

Sept. 27, 1960

C. A. BROCK
VACUUM CLEANER

2,954,095

Filed Sept. 30, 1957

2 Sheets-Sheet 1

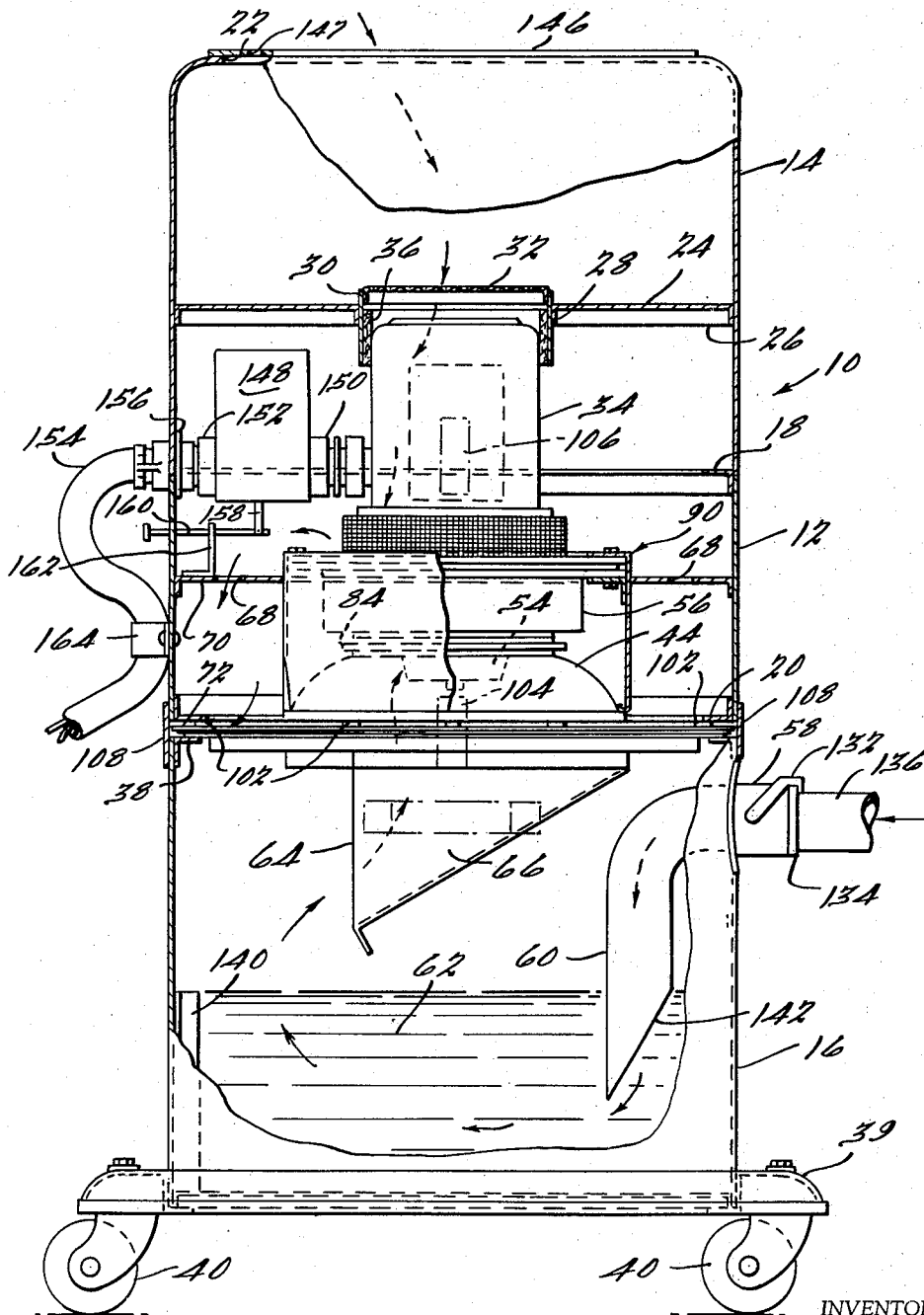


FIG. 1.

