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(54) **METHOD AND APPARATUS OF PARTICLE TRANSFER IN MULTI-STAGE PARTICLE SEPARATORS**

VERFAHREN UND VORRICHTUNG ZUM ÜBERTRAGEN VON PARTIKELN IN MEHRSTUFIGEN ABSCHEIDERN

PROCEDE ET APPAREIL DE TRANSFERT DE PARTICULES UTILISES DANS DES SEPARATEURS DE PARTICULES A PLUSIEURS ETAGES

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- **PATENT ABSTRACTS OF JAPAN vol. 1997, no. 04, 30 April 1997 (1997-04-30) & JP 08 322768 A (SHARP CORP), 10 December 1996 (1996-12-10)**

EP 1 274 337 B1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates generally to the transfer and removal of particles separated in multi-stage separators such as may be used by vacuum cleaners. In one particular application, the invention relates to the multi-stage separation having upstream and downstream separation stages wherein the position at which the separated particles exit from the downstream separation stage is positioned above the position at which the separated particles exit the upstream separation stage.

BACKGROUND OF THE INVENTION

[0002] The use of multiple cyclones connected in parallel or series has long been known to be advantageous in the separation of particulate matter from a fluid stream. Typically, a relatively high speed fluid stream is introduced tangentially to a generally cylindrical or frusto-conical first stage cyclone separator, wherein the dirty air stream is accelerated around the inner periphery of the first stage cyclone separator. Fluid exiting the first stage cyclone separator is fed to the inlet of a second stage cyclone separator wherein the described separation process is repeated. Typically, successive separators are configured to remove ever-smaller particles from the fluid stream, until a desired cleaning efficiency is achieved. Particulate matter disentrained from the fluid flow is typically collected at the bottom of each stage.

[0003] The advantages of multi-stage cyclonic separation are disclosed in U.S. Patent No. 3,425,192 to Davis. As shown in Figure 1, multi-stage separator 10 essentially comprises a large, lower first stage cyclone separator 12 connected in series with a plurality of smaller, parallel second stage cyclone separators 14 disposed over cyclone separator 12. A motor (not shown) draws air through a cleaning head and into a dirty air inlet 16 of the first stage cyclone separator 12. From first stage cyclone separator 12, the air flows into second stage cyclone separators 14 and, from there, continues on through the vacuum motor to a clean air exhaust port (not shown). Particles separated from the fluid flow are deposited by first stage cyclone separator 12 into a primary collector 20, while particles separated from the fluid flow by second stage cyclone separators 14 are deposited into a secondary collector 22, vertically disposed over primary collector 20. When primary and/or secondary collectors 20 and 22 become laden with deposited particles, and must therefore be emptied; two distinct emptying steps are required to clear the collectors of their contents.

[0004] In accordance with the present invention, there is provided a vacuum cleaner comprising:

(a) a cleaner head having a dirty air inlet; and,

(b) a filtration member in fluid flow communication with the dirty air inlet and with a source of suction, the filtration member comprising a cyclonic cleaning unit comprising a first cyclonic stage having at least one upstream cyclone which has an associated upstream particle collector and a second cyclonic cleaning stage comprising a plurality of downstream cyclones which have an associated downstream particle collector, the particle collectors are configured such that the downstream particle collector is emptied when the upstream particle collector is emptied.

[0005] In one embodiment, the vacuum cleaner further comprises a main casing and a filtration casing, the filtration casing housing at least the upstream cyclone, the upstream particle collector and the downstream particle collector, and wherein the filtration casing is removably mounted to the main casing.

[0006] The downstream particle collector may comprise a chamber having an open top and an open bottom and a movable bottom panel may be provided adjacent the bottom of the chamber.

[0007] In another arrangement the downstream particle collector may comprise a collector housing including a collector wall and a removable bottom panel and the bottom panel may be movably mounted with respect to the collector wall for emptying the downstream particle collector.

[0008] The second cyclonic cleaning stage may comprise a plurality of cyclones in parallel. The first cyclonic cleaning stage may comprise a single cyclone.

[0009] In one arrangement, the upstream particle collector has a bottom, the downstream particle collector has a bottom and the bottom of the first and second particle collectors lie in a common plane.

[0010] The second cyclonic cleaning stage may be positioned above the first cyclonic cleaning stage.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] For a better understanding of the present invention, and to show more clearly how it may be carried into effect, reference will now be made by way of example to the accompanying drawings.

[0012] The drawings show a preferred embodiment of the present invention, in which:

Figure 1 is a vertical cross section through a multi-stage cyclonic separator according to the prior art;
Figure 2 is a perspective view of a multi-stage separator according to the present invention;
Figure 3a is an exploded perspective view of the multi-stage separator of Figure 2;
Figure 3b is an exploded perspective view of an alternate embodiment of the multi-stage separator of Figure 2;
Figure 4 is a perspective view of the multi-stage

separator of Figure 2, with the second stage collector shown in a partially open position;

Figure 5 is a perspective view of a household vacuum cleaner according to the present invention;

Figure 6 is a perspective view of an alternate embodiment of a multi-stage separator having a particle transfer member according to the present invention;

Figure 7 is a perspective view of a further alternate embodiment of a multi-stage separator having a particle transfer member according to the present invention;

Figure 8 is a perspective view of a further alternate embodiment of a household vacuum cleaner having a particle transfer member according to the present invention;

Figure 9 is a perspective view of a further alternate embodiment of the second stage particle collector according to the present invention; and,

Figure 10 is an enlarged side view of the second stage particle collector of Figure 9.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0013] The present invention relates to multi-stage particle separation systems wherein the particles separated in a second (or downstream) separation stage are transported to a position wherein they may be removed from the multi-stage particle separation systems together with the particles separated in a first (or upstream) separation stage. The improvements may be used in any multi-stage separation system wherein material separated by a second stage separation process is to be stored in a storage container which is to be periodically emptied. The downstream separation stage may use any separation technique, eg a cyclone separator, a Prandtl layer turbine, an electrostatic precipitator or the like, which produces separated particles that must be handled in such a way that they will not be re-entrained in fluid flowing through the downstream separation stage (eg, stored in a reusable container). Preferably, the downstream and the upstream separation stages use such separation techniques.

[0014] The preferred embodiment of the present invention is described in its use with a vacuum cleaner and in particular an upright vacuum cleaner. It will be appreciated that the improvements in multi-stage separation described herein may be used with canister vacuum cleaners, back pack vacuum cleaners, central vacuum cleaner systems as well as single and multi-stage separators of any sort, including industrial dust or particle collection systems wherein particles are to be removed from a fluid (i.e. a liquid and/or a gas).

[0015] An improved multi-stage separator according to the present invention is shown generally in the Figures at 30. Referring to Figure 2, separator 30 comprises a first stage cyclone 32 and a plurality of second stage cyclones 34. First stage cyclone 32 has a first stage collector 36 and second stage cyclones 34 have a second stage collector 38. First stage cyclone 32 and second stage cyclones 34 are housed within a housing 40 having a top 41, a lower portion comprising container 66 and an upper portion comprising second stage assembly 51. As shown in Figure 2, top 41 comprises a mesh screen that is positioned upstream of a motor driven fan. However, it will be appreciated that second stage assembly 51 may be open or it may be closed if it is provided with a fluid outlet. First stage cyclone 32 has an fluid inlet 42, fed by a fluid feed conduit 45, and a fluid outlet 46. Fluid outlet 46 feeds a transfer conduit 44 which is in fluid communication with a plurality of second stage cyclones 34 via a plurality of inlets 47. Second stage cyclones 34 each have a fluid outlet 49 positioned beneath mesh screen 41.

[0016] As shown in Figure 2, transfer conduit 44 extends above mesh screen 41 to engage a support member (not shown) to fix second stage cyclones 34 in position. The interior of conduit 44 is sealed to cause the air to enter second stage cyclones 43. Alternately, transfer conduit 44 may terminate at inlets 47 and alternate support means may be provided to position second stage cyclones 34 -in second stage assembly 51 (eg. by means of support members attached to the inner wall of second stage assembly 51).

