Nov. 12, 1940. C. A. BROCK ET AL 2,221,572

VACUUM CLEANER CONSTRUCTION

Filed Dec. 24, 1937 3 Sheets-Sheet 1

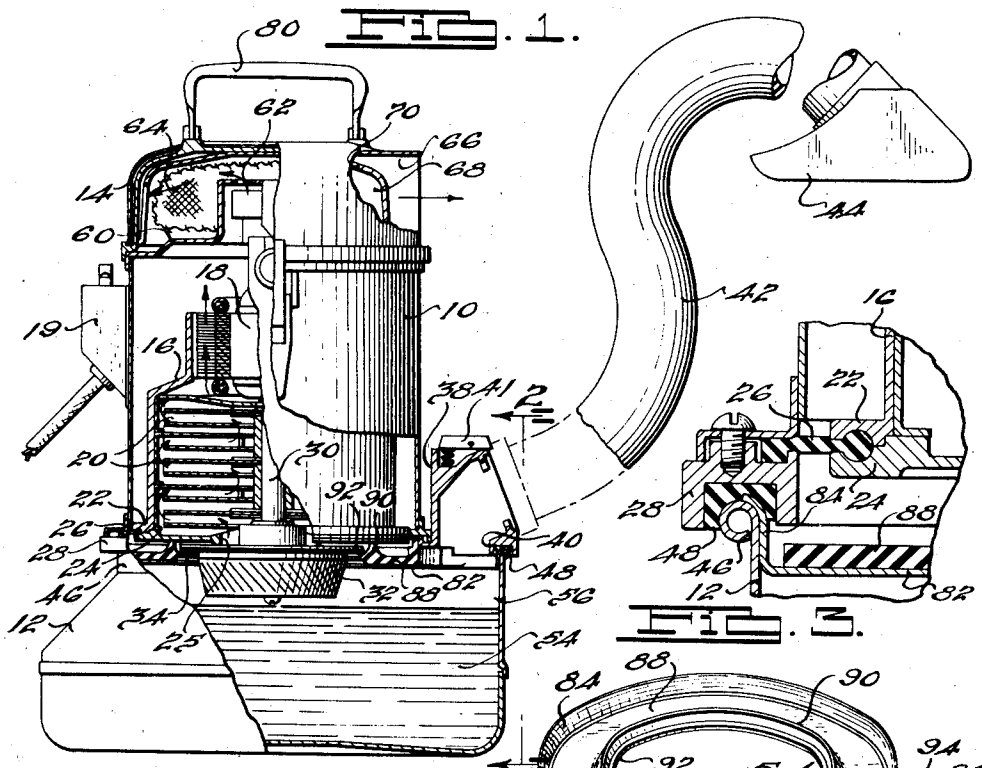

FIG. 1.

FIG. 3.

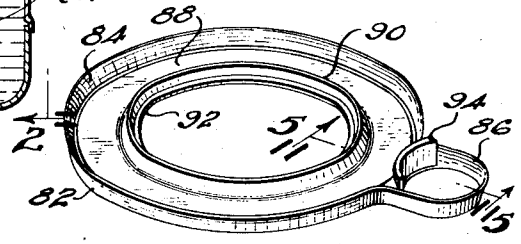

FIG. 4.

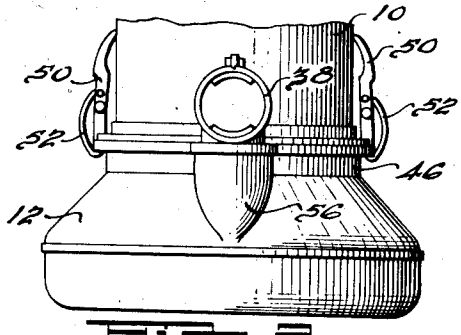

FIG. 2.

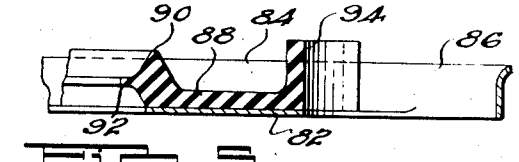

FIG. 5.