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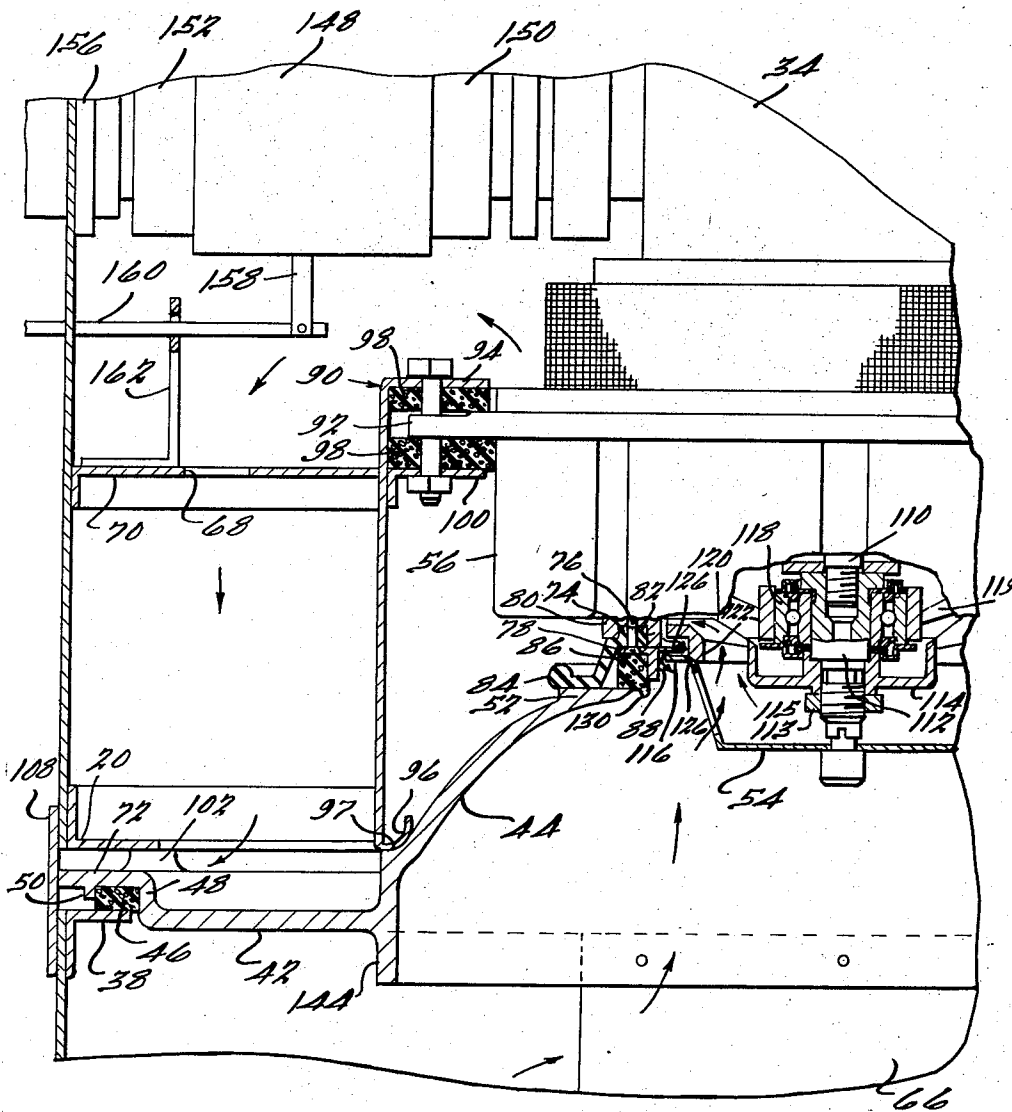
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Fi. 2.