[0017] While the first and second stages are connected in series, it will be appreciated that the improvements disclosed herein may be used in a system wherein the first and second stages are connected in parallel. It will also be appreciated that additional separation stages may be positioned upstream, downstream or both upstream and downstream from the first and second separation stages. It will further be appreciated that first stage cyclone 32 may comprise a plurality of cyclones and/or that the second stage may comprise only one second stage cyclone 34 (see for example Figure 7). The fluid may be propelled through separator 30 by any means known in the art. For example, a pump may be positioned upstream of separator 30 or, in the case of a vacuum cleaner, a source of suction (eg. a motor driven fan) may be positioned downstream from separator 30.

[0018] Beneath second stage cyclones 34 is a particle transfer member 48 which slopes downwardly to second stage collector 38. Second stage collector 38 has side walls 50 and a bottom 52. Referring to Figure 3a, bottom 52 is separable from side walls 50.

[0019] In the embodiment wherein separator 30 is used in a vacuum cleaner (see, for example, Figure 5), a motor-driven fan draws particle-laden fluid via a feed conduit into first stage inlet 42 via fluid feed conduit 45. The fluid flows cyclonically within a first stage cyclone 32 depositing particles in first stage collector 36 (which may be the bottom surface of container 66). The fluid exits first stage cyclone 32 via outlet 46 and is delivered by conduit 44 to the inlets 47 of second stage cyclones 34. Cyclonic flow in second stage cyclones 34 further

separates particles from the fluid flow, which particles fall on to particle transfer member 48 for transfer to second stage collector 38. The fluid flow then exits second stage cyclones 34 via outlets 49, and is expelled from separator 30. The separated particles travel under the influence of gravity along particle transfer member 48 to second stage collector 38.

[0020] Preferably, as shown in Figure 2, transfer member 48 comprises a helical ramp which slopes downwardly, around centre conduit 44, to second stage collector 38. Transfer member 48 is preferably angled sufficiently to cause the particles to slide easily down transfer member 48 to second stage collector 38 under the influence of gravity without substantially collecting on the surface of transfer member 48. Preferably, the motor-driven fan is mounted as part of the casing in which separator 30 is mounted. Accordingly, vibration from the operation of the motor-driven fan may assist the particles to travel along particle transfer member 48 under the influence of gravity (in which case particle transfer member may be at a lesser incline).

[0021] Deposited particles accumulate in second stage collector 38 and, eventually, second stage collector 38 must be emptied. In accordance with one aspect of the instant invention, second stage collector is configured so that it is emptied when first stage collector 36 is emptied. For example, as shown in Figures 3a, 4, 9 and 10 second stage collector may be constructed so that the contents of second stage collector 38 are emptied into first stage collector when container 66 is removed from second stage assembly 51. Alternately, as shown in Figures 3b, 6 and 7, second stage collector 38 is constructed so that it is emptied when first stage collector 36 is emptied (eg. by inverting container 66). Container 66 may completely contain first stage cyclone 32, or may comprise only a portion thereof. It will be understood that container 66 need only comprise first stage collector 36 and such additional portion as necessary to permit collectors 36 and 38 to be emptied and removed as described herein.

[0022] As illustrated in Figure 3a, second stage collector 38 is separable into two components, namely side walls 50 and bottom 52. Bottom 52 is affixed to the interior of container 66 while side walls 50 are affixed to second stage assembly 51, such as to first stage outlet 46 or the lower surface of particle transfer member 48. Referring to Figure 4, to empty the contents of second stage collector 38 into first stage collector 36, container 66 is rotated in the direction of arrow A so that bottom 52 moves relative to side walls 50 thereby causing the contents of second stage collector 38 to fall into first stage collector 36 which acts as a particle receiving chamber. Container 66 may then emptied by inverting container 66 over a garbage container. Thus, only a single emptying step is required to empty separator 30.

[0023] Referring again to Figure 4, side wall 50 preferably has a lower edge 54 which moves over the surface of bottom 52, as bottom 52 moves away from side walls 50, to sweep the surface of bottom 52 to assist in removing particles therefrom. Bottom 52 may optionally also be canted relative to the horizontal (not shown) to encourage particles thereon to slide off into first stage collector 36 when bottom 52 is moved away from side walls 50.

[0024] In the embodiment of Figures 9 and 10, bottom 52 is hingedly connected to side walls 50 by a hinge 56, rather than completely separable therefrom. A cam 58 positioned on the inner surface of container 66 is moveable (when container 66 is rotated relative to assembly 51) between a closed position in which it is positioned beneath bottom 52 (Figure 9) and an open position in which it has been moved away from bottom 52 (solid lines in Figure 10). When container 66 is rotated in the direction of Arrow B in Figure 10, cam 58 is moved to a position beneath side walls 50 and bottom 52 follows cam 58 into a position beneath side walls 50 (as illustrated in dotted outline in Figure 10), thereby closing second stage collector 38. When cam 58 is moved away from side walls 50, by the rotation of container 66, bottom 52 is permitted to swing freely to its open position due to gravity thereby dumping the contents of second stage collector 38 into first stage collector 36.

[0025] In the embodiment of Figure 3b, second stage collector 38 is affixed to the inner surface of container 66. In this embodiment, when assembly 51 is removed from container 66, second stage collector 38 is positioned inside container 66. Thus when first stage collector 36 is emptied, eg. by inverting container 66, second stage collector 38 is also emptied.

[0026] Referring to Figure 5, upright vacuum cleaner 200 has a cleaner head 202 with rear wheels 204 and front wheels (not shown) for moving cleaner head 202 over a floor, a casing 206 which is pivotally mounted to cleaner head 202 and a handle 208 for moving of vacuum cleaner 200 over the floor. Casing 206 houses separator 30 according to the present invention. Vacuum cleaner 200 may be of any construction provided that container 66 is removable from vacuum cleaner 200 for emptying. Air inlet 42 of separator 30 communicates with a dirty air inlet (not shown) adjacent the floor in the lower surface of cleaner head 202. Container 66 is removable from main casing 206, via a handle 212, for the periodic emptying of the particles therein. It will be understood by one skilled in the art that only the lower portion of first stage cyclone 32 (i.e. the portion with collector 36) may be removable from housing 40 provided that the contents of second stage collector 38 are emptied into first stage collector 36 prior to the removal of first stage collector 36 from vacuum cleaner 200. Accordingly, neither second stage collector 38, second stage cyclones 34 nor the entirety of first stage cyclone 32 need be disposed interior of the portion of container 66 which is removable from housing 40, but rather may be fixedly located in main casing 206 above the portion of container 66 which is removable from housing 40. In this embodiment, first stage collector 36 comprises a chamber

positioned below first stage cyclone 32 and separated therefrom by a plate 68 having a plurality of openings 69 therein.

[0027] In the embodiment of Figure 6, second stage collector 38 comprises a side container 70 having an inlet at an upper portion thereof and a bottom 72 positioned at a location beneath the inlet. As shown in Figure 6, bottom 72 is substantially planar with the bottom of first stage collector 36. Side collector is preferably a one piece assembly with container 66 so that container 66 and side container 70 are removed as a one piece assembly from casing 206. Thus container 70 may be have a lower portion 71 that is integrally formed with container 66. Alternately, the may be individually moulded and then assembled together to form a one piece unit. In either case, when first stage collector 36 is removed from casing 206 for emptying, eg. by inverting container 66, lower portion 71 of container 70 is also removed from casing 206 and emptied.

[0028] Particle transfer member 48 is configured to convey particles separated by the second stage to second stage collector 38. It will be apparent to one skilled in the art that the configuration of transfer member 48 will vary depending upon the position of second stage collector 38. For example, referring to Figure 6, transfer member 48 comprises a disc canted to direct deposited particles laterally to side container 70. In this embodiment, guide or spout 74 is optionally provided to direct particles from transfer member 48 to side container 70. It will also be apparent that collector 38 is disposed below particle transfer-member 48 so that particles may travel across transfer member 48 and be deposited into collector 38.

