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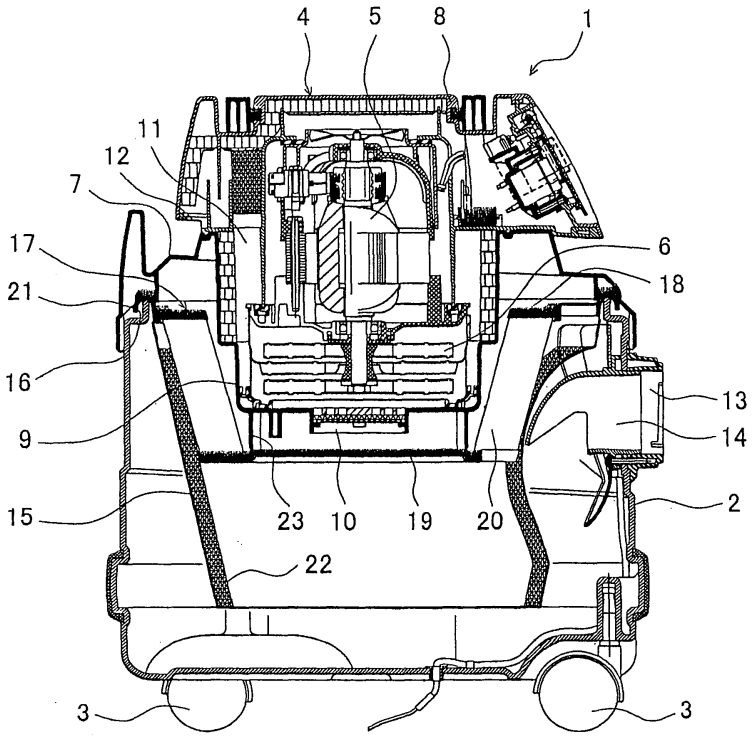
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(54) Dust collector

(57) A dust collector which can brush off dust in a primary filter (15) automatically. A bag-shaped pre-filter (15) is installed on an upper opening of a tank (2) of a dust collector (1), and a powder filter (17) protruding towards an inner portion of the pre-filter (15) so as to partition a main body (4) and a suction tube (13), is installed over the upper opening of the tank (2) on an inner side of the pre-filter (15). A damper (22) corresponding to a plate-shaped sponge is interposed between the pre-filter (15) and the powder filter (17) in such a manner as to cover an inner side surface of the pre-filter (15) over its entire periphery. In accordance with contraction and restoration motion of the pre-filter (15) and of the damper (22) that result from operation and cessation of operation, dust attached to the pre-filter (15) can be brushed off.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a dust collector which is provided with a main body having a motor and a fan in an upper portion of a tank having a suction port, which sucks ambient air from the suction port on the basis of rotation of the fan caused by driving the motor, and which captures dust by means of a filter provided within the tank.

Description of the Related Art

[0002] The dust collector includes a main body having a motor and a fan for being detachably mounted on to an upper portion of a tank having a suction port. In the dust collector, air is sucked from the suction port by rotations of the fan in accordance with driving of the motor, and discharged to an external portion through an inner side of the main body. Within the tank are provided a bag-shaped primary filter, and a secondary filter protruding in a closed-end tubular shape towards an inner side of the primary filter so as to inhibit contraction of the primary filter. When air including dust first passes through the primary filter, major concentrations of dust are captured by the primary filter, or come down within the tank so as to be collected, and minor concentrations of dust passing through the primary filter are captured by the secondary filter.

[0003] In the dust collector mentioned above, dust is liable to be attached to the primary filter with which most dust is brought into contact, and the degree of suction force is reduced by the occurrence of clogging. In order to solve the above problem, as a dust collector disclosed in Japanese Unexamined Patent Publication No. 2002-45318 for example, it has been considered to provide a cage-shaped filter cage which is constituted by a rigid steel wire and a spring steel wire on an inner side of the primary filter as a countermeasure. In this dust collector, the dust can be automatically brushed off as follows. First, at a time of sucking the primary filter is closely contacted with the filter cage and elastically deformed toward an inner side by means of a negative pressure. Then, when operation is stopped, the negative pressure is cancelled and thus the primary filter is expanded by utilizing a restoration motion of the filter cage to its original shape.

