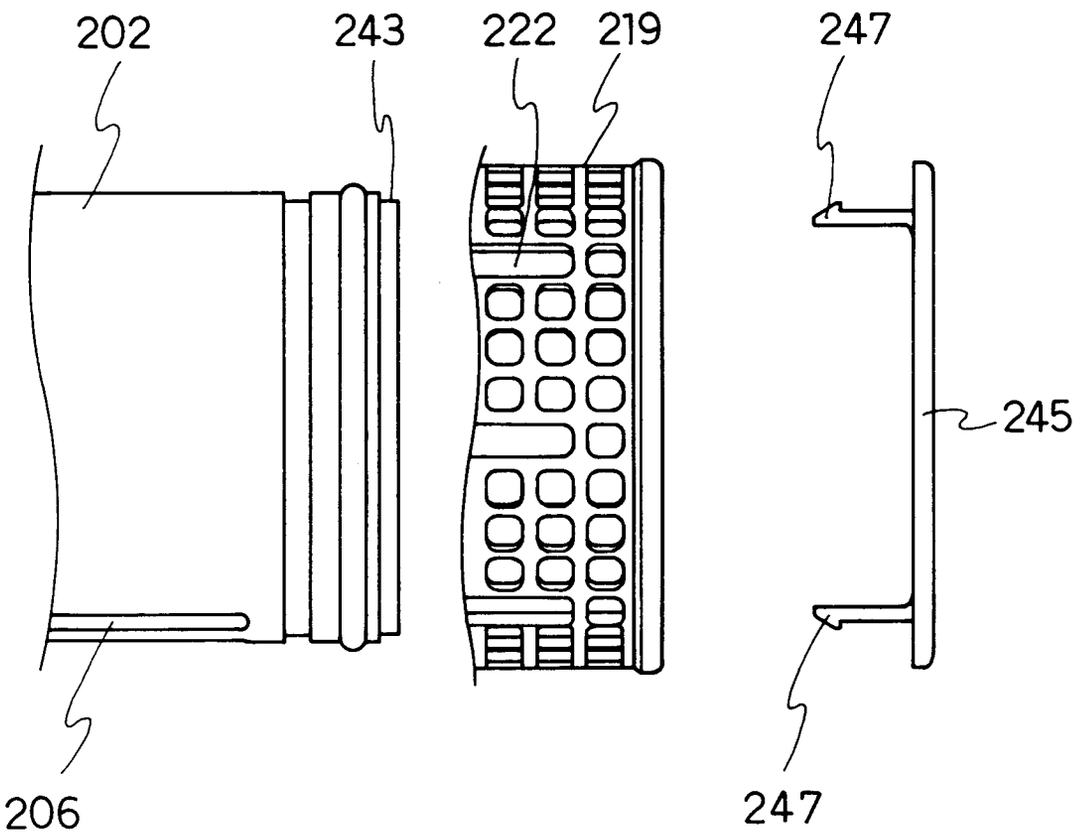

FIG. 31

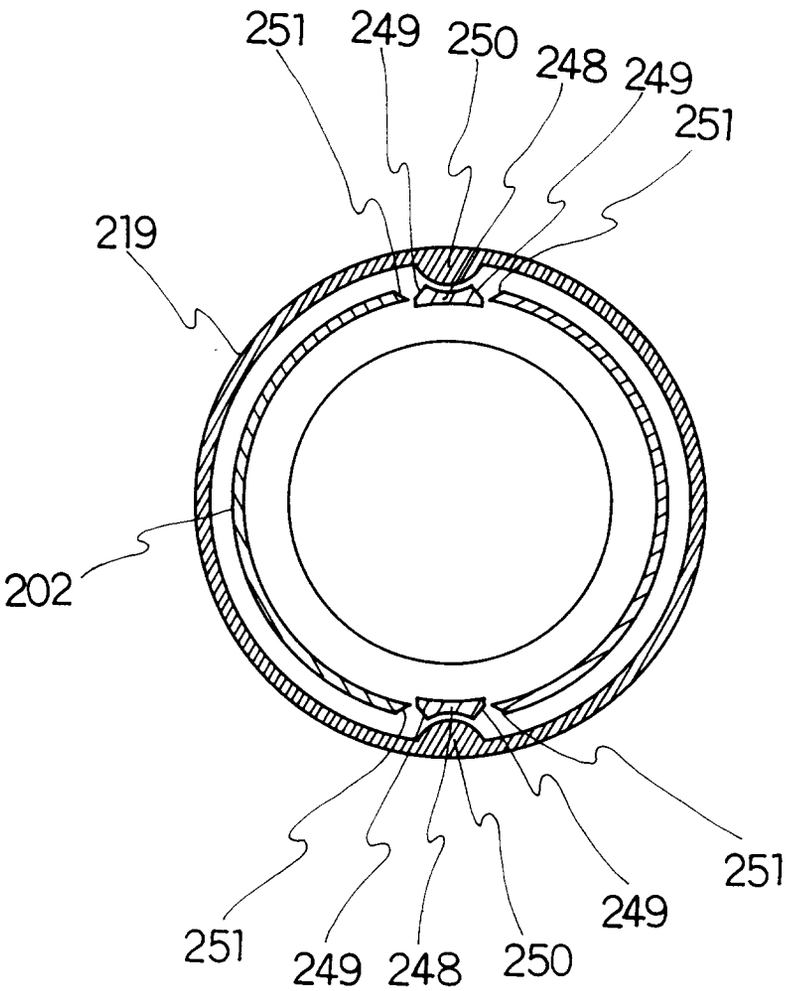

FIG. 32

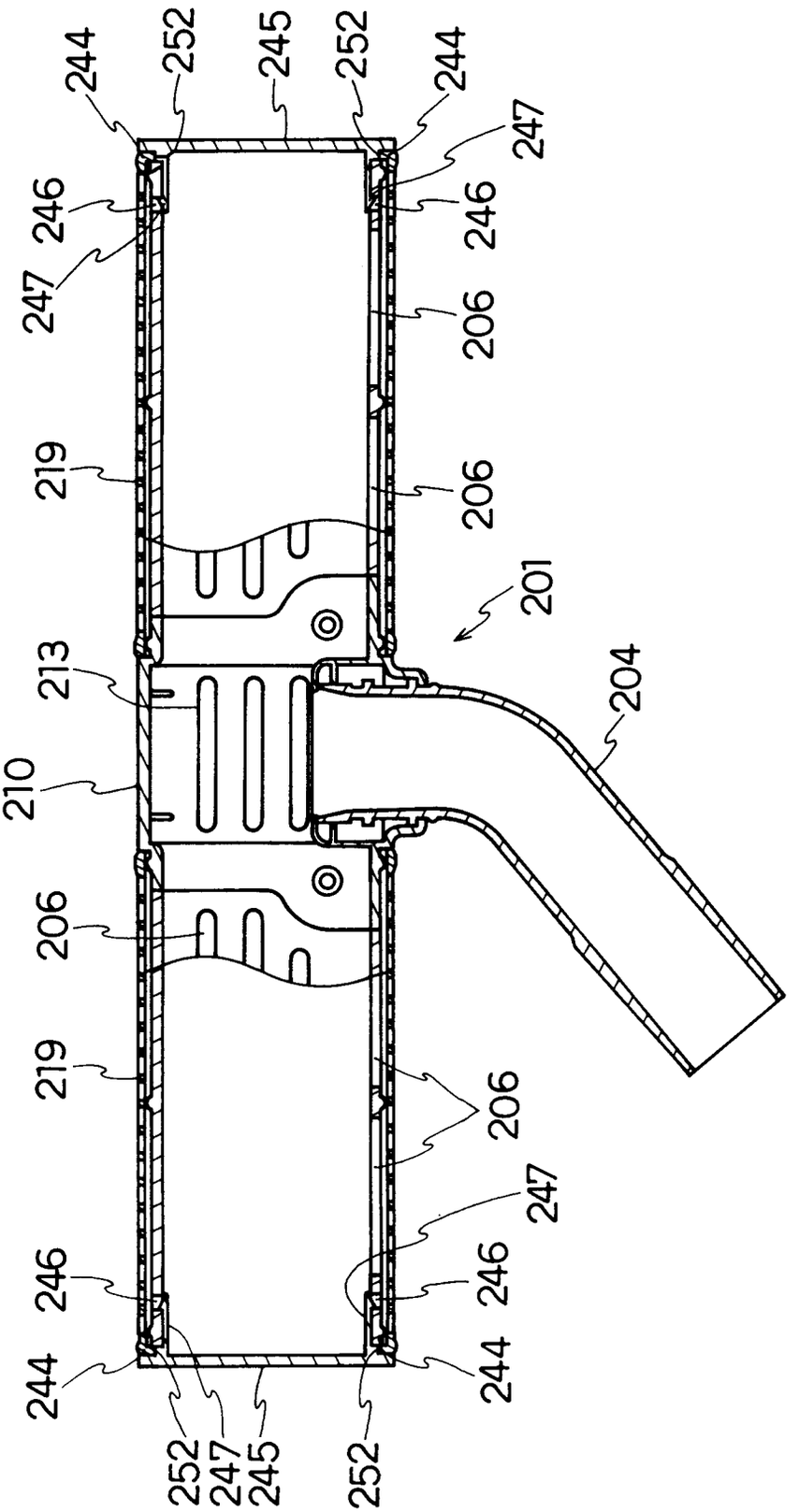
244
252
245
252
244
247
246
246
247
206
219
206
201
213
204
210
206
219
206
247
246
246
244
244
252
247
245
252