[0029] Referring to Figure 7, transfer member 48 is shown used with advantage in a multi-stage separator 300 having its filtration stages arranged in a side-by-side configuration. Here, separator 300 comprises a first stage cyclone 32 and a second stage cyclone 34, the first stage and second stage being connected in series. First stage cyclone-32 has an fluid inlet 42 and a fluid outlet 46 which is in fluid flow communication with conduit 44 which is in fluid communication with second stage cyclone 34 via inlet 47. Second stage cyclone 34 has a fluid outlet 49 in communication with a conduit leading to a driving member (eg. a motor-driven fan which is not shown). Particle transfer member 48 is positioned at the bottom of first stage cyclone 32 and comprises a sloped member canted to direct deposited particles substantially laterally from first stage separator 32 to second stage collector 38 (which is also positioned at the bottom of second stage separator 34) via opening 78 in assembly 51. Thus, in essence, in this embodiment first stage collector 36 and second stage collector 38 are one and the same. A spout member 74 is optionally provided to assist in transferring particles from transfer member 48 to collector 36/38 and, thus, it is only necessary to remove collected particles from the one collector 36/38. It will be apparent that collector 36/38 is disposed below particle transfer member 48 so that particles may travel across transfer member 48 and be deposited onto collector 36/38.

[0030] The present invention can also be used advantageously with a single stage filtration means, not forming put of the present invention, wherein it is desirable to transfer the contents of the single stage collector to a more accessible position prior to emptying. For example, referring to Figure 8, vacuum cleaner 220 has a single stage of cyclonic cleaning, namely a cyclone 32 having an adjacent external container 70. Struts 222 extend between the upper and lower portions of casing 206. Transfer member 48 transfers particles deposited by the cyclone to side container 70. Side collector 70 is separable from container 66 and casing 206, thereby permitting the user to empty particles collected by cleaner 220 simply by detaching external container 70 from the container 66 and appropriately emptying its contents.

[0031] Therefore, the transport member according to the present invention advantageously provides convenience in transporting collected particles to a collector for more convenient emptying thereof. The convenience added by the present invention permits a wider configuration of multi-stage separation devices to be used conveniently in domestic and household applications.

[0032] The collector according the present invention also advantageously increases the flexibility of various multi-stage separation mechanisms for facilitating ease-of-use and convenient operation of household vacuum cleaners. As stated above, the upstream and downstream separation stages may use any separation technique which produces separated particles that must be handled in such a way that they will not be re-entrained in fluid flowing out of the separation stage (ie. the stage is capable of depositing and storing separated particles in a reusable container) such as, for example, a cyclone separator, a Prandtl layer turbine, an electrostatic filter, a fibre filter or the like.

Claims

1. A vacuum cleaner comprising:

(a) a cleaner head having a dirty air inlet; and
(b) a filtration member in fluid flow communication with the dirty air inlet and with a source of suction, the filtration member comprising a cyclonic cleaning unit comprising a first cyclonic stage (32) having at least one upstream cyclone which has an associated upstream particle collector (36) and a second cyclonic cleaning stage (34) comprising a plurality of downstream cyclones which have an associated downstream particle collector (38), the particle collectors are configured such that the downstream particle collector (38) is emptied when the upstream particle collector (36) is emptied.

2. The vacuum cleaner as claimed in claim 1 further comprising a main casing and a filtration casing (66), the filtration casing housing at least the upstream cyclone (32), the upstream particle collector (36) and the downstream particle collector (38), and wherein the filtration casing (66) is removably mounted to the main casing (206)

3. The vacuum cleaner as claimed in claim 1 or claim 2, wherein the downstream particle collector comprises a chamber having an open top and an open bottom and a movable bottom panel (52, 52') is provided adjacent the bottom of the chamber.

4. The vacuum cleaner as claimed in claim 1 or claim 2, wherein the downstream particle collector comprises a collector housing including a collector wall and a movable bottom panel (52, 52') and the bottom panel is movably mounted with respect to the collector wall for emptying the downstream particle collector.

5. The vacuum cleaner as claimed in any of claims 1 to 4, wherein the second cyclonic cleaning stage (34) comprises a plurality of cyclones in parallel.

6. The vacuum cleaner as claimed in claim 5, wherein the first cyclonic cleaning stage (32) comprises a single cyclone.

7. The vacuum cleaner as claimed in claim 1, claim 5 or claim 6, wherein the upstream particle collector (36) has a bottom, the downstream particle collector (38) has a bottom (72) and the bottom of the first and second particle collectors lie in a common plane.

8. The vacuum cleaner as claimed in any of claims 1, 2, 5, 6 or 7, wherein the second cyclonic cleaning stage (34) is positioned above the first cyclonic cleaning stage (32).

Patentansprüche

1. Staubsauger, umfassend:

(a) einen Reinigungskopf mit einem Schmutzlufteinlass; und

(b) ein Filtrationselement in Strömungskommunikation mit dem Schmutzlufteinlass und mit einer Saugquelle, wobei das Filtrationselement eine Zyklonreinigungseinheit aufweist, die eine erste Zyklonstufe (32) mit mindestens einem stromaufwärts liegenden Zyklon, welcher einen zugehörigen stromaufwärts liegenden Partikelsammler (36) umfasst, und eine zweite Zyklonreinigungsstufe (34) aufweist, die eine Mehrzahl stromabwärts liegender Zyklone aufweist, welche einen zugehörigen stromabwärts liegenden Partikelsammler (38) umfasst, wobei die Partikelsammler derart aufgebaut sind, dass der stromabwärts liegende Partikelsammler (38) entleert wird, wenn der stromaufwärts liegende Partikelsammler (36) entleert wird.

2. Staubsauger nach Anspruch 1, der ferner ein Hauptgehäuse und ein Filtrationsgehäuse (66) aufweist, wobei das Filtrationsgehäuse mindestens den stromaufwärts liegenden Zyklon (32), den stromaufwärts liegenden Partikelsammler (36) und den stromabwärts liegenden Partikelsammler (38) aufnimmt, und wobei das Filtrationsgehäuse (66) entfernbar an dem Hauptgehäuse (206) angebracht ist.

3. Staubsauger nach Anspruch 1 oder Anspruch 2, bei dem der stromabwärts liegende Partikelsammler eine Kammer mit einem offenen Oberteil und einen offenen Boden aufweist, und eine bewegbare Bodenplatte (52, 52') angrenzend an den Boden der Kammer vorgesehen ist.

4. Staubsauger nach Anspruch 1 oder Anspruch 2, bei dem der stromabwärts liegende Partikelsammler ein Sammlergehäuse aufweist, das eine Sammlerwand und eine bewegbare Bodenplatte (52, 52') einschließt, und die Bodenplatte bewegbar in bezug zu der Sammlerwand zum Entleeren des stromabwärts liegenden Partikelsammlers angebracht ist.

5. Staubsauger nach einem der Ansprüche 1 bis 4, bei dem die zweite Zyklonreinigungsstufe (34) eine Mehrzahl paralleler Zyklone aufweist.

6. Staubsauger nach Anspruch 5, bei dem die ersten Zyklonreinigungsstufe (32) einen einzigen Zyklon aufweist.

7. Staubsauger nach Anspruch 1, Anspruch 5 oder Anspruch 6, bei dem der stromaufwärts liegende Partikelsammler (36) einen Boden aufweist, der stromabwärts liegende Partikelsammler (38) einen Boden (72) aufweist, und der Boden des ersten und zweiten Partikelsammlers in einer gemeinsamen Ebene liegen.

8. Staubsauger nach einem der Ansprüche 1, 2, 5, 6 oder 7, bei dem die zweite Zyklonreinigungsstufe (34) über der ersten Zyklonreinigungsstufe (32) positioniert ist.

Revendications

1. Un aspirateur comportant :

(a) une tête d'aspiration dotée d'une entrée d'air souillé ; et
(b) un élément de filtration en communication de débit fluide avec l'entrée d'air souillé et avec une source d'aspiration, l'élément de filtration comportant une unité de nettoyage cyclonique comportant un premier étage cyclonique (32) possédant au moins un cyclone amont doté d'un collecteur de particules amont associé (36) et un deuxième étage de nettoyage cyclonique (34) comportant une pluralité de cyclones aval possédant un collecteur de particules aval associé (38), les collecteurs de particules étant configurés de telle manière que le collecteur de particules aval (38) est vidé lorsque le collecteur de particules amont (36) est vidé.