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2,954,095

VACUUM CLEANER

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Filed Sept. 30, 1957, Ser. No. 686,921

5 Claims. (Cl. 183—22)

This invention relates to vacuum cleaners, pertaining particularly to vacuum cleaners of the type disclosed in my copending application, Serial No. 565,336, filed on February 14, 1956, now Patent No. 2,886,127 granted May 12, 1959, and my patents 2,221,572, granted November 12, 1940 and 2,228,750, granted January 14, 1941.

The main object of the invention is to improve the separation of dust from air in a vacuum cleaner and to improve the separation of dust and liquids from air in cleaners utilizing liquid baths.

Another object of the invention is to provide a water-bath type vacuum cleaner having an improved pan construction that enables a fan motor combination to be employed which is capable of developing a relatively higher capacity for air flow than prior vacuum cleaners.

Another object of the invention is to provide a water-bath type vacuum cleaner having a pan construction incorporating a baffle to protect the rotatable separator of the vacuum cleaner from excessive spray and from direct water splashing.

Another object of the invention is to provide a water-bath type vacuum cleaner having an input nozzle with an end configuration which facilitates swifter air exit into the water disposed in the bottom of the vacuum cleaner, and better trapping of dust particles.

It is another object of the invention to provide a water-bath type vacuum cleaner that is entirely explosion proof in design and has increased capacity for air flow.

The manner of accomplishing the foregoing objects and other objects of the invention, may be more fully understood from the following description of an embodiment of the invention when read with reference to the accompanying drawings in which:

Fig. 1 is a side elevational view of a vacuum cleaner embodying the principles of the present invention; and

Fig. 2 is an enlarged sectional view of a portion of the structure represented in Fig. 1.

The disclosed vacuum cleaner comprises a container 10 having three interjoined but detachable portions; a main housing portion 12, a cap assembly 14 and a pan assembly 16. The main housing portion 12 includes a generally circular cylindrical sheet metal element having reinforcing rings 18 and 20 of angle shaped cross section secured at the periphery of the upper and lower ends thereof, as by spot welding or any other suitable means. It will be observed that the downwardly extending flanges of the rings 18 and 20 are secured to the inner surface of the main housing portion and that the upper horizontally disposed flange of the ring 18 projects above the top edge of the main housing portion 12.

The cap assembly 14 also includes a generally circular cylindrical sheet metal element having the upper end thereof spun over to define a circular aperture 22, while the lower end of the upper cap assembly fits over and intimately engages the reinforcing ring 18 affixed to and projecting from the upper end of the main housing portion 12. The sliding engagement between these parts is such as to inhibit the flow of air therebetween but yet

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permit the removal of the cap assembly 14 if the occasion for such should arise. An intermediate washer shaped sheet metal element 24 has an outer downwardly extending flange 26 secured to the inner surface of the upper cap assembly 14, as by spot welding or other suitable means, and an inner downwardly extending flange 28 which defines a central aperture therethrough.

A cylindrical sheet metal element 30 is secured to the flange 28 of the element 24 and within the aperture defined thereby with a screen 32 mounted across the upper end thereof. The screen 32 enables air to freely pass therethrough, as indicated by the arrows, and into a motor assembly 34, but substantially reduces the passage of dust particles and other impurities. A suitable resilient material 36, such as sponge rubber, is disposed within and preferably cemented to the inner surface of the element 30 so as to engage the upper end of the motor assembly 34 to provide a resilient lateral support therefor. The main support for the motor assembly 34 will be described in greater detail hereinafter.

The pan assembly 16 has a generally circular cylindrical element having a reinforcing ring 38 of angle shaped cross section secured within the upper end thereof, as by spot welding or other suitable means, and the lower end of the pan assembly is adapted to be mounted on a base 39 having dolly wheels 40 so as to make the entire vacuum cleaner easily transportable. A molded or cast top member 42 having a dome-shaped central portion 44 is mounted over the upper end of the pan assembly with a gasket 46 therebetween to provide an air tight seal. As most clearly illustrated in Fig. 2, the periphery of the top member 42 is offset upwardly to provide an annular flange 72 having vertical portions 48 and 50 which tend to enclose the gasket 46 to more effectively prevent the passage of air into the pan assembly. To further reduce the possibility of the passage of air, the gasket 46 is preferably cemented to the reinforcing ring 38 and the engaged portions of the top member 42. It will be observed that the vertical portion 50 of the top member 42 is relatively short so that the lower end thereof is spaced apart from the reinforcing ring 38 to insure that it will not contact the reinforcing ring when the gasket material 46 is compressed due to the vibrations of the upper portion of the vacuum cleaner caused by the operation of the motor and fan assembly as will be described in greater detail hereinafter.