[0004] However, since due to its shape, the cage-shaped filter cage is brought into partial contact with the primary filter, restoration motion is hard to be uniformly transmitted to the primary filter at a time of a cessation of operation. Moreover, the primary filter is expanded only partially, and the dust is brushed off unevenly.
Accordingly, a reduction in the degree of suction force by the clogging can not be completely nullified. Further, since the filter cage is independently manufactured of steel wire, steel plate or the like, increases in costs arise.

[0005] Accordingly, an object of the present invention is to provide a dust collector which, with a less expensive structure, can evenly and effectively brush off dust in a primary filter automatically, and which can sustain a preferable dust-collecting function.

SUMMARY OF THE INVENTION

[0006] In order to achieve the object mentioned above, in accordance with a first aspect of the present invention, a dust collector is provided, wherein an elastic body having air permeability is interposed between a primary filter and a secondary filter in such a manner as to cover at least the entirety of an inner side surface of the primary filter.

[0007] In accordance with a second aspect of the present invention, in addition to the object of the first aspect, the elastic body is constituted by a plate-like sponge, for purposes of obtaining a satisfactory elastic body less expensively.

[0008] In accordance with a third aspect of the present invention, in addition to the object of the first or second aspect, a reinforcing portion which is in close contact with an inner bottom surface of the secondary filter is provided in a protruding manner on a lower surface of the main body, in order to effectively prevent a buckling deformation of the secondary filter at a time of operation.

[0009] In accordance with the invention described in the first aspect, it is possible to brush off dust attached to the primary filter efficiently and evenly, by contraction and restoration motion of the primary filter and the elastic body caused by operation and a cessation of operation. Accordingly, it is possible to prevent lowering of the suction force which is caused by the clogging of the primary filter, and it is possible to maintain a satisfactory dust-collecting function. Further, since the structure is simplified by interposing the elastic body between the primary filter and the secondary filter, increases in costs can be restricted to a modest level. Further, since the elastic body has a filtering function, the amount of dust attached to the secondary filter is reduced. As a result, the maintenance of the secondary filter needs not to be made frequently, thereby enhancing usability. In accordance with the invention described in the second aspect, in addition to the effects of the first aspect, it is possible to obtain less expensively a satisfactory elastic body with a high degree of restoration force.

[0010] In accordance with the invention described in the third aspect, in addition to the effect of the first or second aspect, it is possible to prevent effectively the secondary filter from being buckled or deformed at a time of operation, and it is also reasonable to expect an improvement in the level of durability.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 is a cross sectional view of a dust collector.
Fig. 2 is an explanatory view of a pre-filter.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0012] A description will be given below of an embodiment in accordance with the present invention, with reference to the accompanying drawings.

[0013] Fig. 1 is a cross sectional view showing an example of a dust collector. A dust collector 1 is constituted by a closed-end circular tank 2 provided with casters 3, 3, ... in a bottom portion and an opening at an upper side, and a main body 4 mounted on an upper side of the tank 2 and provided with a motor 5 and a fan 6. The main body 4 has a tank cover 7 closing the upper opening of the tank 2, and a cowling 8 coupled to an upper side of the tank cover 7; and the main body 4 accommodates the motor 5 between a tubular portion 9 provided in the center of the tank cover 7 in a downward protruding manner, and the cowling 8. The motor 5 is provided in a manner such that the fan 6 is faced downward. The main body 4 can discharge air sucked from a suction air port 10 formed in the center of a lower surface of the tubular portion 9, through an air discharge port 12 provided in a lower side of a peripheral edge of the cowling 8, using a ventilation path 11. Further, the main body 4 can be fixed to the tank 2 by locking a hook (not shown) provided on an upper side of a side surface of the tank 2, on to the peripheral edge of the tank cover 7, in a state of being mounted on the tank 2. Reference numeral 13 denotes a suction tube in which a suction port is open on the side surface of the tank 2 and to which a suction hose or the like can be connected. Reference numeral 14 denotes a holder which is inserted within the suction tube 13 from the inner side of the tank 2, and guides air sucked into the suction tube 13 to the bottom portion of the tank 2.