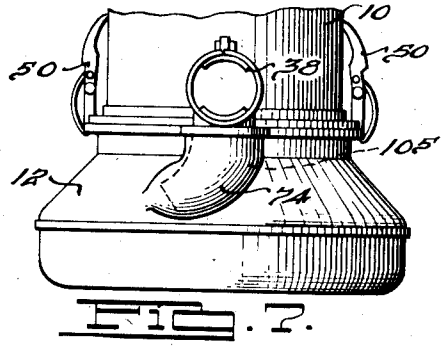

FIG. 7.

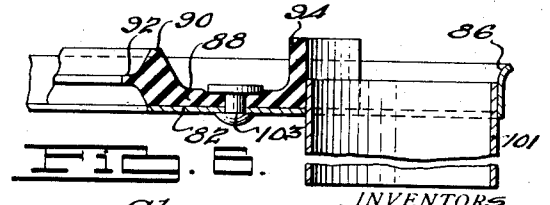

FIG. 6.

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Fig. 8.

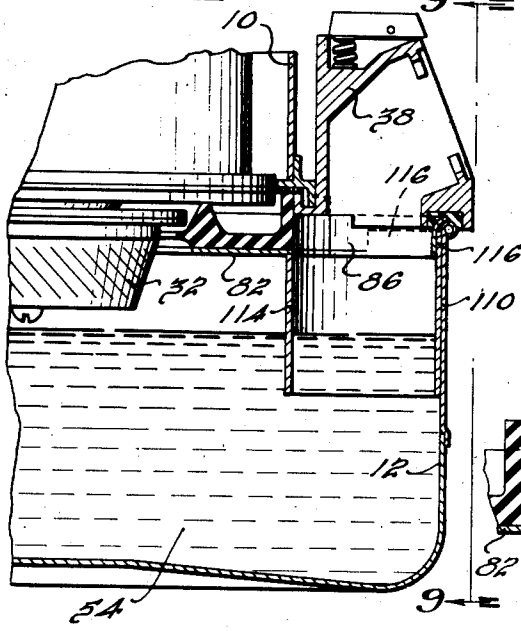
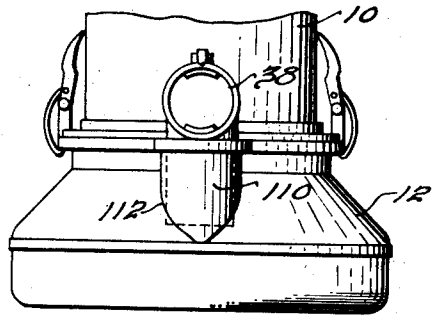


Fig. 9.



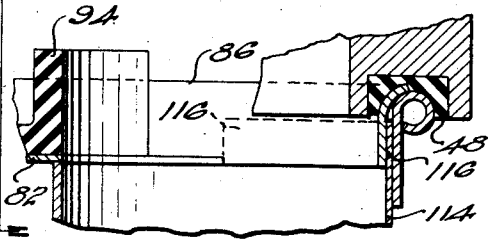


Fig. 10.

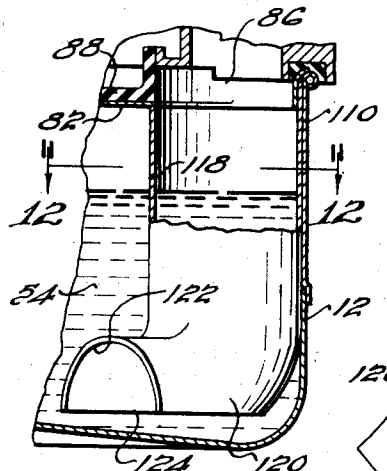


Fig. 11.

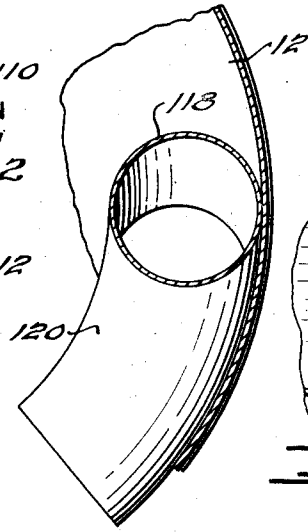


Fig. 12.