The upper end of the dome-shaped portion 44 terminates in an annular flange 52, the upper surface of which is planar, or slanting inward and downward to tend to cause any water lying thereon to flow into the pan when the pan is opened, that is when the elements mounted thereon are removed.

The motor assembly 34 is supported within the main housing portion 12 in a manner to be described, and the motor therein is adapted to drive both a lower separator 54 and a multi-stage fan disposed within an adapter 56 so as to draw air through a socket 58 and pipe 60, over or through water 62 lying in the bottom of the pan assembly 16, through open end 64 of a baffle 66, and thence through the separator 54 and fan which course is clearly disclosed in Fig. 1 by the appropriate arrows. As further indicated by the arrows the air is exhausted from the upper end of the fan and passes downwardly through apertures 68 in a washer shaped sheet metal element 70 and thence out to the atmosphere through the space between the lower flange of the reinforcing ring 20 and the annular flange 72 at the periphery of the top member 42.

As most clearly illustrated in Fig. 2, the adapter 56 is resiliently supported for limited vertical movement relative to the main housing portion 12 by means including support ring 74, preferably formed from a resilient material such as rubber. The support ring 74 is secured to

the adapter by means of a plurality of annularly disposed screws 76 passing through apertures therein and in the flange portion of a clamping ring 78, and threadably engaging apertures in the adapter 56. To insure a secure engagement between the support ring 74 and the adapter 56, the adapter is provided with vertically extending flanges 80 and 82 which tend to enclose the support ring to provide a better seal against air and to prevent the support ring from slipping radially outwardly.

Dual air sealing means are provided for insuring that air from the atmosphere can enter the pan assembly 16 only through the socket 58. As one of those means, the support ring 74 is provided with a radially outwardly extending lip portion 84, the outer edge of which is beaded as a reinforcement and the under surface of which is adapted to engage, over a horizontal annulus of substantial width, the upper surface of the flange 52 of the dome-shaped portion 44. As the other such means, a gasket 86, preferably formed of a resilient material such as sponge rubber, is disposed in the annular cavity defined by the inner face of the lower portion of the support ring 74, by the under surface of the flange of the clamping ring 78, and by the outer surface of a gasket flange 88 which depends downwardly from and is preferably integral with the inner clamping ring 78. The gasket 86 is preferably cemented to the clamping ring 78, and the under surface of that gasket is adapted to engage, over a horizontal annulus of substantial width, the upper surface of the flange 52.

The configuration of the support ring 84 and the thickness of the gasket 86 are selected so that when the pan assembly 16 is mechanically latched to the main housing portion 12, in a manner to be described, gasket 86 is slightly compressed and lip 84 is deflected somewhat from its normal, free position so that both elements continuously exert a force to maintain themselves in contact with the upper surface of the flange 52. The sealing effect is emphasized when the machine is in operation in two ways. First the pressure differential between the inside and outside of the pan assembly 16 tends to force the support ring lip 84 more tightly into engagement with the upper surface of the flange 52. Additionally, a flexible support 90 for upper flange 92 of the adapter 56 permits a limited amount of vertical motion of the adapter relative to the main housing portion 12 and hence, relative to the pan assembly 16 and top member 42 with the adapter 56 and motor assembly mounted thereon moving vertically downwardly toward the pan assembly when the machine is in operation due to the propelling effects of the multi-stage fan assembly (not shown) disposed within the adapter 56. In practice, the amplitude of this motion may be in the order of one-eighth of an inch. This downward motion further increases the engaging forces between the sealing elements 84 and 86 and the flange 52, tending further to deflect the former and tending further to compress the latter. It will be noted that the described type of mounting for the adapter 56 not only permits an enhancing of the sealing to the pan assembly 16, but also the resilient nature of the support results in there being substantially no transmission of the motor vibration to the pan assembly 16 or to the main housing portion 12.