2. L'aspirateur selon la revendication 1 comportant en outre un caisson principal et un caisson de filtration (66), le caisson de filtration abritant au moins le cyclone amont (32), le collecteur de particules amont (36) et le collecteur de particules aval (38), et dans lequel on a prévu que le caisson de filtration (66) est monté de manière à pouvoir être détaché-sur le caisson principal (206).

3. L'aspirateur selon la revendication 1 ou la revendication 2, dans lequel il est prévu que le collecteur de particules aval comporte une chambre munie d'un sommet ouvert et d'un fond ouvert et qu'un panneau de fond mobile (52, 52') est prévu en position adjacente au fond de la chambre.

4. L'aspirateur selon la revendication 1 ou la revendication 2, dans lequel il est prévu que le collecteur de particules aval comporte un logement de collecteur muni d'une paroi de collecteur et d'un panneau de fond mobile (52, 52'), et que le panneau de fond est monté de manière mobile par rapport à la paroi de collecteur afin de vider le collecteur de particules aval.

5. L'aspirateur selon une quelconque des revendications 1 à 4, dans lequel on a prévu que le deuxième étage de nettoyage cyclonique (34) comporte une pluralité de cyclones en parallèle.

6. L'aspirateur selon la revendication 5, dans lequel on a prévu que le premier étage de nettoyage cyclonique (32) comporte un seul cyclone.

7. L'aspirateur selon la revendication 1, la revendication 5 ou la revendication 6, dans lequel on a prévu que le collecteur de particules amont (36) a un fond, le collecteur de particules aval (38) a un fond (72) et les fonds des premier et deuxième collecteurs de particules sont situés dans un plan commun.

8. L'aspirateur selon les revendications 1, 2, 5, 6 ou 7, dans lequel on a prévu que le deuxième étage de nettoyage cyclonique (34) est positionné au-dessus du premier étage de nettoyage cyclonique (32).

FIG.1.
(PRIOR ART)

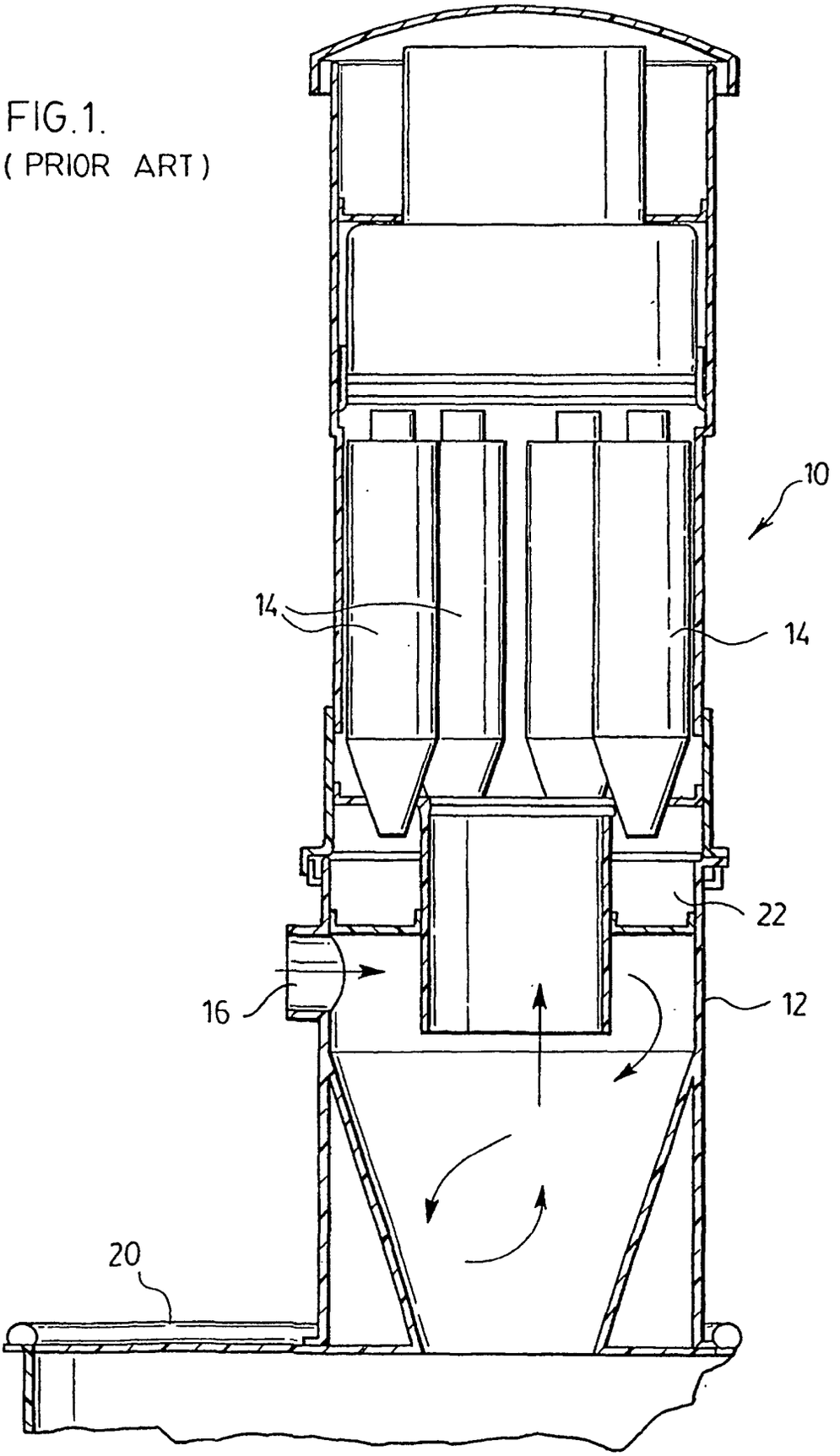
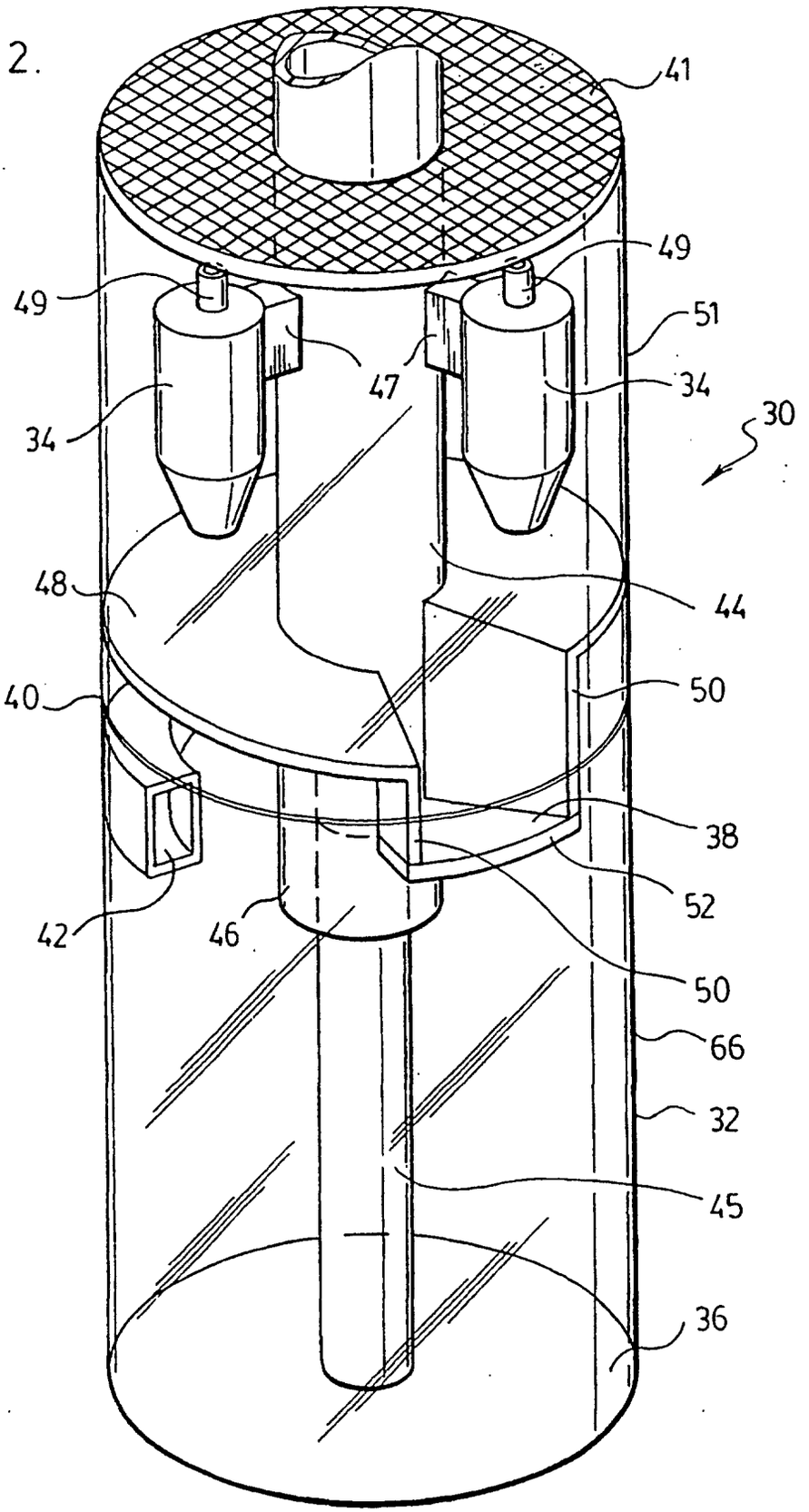