[0014] On the other hand, a pre-filter 15 constituting a primary filter is installed on the upper opening of the tank 2. As shown in Fig. 2, the pre-filter 15 is a closed-end bag body which is open in an upper portion, is formed in a bowl shape in which a diameter becomes gradually smaller toward a lower side, and is made of a synthetic fiber (for example, a polyester). The pre-filter 15 is capable of partitioning the main body 4 and the suction tube 13 inside the tank 2 by locking a hook 16 provided on the peripheral edge of the upper opening, on to the periphery of the upper opening of the tank 2. Further, a well-known anti-static finish in which a hydrophilic anti-static agent is added to the fiber is applied to the pre-filter 15.

[0015] Further, a powder filter 17 serving as the secondary filter is installed on the upper opening of the tank 2 on an inner side of the pre-filter 15. The powder filter 17 is also formed in an outer shape of closed-end tubular in which a diameter becomes gradually smaller toward a lower side. The powder filter 17 is constituted by a top plate 18 at an upper end, a bottom plate 19 at a lower end, and a filter 20 arranged between plates 18 and 19, and the filter 20 is formed by folding a synthetic resin (for example, a polyester) in a cylindrical shape. The powder filter 17 is capable of partitioning the main body 4 and the suction tube 13 by protruding toward an inner portion of the pre-filter 15 when a hook portion 21 provided on a peripheral edge of the top plate 18 is locked, on to the periphery of the upper opening of the tank 2 from above the hook 16 of the pre-filter 15.

[0016] Further, reference numeral 22 denotes a damper serving as an elastic body. The damper 22 is made of a polyurethane sponge having a predetermined thickness (10 mm in this case) and formed in a plate shape, and is rounded in a tubular shape in conformity with the inner side surface of the pre-filter 15. By doing this, the damper 22 is interposed between the pre-filter 15 and the powder filter 17 over the entirety of its inner side, except for the bottom portion of the pre-filter 15. Accordingly, in a state in which operations are stopped, the pre-filter 15 is kept in a bowl-shaped bulged shape due to the elasticity of the damper 22.

[0017] On the other hand, a ring-shaped rib 23 corresponding to a reinforcing portion is provided on a lower surface of the tubular portion 9 of the tank cover 7 so as to be protruded toward a lower side on a concentric circle with the suction air port 10, and a lower end of the rib 23 is made to be close to the bottom plate 19 of the powder filter 17.

[0018] In the dust collector 1 structured in the manner described above, the motor 5 is driven and the fan 6 is rotated by turning on a switch (not shown) provided on the main body 4. Then, external air sucked from the suction tube 13 via the suction hose or the like is conveyed to the inner side of the tank 2, passes through the pre-filter 15 and the damper 22 as well as the powder filter 17; the external air thereafter moves forward into the main body 4 from the suction air port 10, and is discharged to the external portion from the air discharge port 12 through the ventilation path 11. In accordance with the air flow, dust sucked with the air into the tank 2 is captured first by the pre-filter 15, dust passing through the pre-filter 15 is captured by the damper 22, and minor concentrations of dust passing through the damper 22 are captured by the powder filter 17.

[0019] In this operational state, since the inner side of the pre-filter 15 in which the suction air port 10 is positioned on the inner side is applied a negative pressure, the pre-filter 15 is contracted and deformed in such a manner as to be in contact with an outer periphery of the powder filter 17, and the damper 22 positioned between filters 15 and 17 is also contracted and deformed. An external force is applied to the powder filter 17 on the basis of the deformation of the pre-filter 15 and the damper 22. However, since the rib 23 provided in a protruding manner in the tubular portion 9 of the tank cover 7 is in

contact with the bottom plate 19 and supports the powder filter 17 from the inner side, it is possible to prevent the filter 20 from becoming buckled or deformed.