FIG. 33

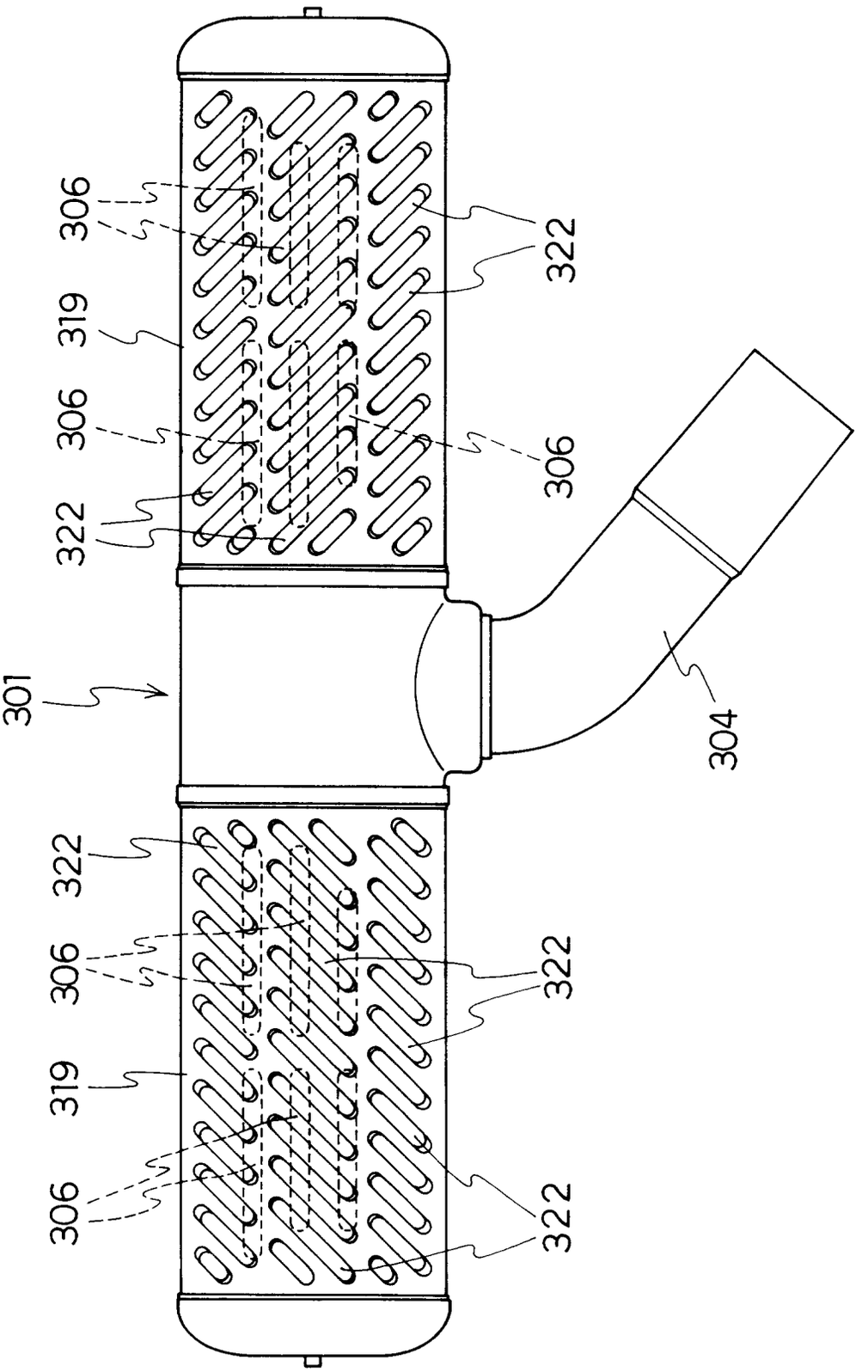