FIG. 2.



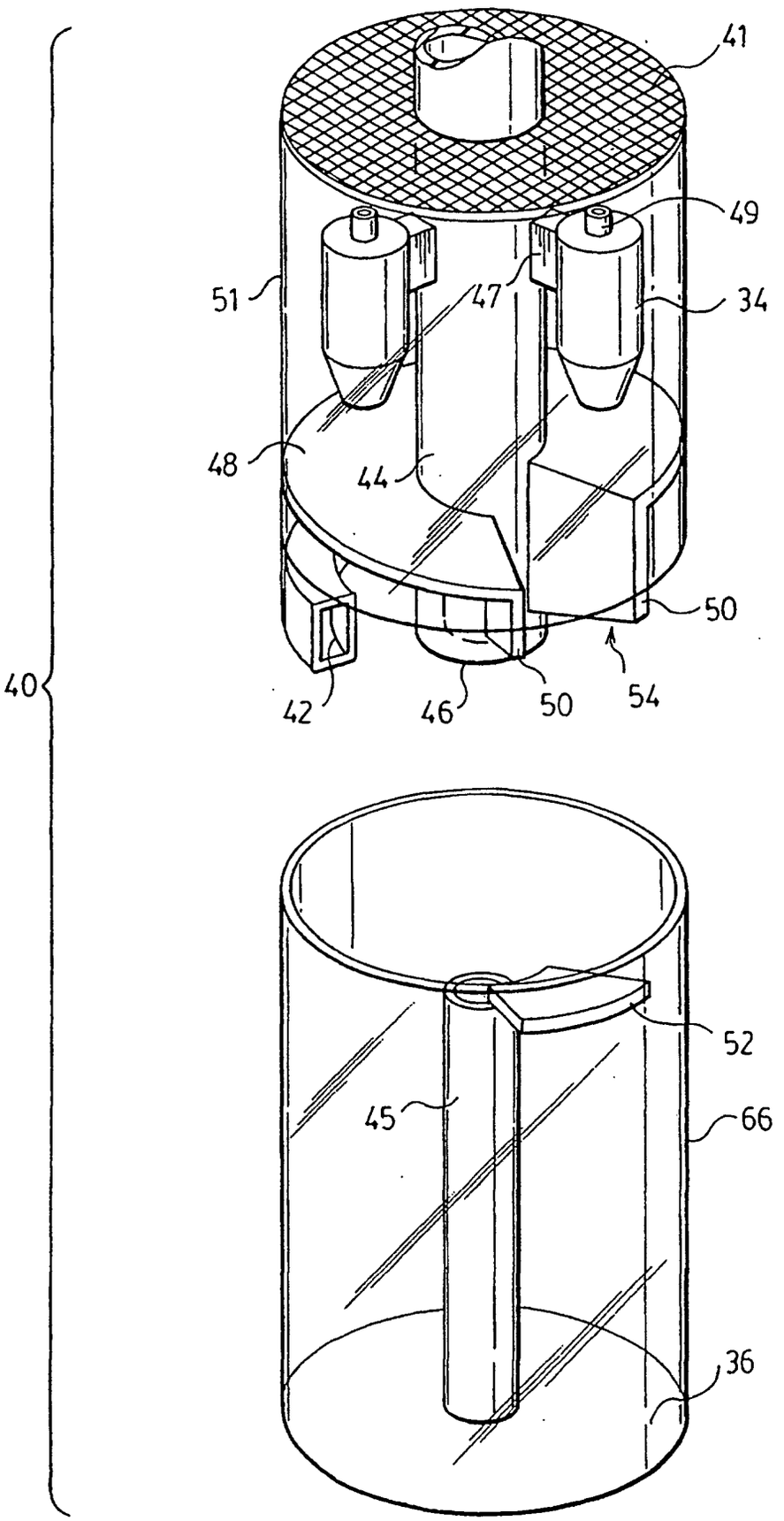


FIG. 3a.

FIG. 3b.

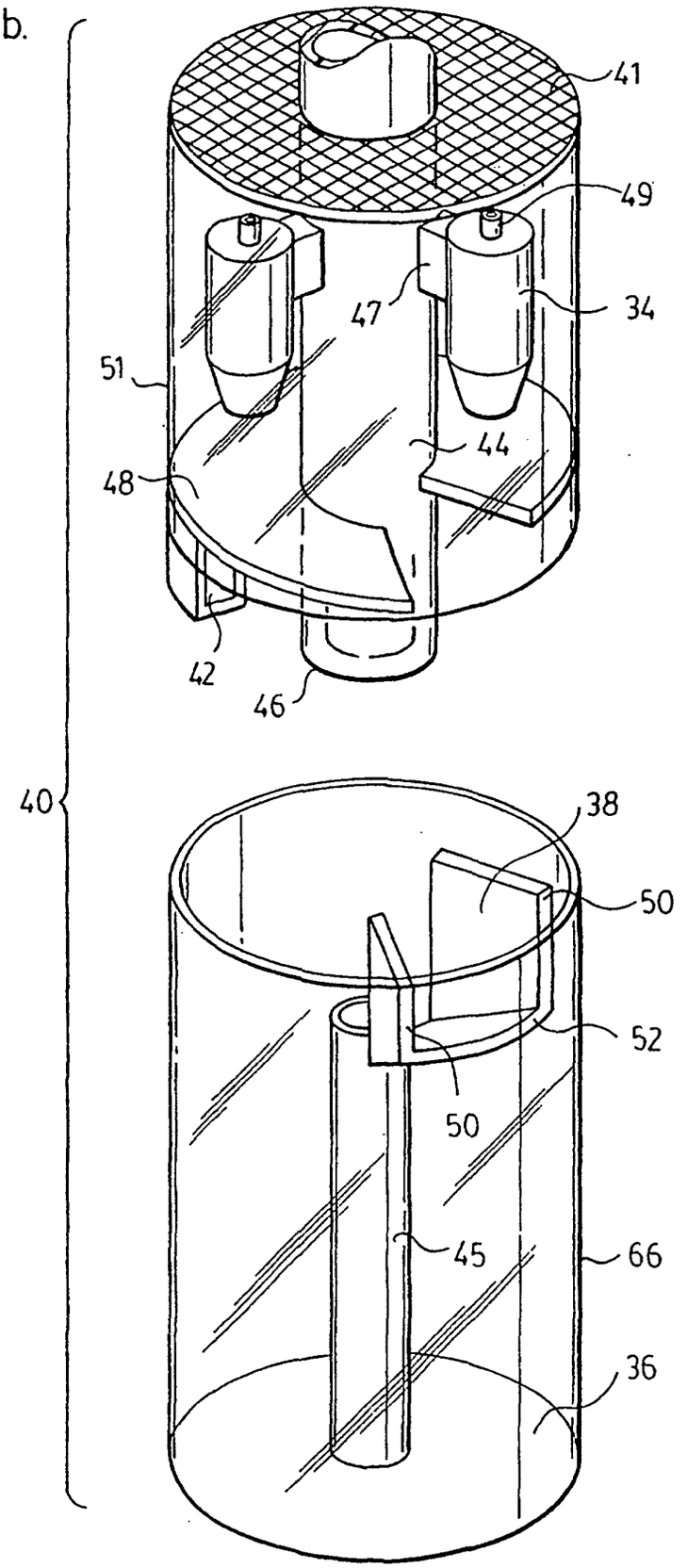


FIG.4.