[0020] Further, when the switch is turned off so as to stop the drive of the motor 5, the air flow stops and the negative pressure is cancelled, and the damper 22 is restored to its original shape by means of elastic force. The pre-filter 15 is pressed over its entire periphery from the inner side by the restoration motion of the damper 22 so as to bulge towards the outer side, and is restored to its original bowl shape. Due to the operation of the pre-filter 15, dust attached to the surface of the pre-filter 15 is brushed off. Particularly in this case, since antistatic finish is applied to the pre-filter 15, the ability of dust to be peeled off is enhanced and dust is effectively removed.

[0021] As described above, in accordance with the dust collector 1 of the embodiment mentioned above, since the damper 22 is interposed between the pre-filter 15 and the powder filter 17 in a manner such as to cover the inner side surface of the pre-filter 15 over its entire periphery, it is possible to brush off dust attached to the pre-filter 15 efficiently and evenly by the contraction and restoration motion of the pre-filter 15 and the damper 22 in accordance with the operation and cessation of operation. Therefore, it is possible to prevent lowering of the suction force which is caused by clogging of the pre-filter 15, and it is possible to maintain a satisfactory dust-collecting function. Further, since the structure is simplified by interposing the damper 22 between the pre-filter 15 and the powder filter 17, increases in costs can be restricted to a modest level. Further, since the damper 22 has a filtering function, the amount of dust attached to the powder filter 17 is reduced. As a result, the maintenance of the powder filter 17 needs not to be made frequently, thereby enhancing usability.

[0022] Particularly in this case, since a plate-shaped sponge is utilized for the damper 22 corresponding to the elastic body, it is possible to obtain a satisfactory damper with a high degree of restoration force less expensively.

[0023] Further, since the rib 23 close to the inner bottom surface of the powder filter 17 is provided in a protruding manner on the lower surface of the tubular portion 9 of the main body 4, it is possible to prevent effectively the powder filter 17 from being buckled or deformed at a time of operation, and it is also reasonable to expect an improvement in the level of durability.

[0024] The elastic body needs not be limited to a sponge as in the embodiment described above, and other materials such as felt can be used as long as the elastic body has air permeability. With some materials, the elastic body may be provided in such a manner as to cover the entirety of an inner peripheral surface including the bottom surface of the primary filter. Further, without being limited to a single elastic body, it is also possible to employ a multilayer structure obtained by laminating elastic bodies of types and characteristics that are different from each other, for example, sponge and felt. Further, the elastic body may be stuck to the inner surface of the primary filter.

[0025] Moreover, the reinforcing portion is not limited to the ring-shaped rib as in the embodiment described above, and the reinforcing portion may be structured by forming the projections or protrusions intermittently as long as it can support the secondary filter. Of course, if the degree of rigidity of the secondary filter is high, the reinforcing portion can be omitted.

[0026] It is explicitly stated that all features disclosed in the description and/or the claims are intended to be disclosed separately and independently from each other for the purpose of original disclosure as well as for the purpose of restricting the claimed invention independent of the composition of the features in the embodiments and/or the claims. It is explicitly stated that all value ranges or indications of groups of entities disclose every possible intermediate value or intermediate entity for the purpose of original disclosure as well as for the purpose of restricting the claimed invention, in particular as limits of value ranges.