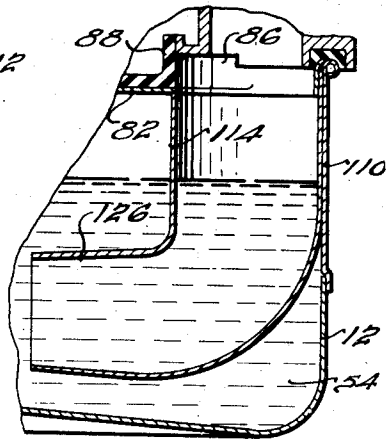


Fig. 13.

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VACUUM CLEANER CONSTRUCTION

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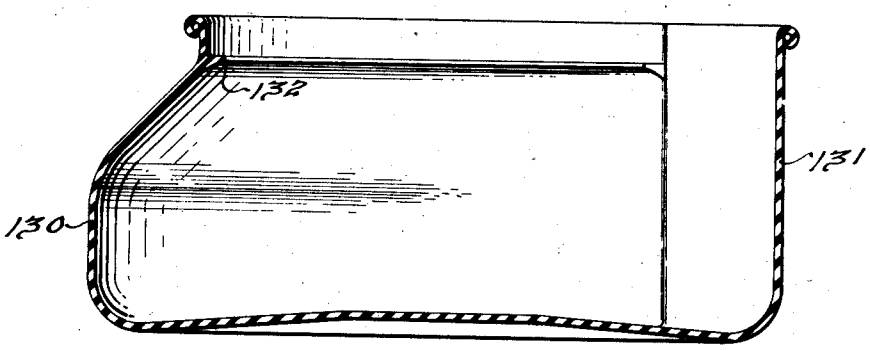

Fig. 14.

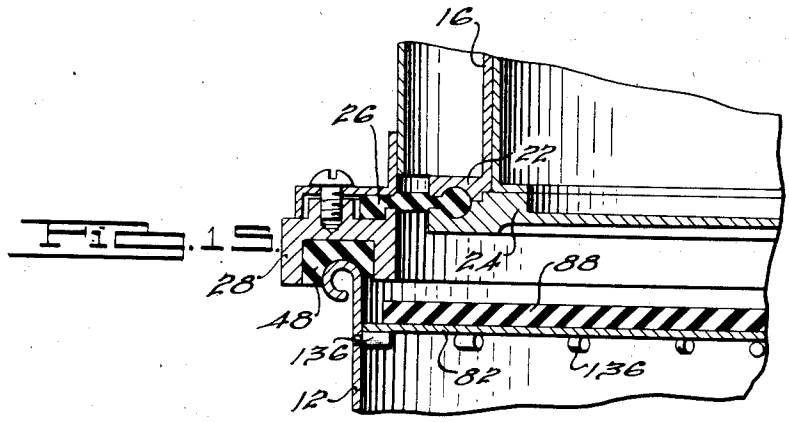

Fig. 15.

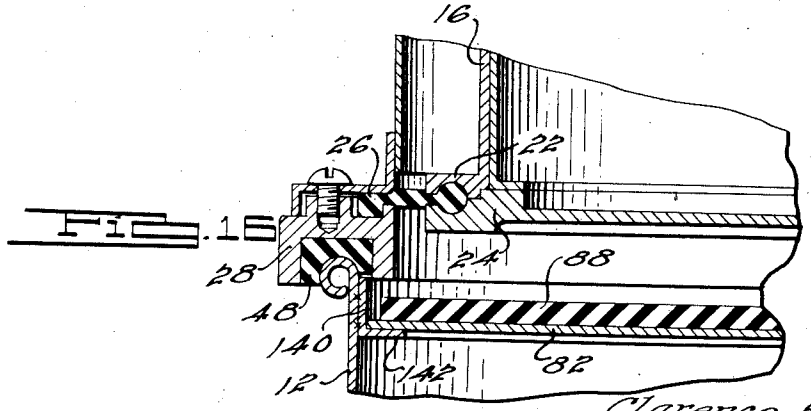

Fig. 16.