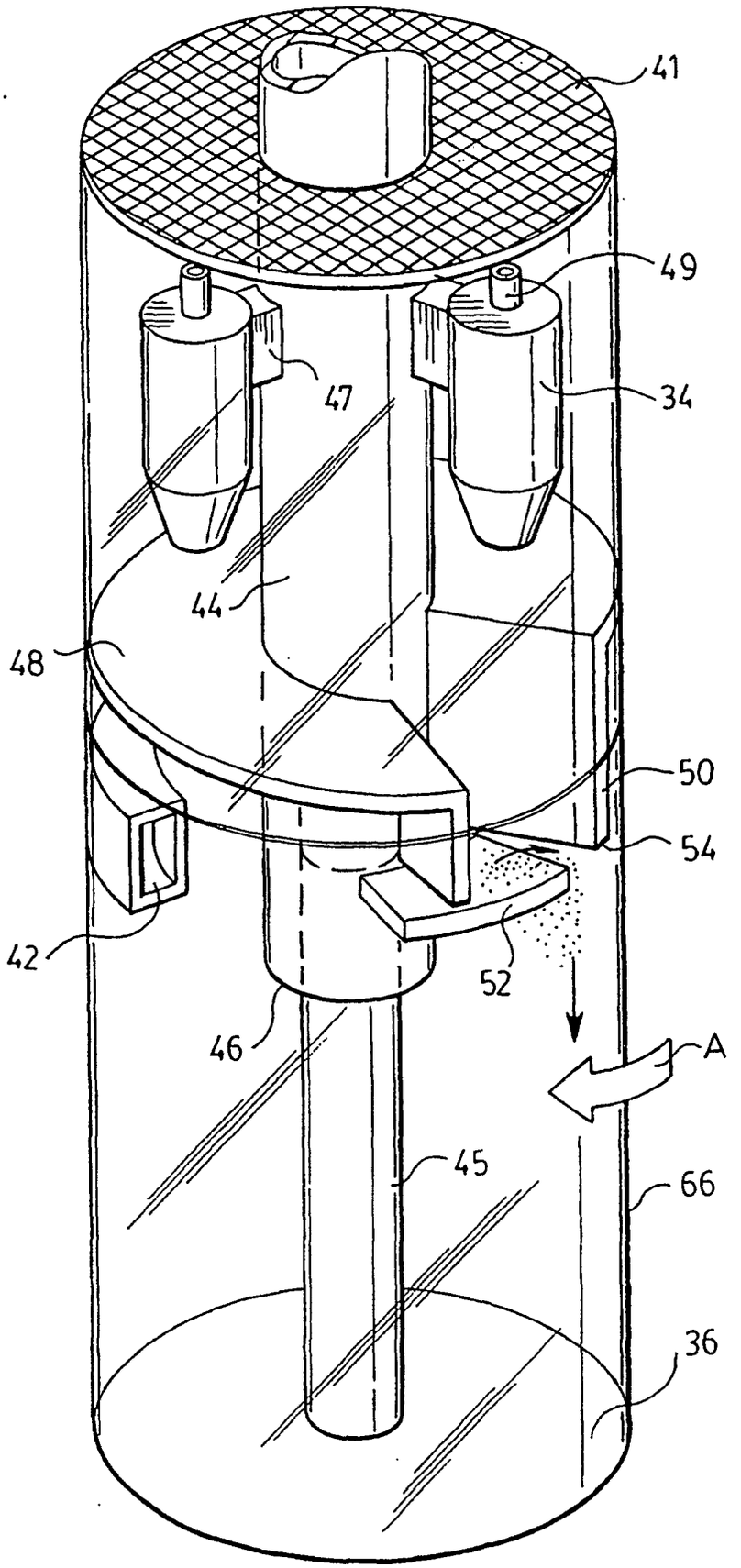


FIG.5.

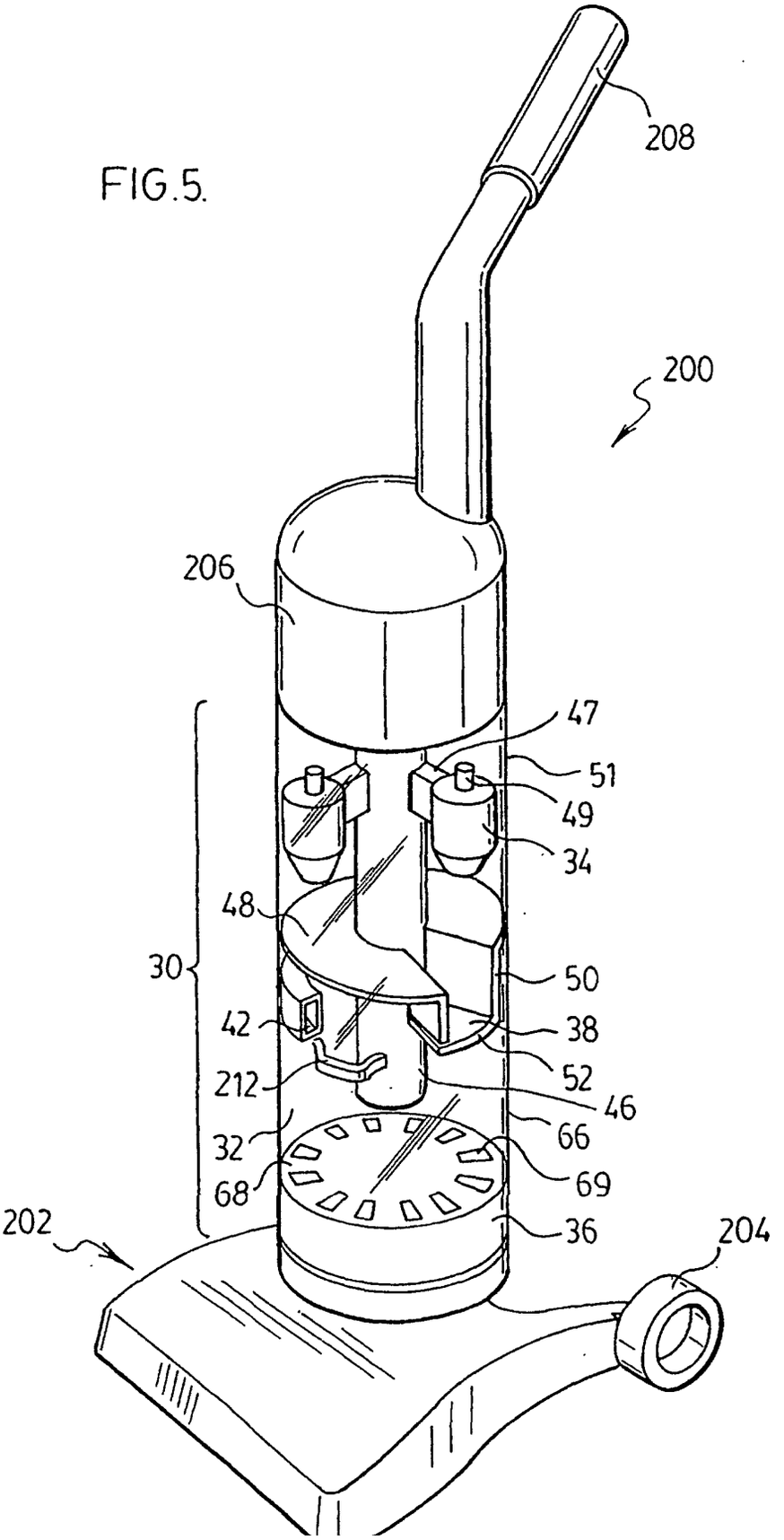

208
200
206
47
51
49
34
48
30
50
42
38
212
52
46
66
32
69
68
36
202
204

FIG.6.