It will be appreciated that the support ring 74 provides an excellent seal to the pan assembly 16 so that the provision of the gasket 86 is not imperative for proper sealing, however, as will be seen, the gasket 86 serves another important function so that its use is desirable.

The flexible support 90 for the upper flange 92 of the adapter 56 includes a generally circular cylindrical sheet metal element having a horizontal, radially inwardly extending flange 94 on the upper end thereof and a rolled edge 96 on the lower end thereof adapted to rest on a rounded shoulder 97 disposed about the periphery of the dome-shaped portion 44. Suitable resilient support rings 98, preferably made from sponge rubber, are disposed on either side of the flange 92 of the adapter 56 and a

clamping ring 100 is disposed beneath the lower resilient supporting ring 98 with a bolt and nut passing through the elements to draw the reinforcing ring 100 upwardly to maintain the resilient support rings 98 in contact with the flange 92. The washer-shaped reinforcing sheet metal element 70 is secured to the cylindrical sheet metal element of the flexible support 90, and a circular downwardly extending flange at the periphery of the element 70 is secured to the inner surface of the main housing portion 12 to provide a lateral support for the adapter 56.

From the above description it is apparent that the rolled lower edge 96 of the flexible support 90 supports the adapter 56 on the curved shoulder 97 of the dome-shaped portion 44. To further stabilize these elements, resilient pads 102 are disposed between the reinforcing ring 20 mounted within the lower end of the main housing portion and the annular flange 72 at the periphery of the top member 42. It is apparent that the pads 102 also maintain the space between the ring 20 and flange 72 to permit the air to be exhausted therethrough as previously described.

Suitable clamps 104, as illustrated in dotted lines in Fig. 1 are provided for mechanically locking the main housing portion 12 to the pan assembly 16, and similar clamps 106 are provided on either side of the container 10 to mechanically lock the cap assembly 14 to the main housing portion 12. In addition, a plurality of guides 108, preferably welded to and extending from the bottom of the main housing portion 12 are disposed about the container so as to guide the main housing portion onto the pan assembly 16 to insure that the separator 54 is centered relative to the dome-shaped portion 44 as the main housing portion is advanced downwardly relative to the pan assembly.

As most clearly illustrated in Fig. 2, the separator 54, which may be of the type disclosed in my Patent 2,228, 750, and my aforesaid copending application, is secured to motor shaft 110 by a stud shaft 112. A nut 113 is screwed on the stud shaft 112 to secure hub portion 114 of spider assembly 115 of the separator 54 against a shoulder on the stud shaft. The rotatable separator 54 effectively serves to permit the passage of air from the cavity of the pan assembly 16 upwardly therethrough, under the pressure differentials created by the fan assembly disposed within the adapter 56, but to prevent the movement of dust or moisture therethrough.

The separator 54 terminates in a generally horizontal annular flange 116 and a rotational clearance is established between the peripheral edge of the flange 116 and the adapter 56, or parts integral therewith, in this case the wall of the flange 88. In order to prevent moisture and dust-laden air from flowing upwardly from the pan assembly 16 through the annular gap around the flange 116, in bypass of the separator 54, the spider assembly 115 is provided to establish a down draft of clean air through the annular air gap to oppose and prevent the upward passage of dust or moisture-laden air there-through.