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Patented Nov. 12, 1940

2,221,572

UNITED STATES PATENT OFFICE

2,221,572

VACUUM CLEANER CONSTRUCTION

Clarence A. Brock, Detroit, Mich., and Nodiah E. Hutchens, Toledo, Ohio, assignors to Rexair, Inc., Detroit, Mich., a corporation of Delaware

Application December 24, 1937, Serial No. 181,582

7 Claims. (Cl. 183—25)

The present invention relates generally to an apparatus for treating air, and particularly relates to a portable vacuum cleaner designed for treating air by impinging the air against the surface of or otherwise bringing it into contact with a liquid bath to treat the air according to the type of liquid used as the bath.

While the specific embodiment of the invention herein shown and described is illustrated as a part of a vacuum cleaner of the type above mentioned, according to certain aspects of the present invention, the invention will find practical utility in other types of structures as will become apparent from the following description to those skilled in the art.

Primary objects of the present invention are to provide a partitioning member between a bath of liquid and a motor and blower unit of a vacuum cleaner which resiliently bears against the bottom of the unit to prevent moisture, such as by splash, from getting on to the unit; to provide an auxiliary, resilient supporting member below a blower and motor unit which is of sufficient strength to support the unit in the event that the regular support for the unit gives way and which will then support the unit in operating position and deaden it against transmission of sound; to provide an annular member with a receptacle into which a rotary separator element extends in which the annular member has a resilient portion which serves to guide the separator when it is positioned within the receptacle; to provide a novel separator member having a tubular element associated therewith which is adapted to be positioned in a receptacle containing a bath of liquid so that the tubular member extends below the normal surface of the bath; and to provide a simplified vacuum cleaner structure which is economical to manufacture and which effectively increases the operating life of the cleaner.

Other objects of the invention will become apparent from the following specification, the drawings relating thereto and from the claims hereinafter set forth.

In the drawings, in which like numerals are used to designate like parts in the several views throughout:

Figure 1 is a side elevational view with parts broken away, showing parts in section, of an apparatus embodying features of the present invention;

Fig. 2 is a partial side elevational view taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is an enlarged fragmentary cross-sectional view illustrating certain details of the embodiment shown in Fig. 1;

Fig. 4 is a perspective view of a partitioning, supporting, and guiding member embodying features of the embodiment shown in Fig. 1;

Fig. 5 is a fragmentary cross-sectional view taken substantially along the line 5—5 of Fig. 4;

Fig. 6 is a view similar to Fig. 5 illustrating a modified form of the present invention;

Fig. 7 is a view similar to Fig. 2 illustrating a modified form of structure;

Fig. 8 is a fragmentary vertical cross-sectional view of another modified form of the present invention;

Fig. 9 is an elevational view on a somewhat reduced scale taken substantially along the line 9—9 of Fig. 8;

Fig. 10 is an enlarged fragmentary vertical cross-sectional view showing certain details of the structure illustrated in Fig. 8;

Fig. 11 is a fragmentary vertical cross-sectional view of a modified form of the structure illustrated in Fig. 8;

Fig. 12 is a cross-sectional view taken substantially along the line 12—12 of Fig. 11;

Fig. 13 is a view similar to Fig. 11 illustrating another modified form of the present invention;

Fig. 14 is a vertical cross-sectional view of a modified form of base receptacle; and

Figs. 15 and 16 are views similar to Fig. 3 illustrating modified structures for mounting the separator in the base receptacle according to the present invention.

The present invention relates to a structure particularly adaptable for use in the structures disclosed and claimed in the Letters Patent of the United States of Clarence A. Brock, No. 2,102,353 granted December 14, 1937, and the co-pending application for Letters Patent of the United States of Clarence A. Brock, Serial No. 130,920, filed March 15, 1937. In the patent and co-pending application referred to, vacuum cleaner structures are illustrated which include an upper casing member separably mounted to a lower base or receptacle member in which a housing is mounted in the upper casing member. The housing has mounted therein a motor and a fan unit; and a rotating dust separator is secured to the shaft of the motor and extends downwardly into the receptacle when the parts are in their assembled positions. According to the structure of the first mentioned co-pending application, a liquid bath is provided in the lower receptacle. For a better and more complete understanding of the type of liquid used in

the receptacle and the advantages of the several types of liquid which may be used, reference may be had to the patent referred to.

According to the present invention, an annular partitioning member is positioned in the lower receptacle and has an annular resilient portion which extends into close proximity to but in slightly spaced relation to the separator element so that the liquid contained in the receptacle such as by splash cannot pass upwardly onto the under surface of the upper unit. The annular member is also of such a construction that it serves as a guide in properly positioning the separator element in the lower receptacle and would also support the housing including the motor and fan in the event that the main support for the housing gave way.