FIG. 34

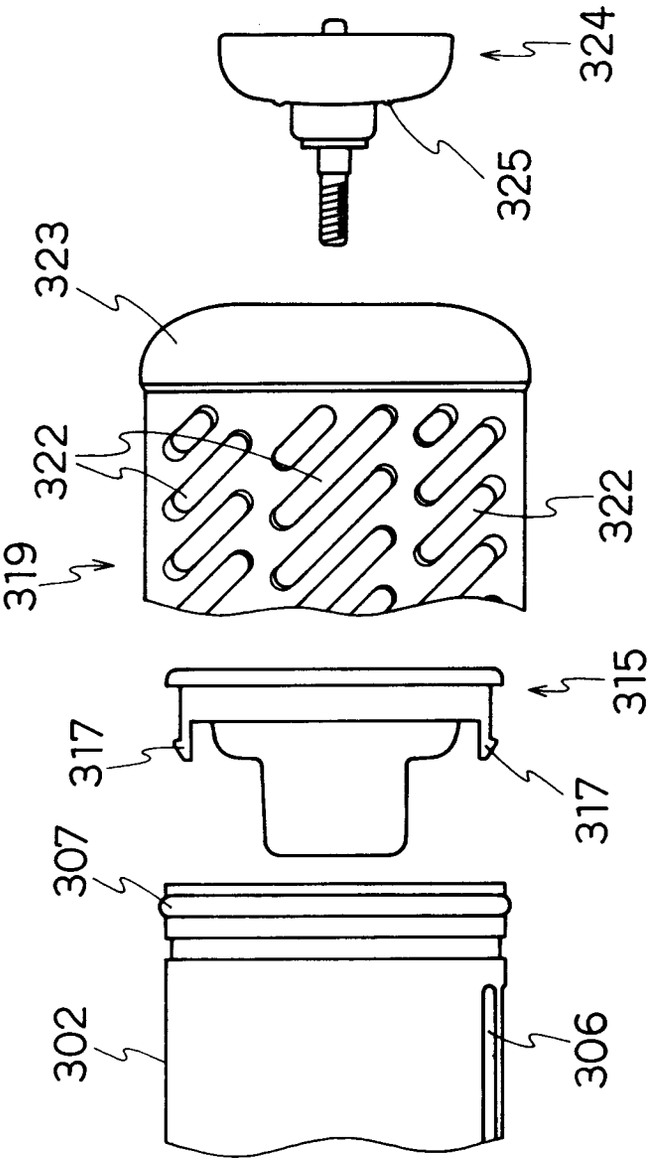

FIG. 35