In its disclosed form, spider assembly 115 includes the hub shaped portion 114 partially enclosing a bearing assembly 118 appropriately supported on the adapter 56 by a plurality of relatively thin, radially extending ribs 119 so that the bearing assembly rotatably supports the stud shaft 112. Hence the hub portion 114 of the spider assembly 115 provides the requisite protection for the bearing assembly 118 without the need for a separate bearing cover, thereby permitting a reduction in the overall height of the assembly. A plurality of blades 120 extend radially from the hub portion 114, the tips of the blades being interjoined by a ring structure 122 which includes a peripheral notch 124 in which the inner peripheral edge of the separator 54 is seated. The outer tips of the blades 120 and the outer edge of the ring 122 extend into spaced proximity to the vertical flange 82 of the adapter 56. Hence, while the major portion of the air passing through

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the separator 54 is directed upwardly through the adapter, an ancillary air flow is established by the blades 120, clean air flowing downwardly between the peripheral edge of the ring 122 and the flange 82 and through the space between the flange 116 on the separator 54 and radially inwardly extending flange 126 of the clamping ring 78, returning to the pan assembly 16.

The flange 52 of the dome-shaped portion 44 is identical to the flange 52 on the pan assembly 50 of my aforesaid copending application, and likewise the separator 54 and lower portion of the support ring 74 with its radially outwardly extending lip portion 84 are identical to the corresponding elements of my copending application. Therefore, if desired, the main housing portion 12 of the present invention and everything connected thereto may be removed from the top member 42 and pan assembly 16, and the main housing portion 12 of my copending application together with the motor assembly and fan supported therein can be mounted directly on the flange 52 of the dome-shaped portion 44 to provide a lower capacity fan motor combination in conjunction with the pan assembly 16 of the present invention.

A further advantage of the disclosed construction is the reduction of drippage when the main housing portion 12 and components mounted thereon are removed from the pan assembly 16. Since water does not tend to collect upon the separator 54 due to its rapid rotational motion in use, the total possible drippage of water to the floor when the main housing portion 12 is disconnected is minimal since the total area, other than those noted, upon which water droplets can collect, is very small. To a large part, this advantageous result is achieved by the use of the gasket 86 which blocks water droplets or moisture-laden air from contacting the undersurface of ring 74 or the undersurface of clamping ring 78. Gasket 86 also serves to keep the upper surface of flange 52 dry, preventing the accumulation of water on that surface which has been an objectionable characteristic of certain of the prior constructions.

If desired, a portion 130 of gasket 86 may be formed as a narrow depending lip terminating in a fine edge, as is represented in somewhat exaggerated form in Fig. 2 of the drawings. Alternatively, if the undersurface of resilient gasket 86 is made substantially planar a depending lip will tend to form since the under edge of the gasket 86 is unsupported and since the remainder of that gasket is, to a high degree, compressed. If a depending lip be formed in either fashion any water droplets tending to collect on the exposed portion of gasket 86 will tend immediately to run down and off of the gasket so that substantially all the dripping will be completed before the pan assembly 16 is removed.

Referring to Fig. 1, the socket 58 has a lock member 132 which is pivotally mounted thereon so as to engage an annular flange 134 on a coupling 136 of a flexible hose (not shown), the remote end of that hose being connected or connectable to a number of known types of nozzle attachments. The hose is the same diameter as the end of the coupling which serves to connect the hose to the socket 58. If desired, the flange 134 may be eliminated and the projecting portion of the coupling 136 may be reduced in diameter to form a shoulder that can be engaged by the lock member 132 to lock the connecting portion in the socket 58. By this arrangement, the socket 58 and the lock member 132 can receive and lock hoses of different diameters such as, for example, a one and a half inch diameter hose when the motor fan combination of the present invention is employed, and a one and a quarter inch diameter hose when the motor fan combination of my copending application is employed.

In the preferred use of the device, the lower portion of the pan assembly 16 contains an appropriate quantity of water 62, in which the dust, dirt and other particles may be dissolved or suspended, a representative level of

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which is indicated as equal to the height of a water gauge 140 disposed adjacent one side of the pan assembly 16. The lower end of the pipe 60 is preferably disposed within the water 62 and is preferably cut off at an angle to provide an elliptical shaped opening facing to the right so that any splash created by the force of air flowing through the pipe and entering the water will be directed toward the right and away from the separator 54, as well as, away from the opening 64 of the baffle 66. The elliptical shaped opening 142 at the end of the pipe will tend to give a swift air exit for a given c.f.m. flow of air through the pipe, and better trapping of dust and other particles.