Referring to the drawings for a better understanding of the invention, and referring particularly to Figs. 1 to 5, one specific embodiment of the invention is illustrated comprising a casing or housing having an intermediate portion of section 10, a lower portion 12 in the form of a pan member, and a top cover portion 14. The housing or casing is preferably constructed of sheet metal or other suitable construction and is generally circular in shape.

A blower housing 16 is mounted within the intermediate section 10 and has mounted therein a suitable electric motor 18, connected to and operated through a conventional switch structure 19, which serves to drive a plurality of centrifugal fans 20. The fans 20 provide a multiple stage blower construction tending to draw air axially upwardly through the housing 16 as indicated by the arrows in Fig. 1. The blower housing is provided at its lower end with an annular flange 22 which has a groove in the axial face thereof. A separator plate 24 has a grooved face adapted to mate with the grooved flange 22 and is secured thereto by means of suitable annularly spaced screws, or the like. An annular packing strip 26 having a beaded edge and preferably formed of rubber or suitable resilient composition is disposed with its beaded edge clamped between the separator plate 24 and the annular flange 22 by means of the screws which secure the separator member to the flange. The other, or outer, edge of the annular packing strip is secured to the lower edge of the intermediate housing section 10 between the lower edge of the section 10 and an annular flange member 28 which is secured to the section 10. The separator member 24 is provided with spaced openings 25 therethrough substantially centrally thereof for communicating the interior of the blower housing with the space within the receptacle 12.

Secured to the lower end of the blower shaft 30 for rotation therewith and spaced below the underside of the separator plate 24 and extending downwardly into the pan member 12 is a centrifugal dust separator element 32 adapted to be driven by the shaft 30. The element 32 may be formed in any conventional manner, and it has been found preferable to construct it from a single, integral sheet metal stamping to provide a frusto-conical structure having helically extending slots therethrough substantially throughout its entire peripheral surface. As disclosed in the co-pending applications, above referred to, the slots in the peripheral surfaces of the dust separator element 32 are defined by helically disposed bars which have their exterior surfaces rounded and the forward or leading edges thereof extending radially inwardly a slightly greater distance than the trailing edges. By such a construction, as the dust separator element rotates the air entering the slots therein is required to follow a relatively tortuous path and due to the inertia of the dust particles it will be seen that they will necessarily impinge upon the rounded surface of the bars and be centrifugally driven away from the elements, thus preventing their entry into the interior thereof.

The dust separator element 32 is provided at its upper axial end with a radially extending flange 34 which is suitably secured to the shaft 30 of the motor for rotation therewith. When the motor 18 is in operation, air will be drawn inwardly through the slots in the separator element 32 by means of the centrifugal blower 20 and dust or other foreign material in such air will impinge upon the rounded surfaces of the bars and be centrifugally driven away.

Secured to one side of the intermediate section 10 is a fitting 38 providing an air inlet opening 40 into the chamber within the pan member 12. The fitting 38 is provided with a spring latch mechanism 41 for releasably securing thereto one end of a flexible conduit 42 which is adapted to be suitably connected to a nozzle member 44.

The pan member 12 has inwardly and upwardly sloping walls over a portion thereof and has an upwardly extending upper peripheral edge 46 which is removably received within the flange 28 of the intermediate section 10. A sealing strip 48 of resilient material, such as rubber, is secured within the flange 28 and embraces the upper edge of the portion 46 when the parts are in their assembled positions for providing a sealed connection between the intermediate section 10 and the pan member 12. Releasable latching means 50 of suitable construction is mounted on the intermediate section 10 and has spring portions 52 which releasably engage the pan member to maintain it in its assembled position with the intermediate section 10.

The pan member 12 provides a receptacle for a bath of liquid 54 having its upper level initially extended near to or adjacent the lower extremity of the separator element 52 which bath is intended as a normal operative part of the mechanism. The pan member 12 may be made of sheet metal and is provided with an integral upstanding outwardly pressed portion 56 adjacent one side thereof which extends upwardly into engagement with the fitting 38 for providing an air inlet conduit into the interior of the pan member 12. The pan member 12 may also be formed of a suitable moldable material, such as rubber, in which case the portion 56 is molded integral with the main portion of the pan 12.