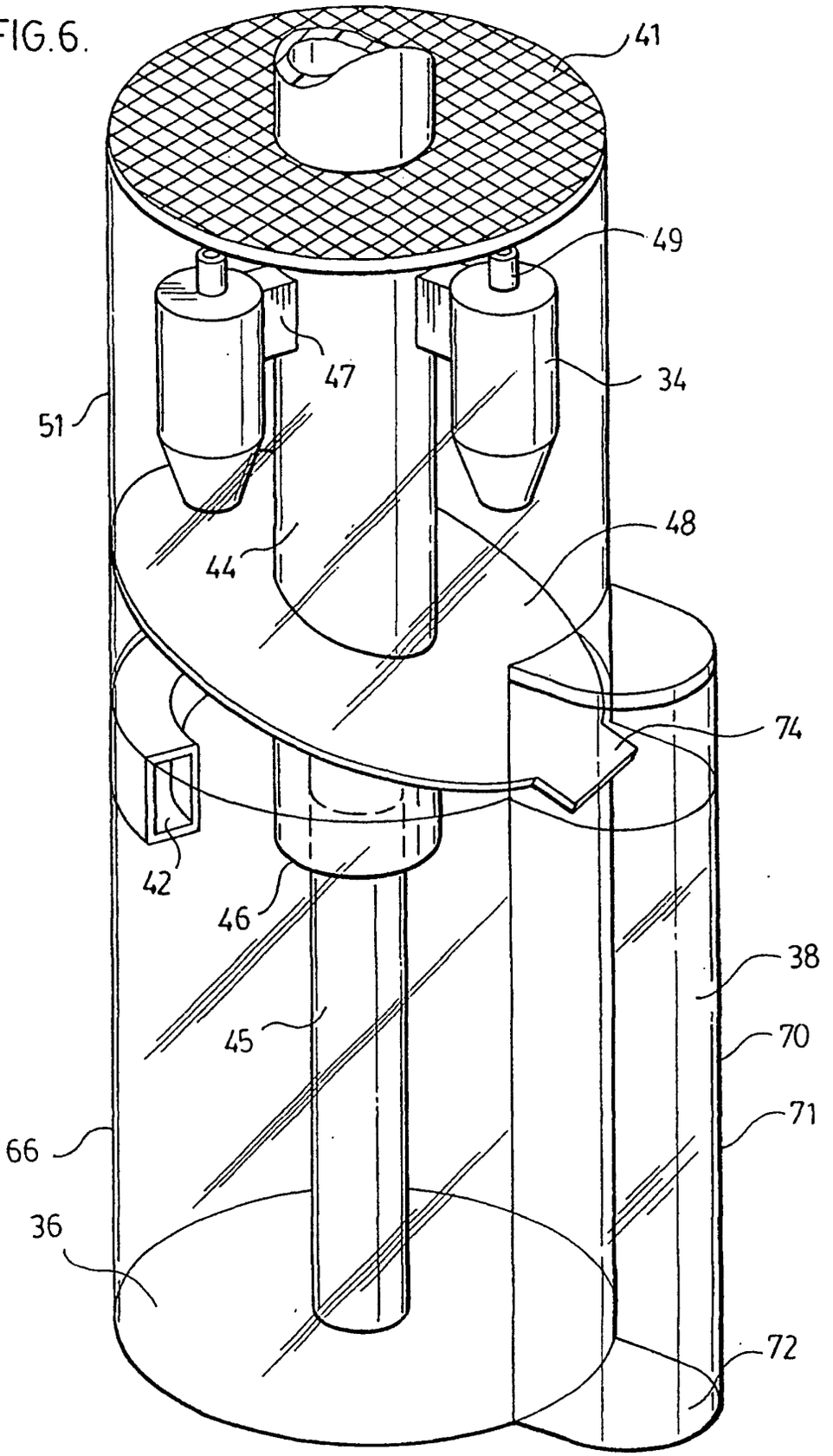


FIG. 7.

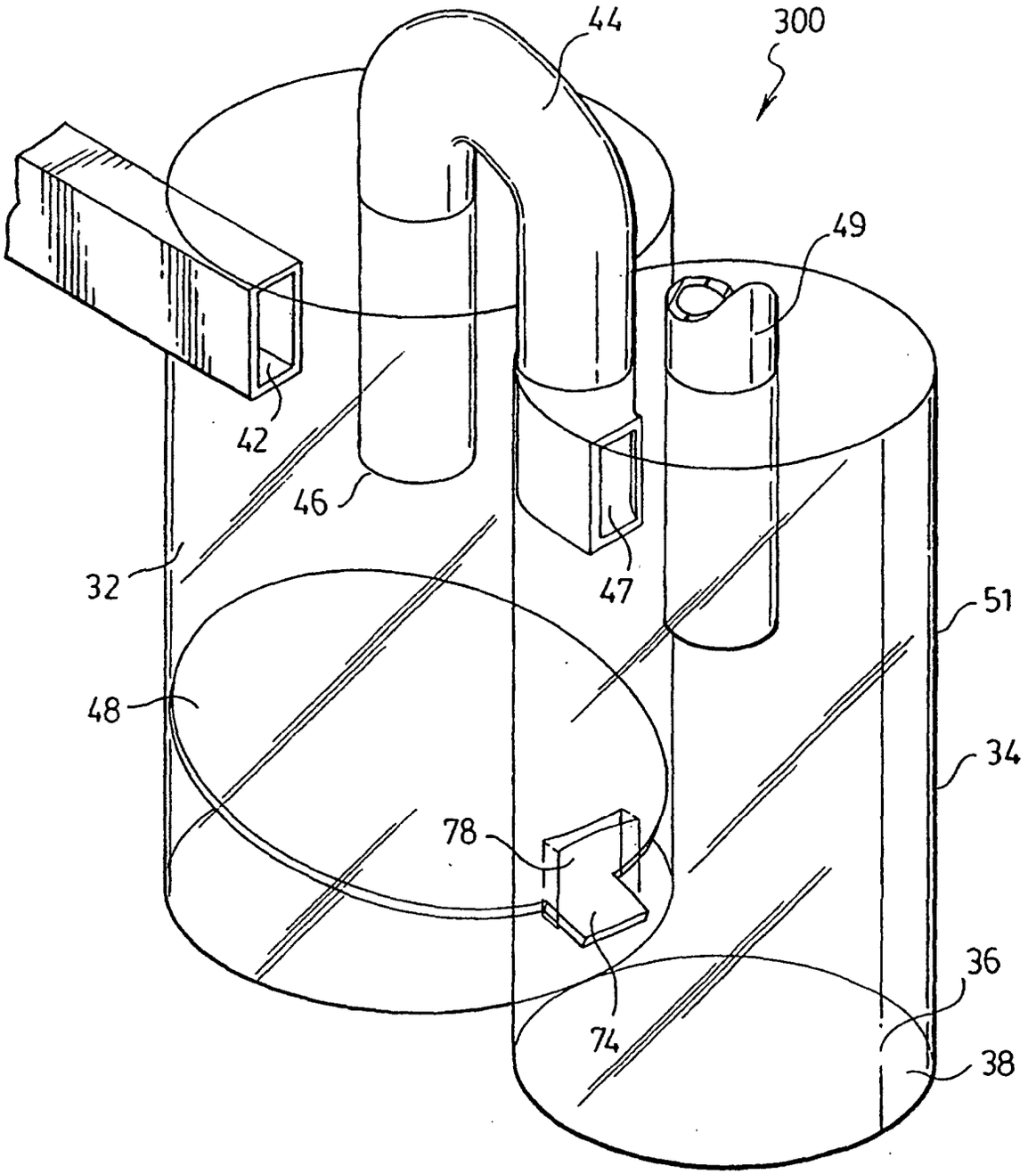
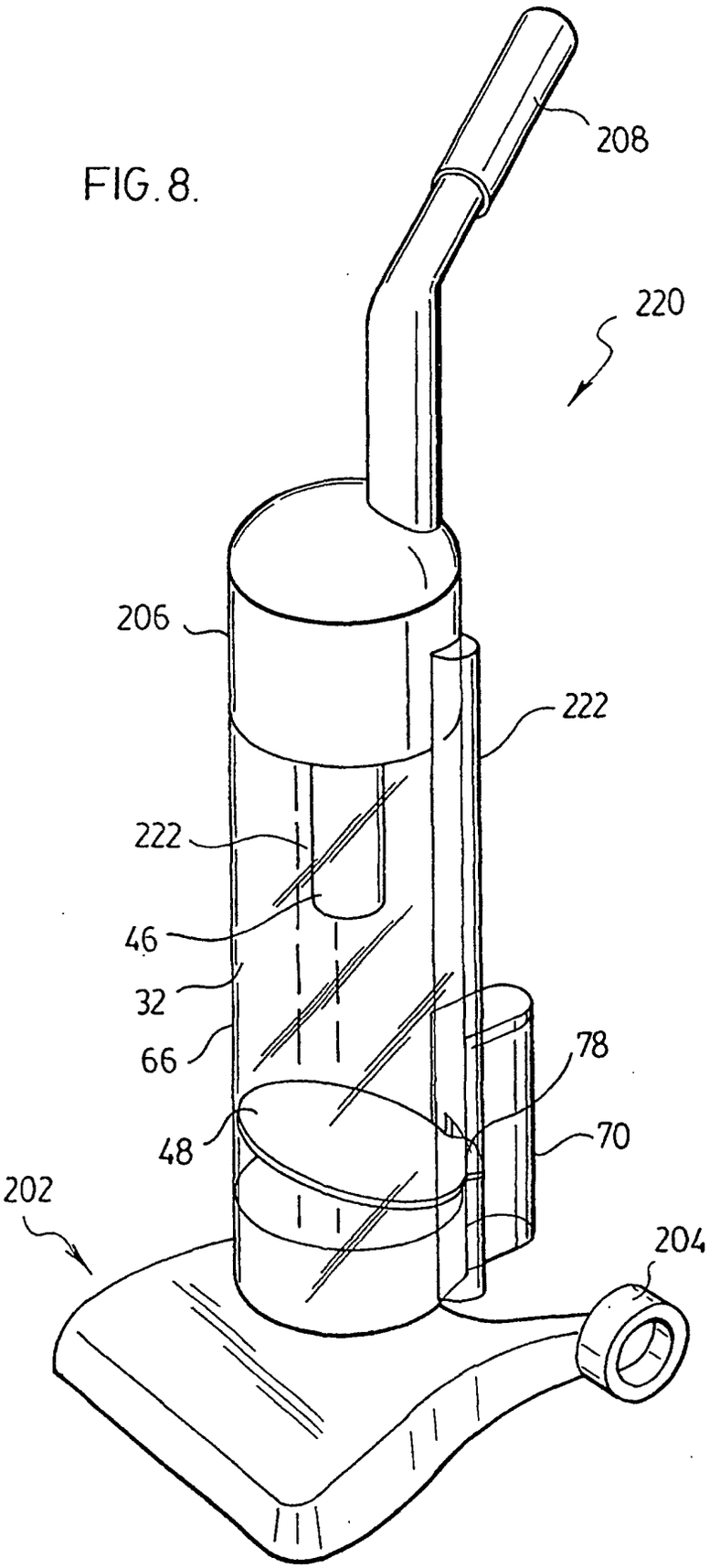