Claims

1. A dust collector comprising:

   a tank (2) having a suction port (13);
   a main body (4) having a motor (5) and a fan (6) and provided in an upper portion of the tank (2);
   a bag-shaped primary filter (15) provided in the tank (2) for partitioning the suction port (13) and the main body (4), and
   a secondary filter (17) for partitioning the suction port (13) and the main body (4) on an upper side of the primary filter (15) so as to protrude in a closed-end tubular shape toward an inner side of the primary filter (15),
   characterized in that due to a rotation of the fan (6) in accordance with driving of the motor (5), ambient air is sucked from the suction port (13) and is discharged to an external portion through the tank (2) and the main body (4), whereby dust sucked with the ambient air can be captured by means of the primary filter (15) and the secondary filter (17),
   wherein an elastic body (22) having air permeability is interposed between the primary filter (15) and the secondary filter (17) in such a manner as to cover at least the entirety of an inner side surface of the primary filter (15).

2. A dust collector as claimed in claim 1, **characterized in that** the elastic body (22) is constituted by a plate-like sponge.

3. A dust collector as claimed in claim 1 or 2, **characterized in that** a reinforcing portion (23) brought into

close contact with an inner bottom surface of the secondary filter (17) is provided on a lower surface of the main body (4) .

4. A dust collector as claimed in claim 2, **characterized in that** the plate-like sponge (22) is formed in a tubular shape in conformity with an inner side surface of the primary filter (15) for being housed in the primary filter (15).

5. A dust collector as claimed in claim 1, **characterized in that** the elastic body (22) is stuck to an inner surface of the primary filter (15).

6. A dust collector as claimed in claim 1, **characterized in that** the tank (2) is circular with a closed end, the main body (4) has a tank cover (7) closing an upper opening of the tank (2) for being mounted on an upper side of the tank (2), and the main body (4) is fixed to the tank (2) by locking a hook provided on an upper side of a side surface of the tank (2) on to the peripheral edge of the tank cover (7), in a state of being mounted on the tank (2).

7. A dust collector as claimed in claim 1, **characterized in that** the primary filter (15) is a closed-end bag body which has an opening in an upper portion and is formed in a bowl shape in which a diameter becomes gradually smaller toward a lower side, and the primary filter (15) partitions the main body (4) and the suction port (13) within the tank (2) by locking a hook (16) provided on the periphery of the opening, on to the periphery of the upper opening of the tank (2).

8. A dust collector as claimed in claim 1, **characterized in that** the primary filter (15) is applied to antistatic finish.

9. A dust collector as claimed in claim 1, **characterized in that** the secondary filter (17) comprises:

a top plate (18) at an upper end for being locked on to the periphery of the upper opening of the tank (2);
a bottom plate (19) at a lower end, and
a filter member (20) arranged between the top plate (18) and
the bottom plate (19).

10. A dust collector as claimed in claim 3, **characterized in that** the reinforcing portion (23) is a ring-shaped rib which is protruded toward a lower side on a concentric circle with the suction air port (10) provided on a lower surface of the main body (4).

11. A dust collector as claimed in claim 1, **characterized in that** a guide member (14) for guiding air to a bottom portion of the tank (2) is provided at the suction port (13) of the tank (2).

12. A dust collector as claimed in claim 1, **characterized in that** a caster (3) is provided in a bottom portion of the tank (2).