An important feature of the invention is the provision of the baffle which is mounted on a circular flange 144 depending downwardly from the top member 42 by any suitable means such as screws. The oval shaped opening 64 on the left side of the baffle 66 is the only opening in the baffle through which the air can pass upwardly into the separator 54 and consequently any splashing or water spray generated by the force of the air flowing into the pan assembly through the pipe 60 cannot directly reach the separator. This protects the separator against direct splash and spray.

Another problem frequently encountered in water-bath type vacuum cleaners is that as the cleaners are moved about, the water 62 tends to splash around so that it may be splashed directly against the separator 54. The present invention substantially eliminates this by providing the downwardly extending flange 144 on the top member 42 which serves as a baffle against water which is splashed up the sides of the pan assembly 16 when the vacuum cleaner is jerked during movement. Further, the right angle between the top member 42 and sides of the pan assembly tends to inhibit the splashing or flow of water up the sides of the pan assembly when the vacuum cleaner is jerked or moved. Experience has proved that these latter features directed toward preventing the direct splashing of water, as well as, water spray from reaching the separator, permits a higher capacity fan motor combination to be used since the pumping and splashing of water heretofore present in prior models due to the high pressure differentials is greatly diminished.

Again referring to Fig. 1, the aperture 22 in the upper end of the cap assembly 14 provides access to the cap assembly to enable tools and the like to be disposed therein so that the cap assembly may be used as a storage space. The washer-like sheet metal element 24 serves as the bottom shelf for supporting tools and other articles placed within the upper cap assembly. If desired, a suitable sheet metal cover 146 may be secured in position over the aperture 22 by suitable means (not shown) to provide a cover for the aperture 22. Of course, if such a cover is employed, suitable apertures 147 or the like would have to be provided therein to enable air to be drawn through the cover 146, the screen 32 and the motor assembly 34, and thence exhausted into the main housing portion 12 from where it is exhausted to the atmosphere as previously described. A suitable auxiliary fan (not shown) is incorporated in the top of the motor assembly 34 to draw the air therethrough.

In the above described embodiment, the entire vacuum cleaner is of explosion-proof design and includes the explosion-proof motor assembly 34, an explosion-proof switch 148, an explosion-proof coupling 150 connecting the switch to the motor assembly, an explosion-proof coupling 152 for connecting the switch to an electrical cord 154 having the other end thereof adapted to be connected to a commercial explosion-proof plug (not shown) and a gasket 156 secured thereover to provide an air-tight seal. Of course, the reinforcing ring 18 is interrupted at the coupling 152 to provide room for the coupling to pass therethrough. To further enhance the explosion-proofing of the vacuum cleaner an actuating

arm 158 for the switch 148 is located within the main housing portion 12 and suitable means 160 projecting through the wall of the main housing portion 12 and movably mounted on a bracket 162 is provided for operating the actuating arm 158 from outside the main housing portion 12. A bracket 164 is also provided for attachment to the outer surface of the main housing portion 12 to clamp the explosion-proof cord 154 to reduce the possibility of the cord being accidentally disconnected from the coupling 152. To further enhance the explosion-proofing of the vacuum cleaner, all rubber and sponge rubber material used, including the rubber of the wheels 40, is electrically conductive so that the entire vacuum cleaner will at all times be grounded.

Although the adapter 56 is illustrated as having the upper flange 92 thereof supported by the flexible support 90 which includes the circular cylindrical sheet metal element having the flange 94 on the upper end thereof and a rolled edge 96 on the lower end thereof, it is readily apparent that the upper flange 92 of the adapter could be similarly supported in a number of other ways. For example, the washer-shaped sheet metal element 70 could be extended radially inwardly beneath the lower resilient support ring 98 and a separate compressing ring could be positioned above the upper support ring 98 and drawn toward the element 70 by the nut and bolt illustrated in Fig. 2 so as to compress the support rings 98 therebetween. In this manner, the circular cylindrical element having the rolled lower edge 96 and the reinforcing ring 100 could be eliminated to provide a less expensive construction for resiliently supporting the upper flange 92 of the adapter 56.