FIG. 8.



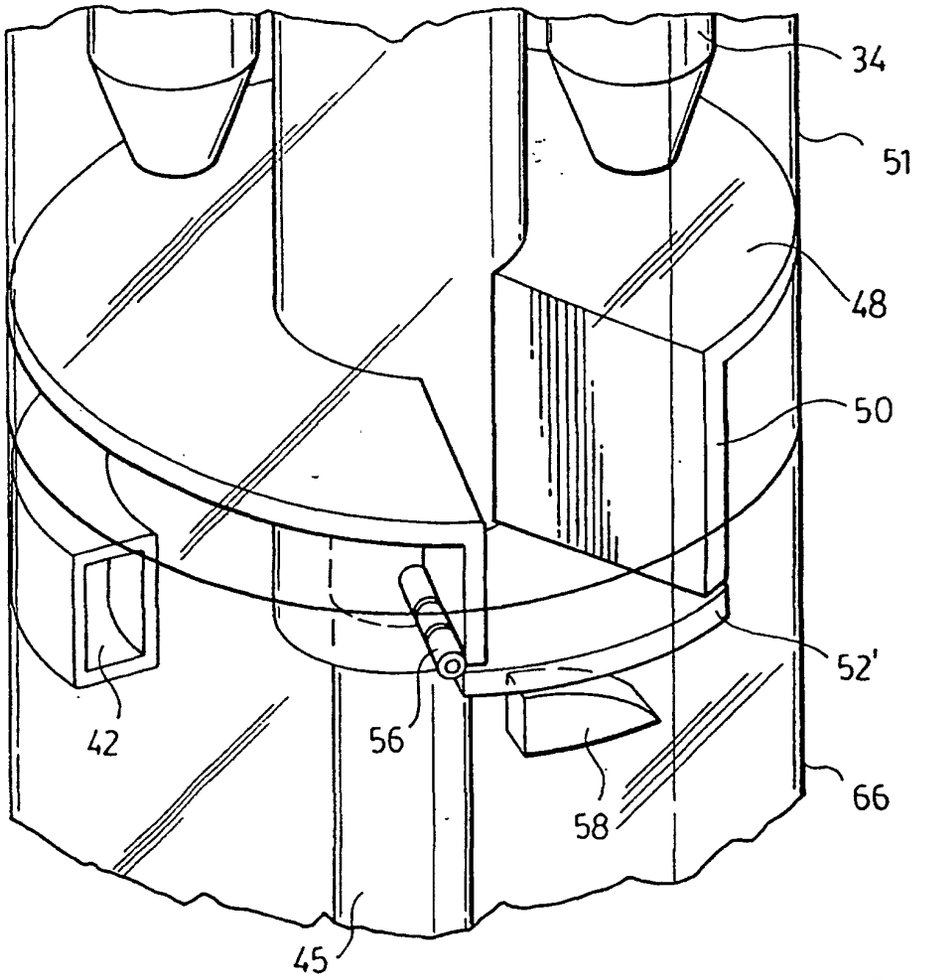


FIG.9.

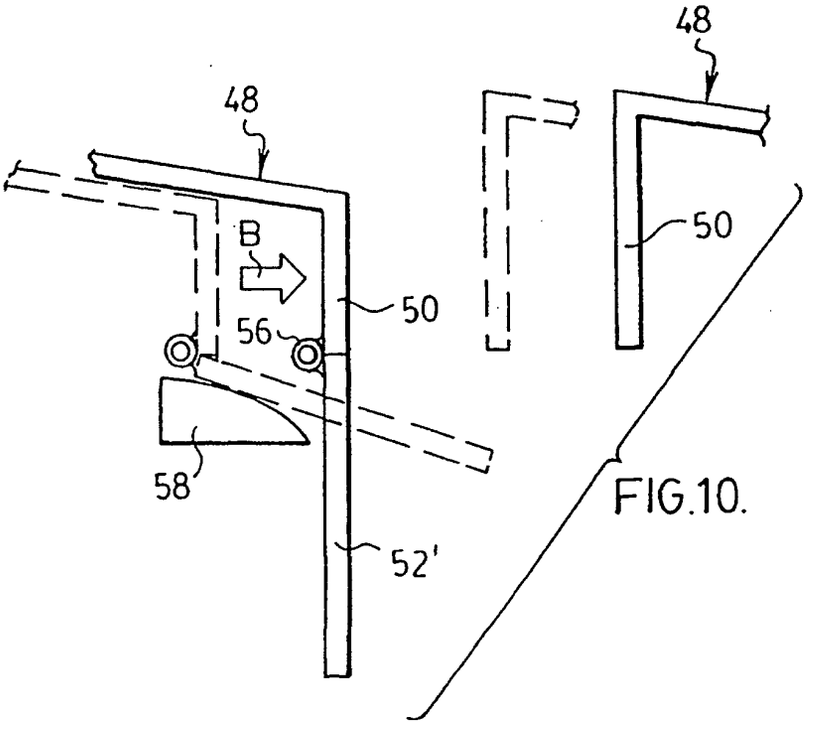


FIG.10.