FIG. 1

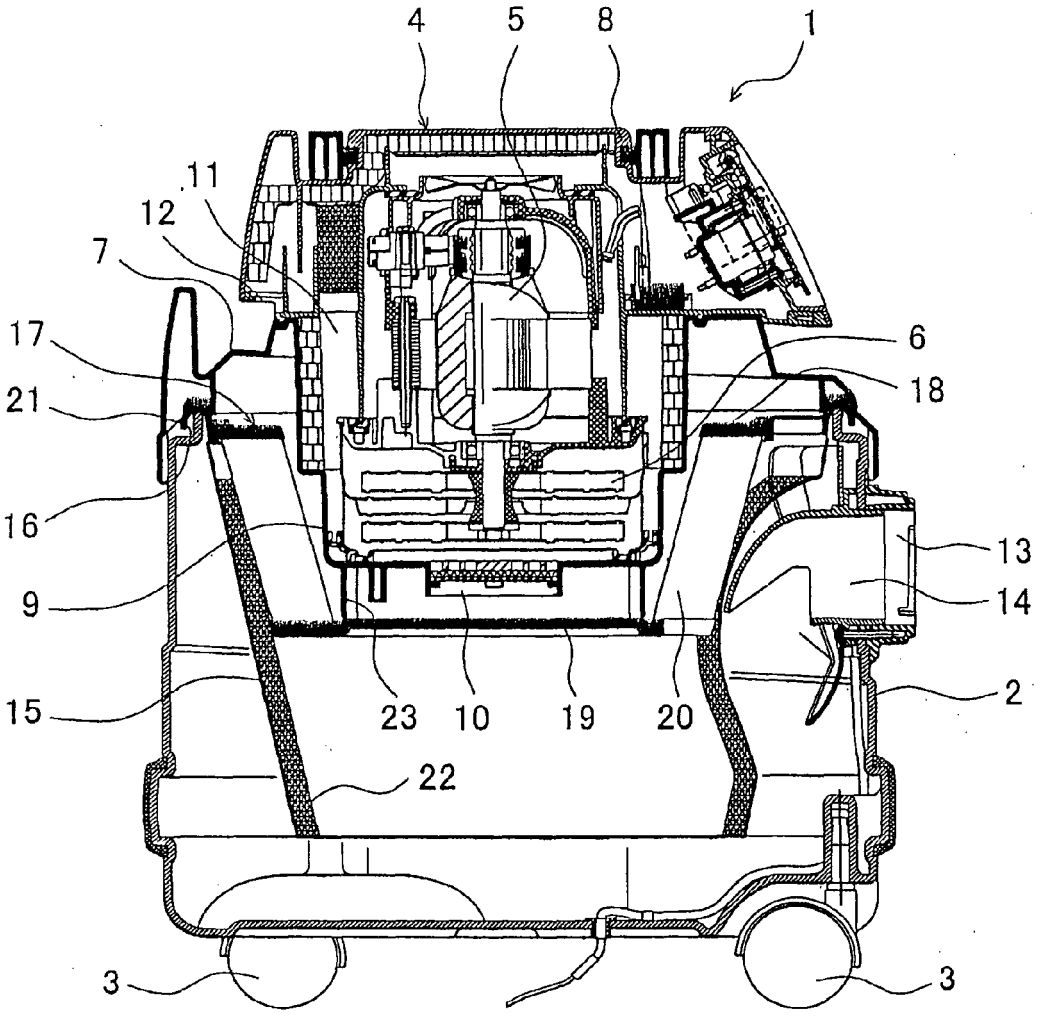
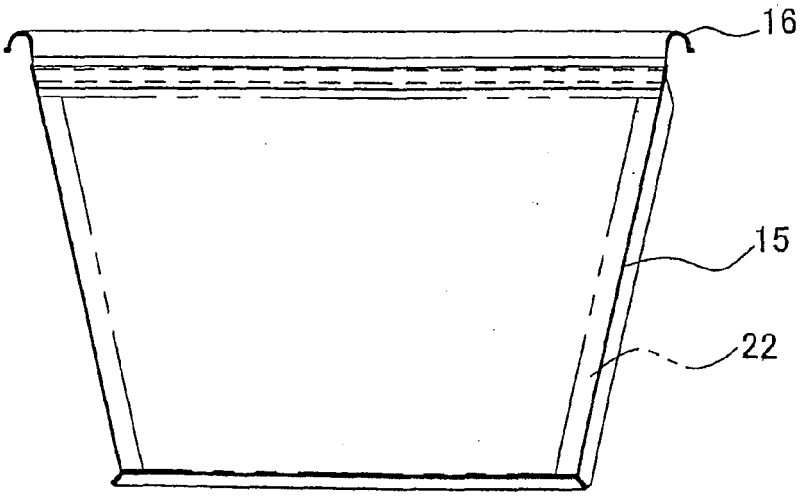


FIG. 2



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2002045318 A **[0003]**