While it will be apparent that the embodiments of the invention herein disclosed are well calculated to fulfill the objects of the invention, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In a vacuum cleaner, a pan assembly adapted to hold water, a top closure member having a dome-shaped central portion terminating at one end in an upper generally annular surface defining a central opening with a circular flange depending downwardly from the other end thereof, said top closure member being sealed to the upper end of the pan assembly, an adapter surmounting said annular surface, means including a resilient gasket interposed between said adapter and said annular surface, a fan mounted within said adapter, a motor assembly surmounting said fan and adapter and having a shaft extending downwardly therefrom for rotatably driving the fan, a stud shaft affixed to the lower end of said shaft to provide an extension thereof projecting beneath said adapter and into said central opening in the top closure member, a rotatable separator element mounted on said stud shaft for processing the air passing therethrough, a main housing portion mounted on said top closure member in spaced relation thereto and resiliently supporting said adapter, and an upper cap assembly mounted on said main housing portion.

2. In a vacuum cleaner, a pan assembly adapted to hold water, a top closure member having a dome-shaped central portion terminating at one end in an upper generally annular surface defining a central opening with a circular flange depending downwardly from the other end thereof, said top closure member being sealed to the upper end of the pan assembly, an adapter surmounting said annular surface, means including a resilient gasket interposed between said adapter and said annular surface, a fan mounted within said adapter, a motor assembly surmounting said fan and adapter and having a shaft extending downwardly therefrom for rotatably driving the fan,

a stud shaft affixed to the lower end of said shaft to provide an extension thereof projecting beneath said adapter and into said central opening in the top closure member, a rotatable separator element mounted on said stud shaft for processing the air passing therethrough, a main housing portion mounted on said top closure member in spaced relation thereto and resiliently supporting said adapter, an upper cap assembly mounted on said main housing portion, said motor assembly having an auxiliary fan therein for drawing air therethrough to cool the motor, means mounted within said upper cap assembly for providing a resilient lateral support for the upper end of the motor assembly, and a screen mounted on said means and adjacent the upper end of the motor assembly for filtering the cooling air passing into the motor assembly.

3. The subject matter as claimed in claim 2 wherein said lateral support provides a shelf within the upper cap assembly and the upper end of the cap assembly has an opening therein to permit tools and other articles to be stored within the upper cap assembly.

4. A vacuum cleaner comprising a pan assembly adapted to hold water and having a side wall, a bottom and a top closure with an aperture therein, fan means mounted on said top closure for drawing air into the pan assembly and out through said aperture, an inlet pipe having the lower end thereof extending downwardly into said pan assembly for directing incoming air into the water at a point adjacent the wall of the pan assembly, means on the upper end of said inlet pipe adapted to be connected to a vacuum cleaner hose means, said lower end of the pipe being cut off at an angle so as to terminate in an elliptical shaped opening facing toward a first portion of said side wall of said pan assembly nearest said pipe, and baffle means for enclosing said aperture in the top closure to protect said fan means from direct water spray or splash, said baffle means having an aperture therein facing in a direction opposite to the direction in which said elliptical shaped opening faces and facing toward the portion of said side wall of said pan assembly which is opposite said first portion.

5. A vacuum cleaner comprising a pan assembly adapted to hold water and having a side wall, a bottom and a top closure with an aperture therein, fan means mounted on said top closure for drawing air into the pan assembly and out through said aperture, an inlet pipe having the lower end thereof extending downwardly into said pan assembly for directing incoming air into the water at a point adjacent the wall of the pan assembly, the opening in said lower end of the pipe facing toward a first portion of said side wall nearest said pipe, means on the upper end of said inlet pipe adapted to be connected to a vacuum cleaner hose means, and baffle means for enclosing said aperture in the top closure to protect said fan means from direct water spray or splash, said baffle means having an aperture therein facing in a direction opposite to the direction in which said opening in the lower end of the pipe faces and facing toward the portion of said side wall of said pan assembly which is opposite said first portion.

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