The liquid within the container may be water, a germicidal solution, oil, or other suitable liquid, solution or mixture depending upon the purpose to which the structure is to be put.

According to the present invention, an annular member 82 is provided which has an upwardly and outwardly bent outer annular flange 84. The flange 84 is also offset as indicated at 86 so that the flange 84 is complementary in shape to the shape of the upper edge 46 of the receptacle 12. An annular member 88 is suitably secured to the upper face of the member 82 by an intermediate cementing layer, and is preferably made of a material such as rubber or the like.

The member 88 has an upwardly extending edge portion 90 and a radially inwardly extending thin edge portion 92 which defines a central

opening through the partition member. The member 88 also has an upstanding portion 94 adjacent the offset portion 86 of the flange 84 to define a portion of the inlet opening.

The annular member 82 is positioned within the receptacle 12 so that the flange 84 engages the upper edge 46 of the pan member. If desired, the flange portion 84 may be made an integral part of the pan member by spot welding the flange 84 to the pan member, or it may be merely positioned in the pan member and be removable relative thereto. The thin edge portion 92 is of such a construction and arrangement that it extends to a position closely to but slightly spaced from the upper edge of the dust separator element 32 so as to prevent the passage of air above the flange portion 34 of the separator element without passing directly through the slots in the separator element. The upwardly directed annular edge 90 is of such a construction and arrangement that it bears against the under surface of the separator plate 24 when the parts are in their assembled position. The annular member 82 with its resilient portion 88 thus affords an effective partitioning member against the passage of the liquid in the form of splash or otherwise from the receptacle 12 upwardly onto the underside of the separator plate 24.

The member 82 is also of such strength that in case the member 26 which forms the sole connection between the casing 16 and the casing 10 should give way the casing 16 would be supported by the annular member 82 and the resilient portion 90 would resiliently support the motor and fan in operating position so that the sweeper would continue to operate and such operation would be deadened against sound from vibration.

A top cover member 60 is suitably secured to the hub of the intermediate section 10 and is provided with a plurality of openings 62 therethrough for the egress of air from the housing section 10. A filter member 64 is mounted on the cover member 60 to insure the complete cleaning of the air passed through the cleaner.

The top cover 14 is provided with an outlet opening 66 adjacent one side thereof, and is also provided with an annular flange adjacent the lower edge thereof which cooperates with the upper edge of the intermediate section 10 for providing a sealed connection between the cover 14 and the intermediate section 10 when the members are in their assembled positions. Means similar to those shown at 50 may be provided for removably securing the top 14 to the intermediate section 10. A substantially circular member 68, having openings 70 therethrough, is mounted to the inner wall of the top member 14 in spaced relation thereto, and in overlying relation to the filter 64 when the parts are in their assembled position. The treated or cleaned air passes outwardly through the opening 70 and is discharged through the openings 66 back into the room or space within which the cleaning unit is being used.

In operation, rotation of the centrifugal separator element 32 causes a swirling of the air within the receptacle above the surface of the bath which in turn, due to friction, causes a swirling or rotation of the bath. This rotation of the bath may, or may not, create a spray or sheet of liquid above the periphery of the bath, depending upon the speed of rotation of the separator. Where such spray or sheet is created all of the air entering the pan 12 will be caused to pass through it, and will be more intimately treated thereby. The air being drawn into the pan member 12 by the blower 20 is caused to pass over the surface of the bath in contact therewith before entering the separator, and any foreign materials carried by the entering air are removed from the air and fixed by the bath in its association with the centrifugal separator. The treated or cleaned air is caused to pass through the slots in the element 32 into the blower housing, through the openings 25 and upwardly therethrough, as indicated by the arrows, into the interior of the housing section 10 out through the top of the cleaner.

Referring to Fig. 6, a modified structure is provided in which a short tubular member 101 is provided which is adapted to be secured to the pan member 82 within the inlet opening defined by the flange portion 86 and the curved portion 94. The tubular member 101 is of such a length that it is adapted to extend downwardly below the top surface of the liquid bath 54 to provide an air inlet conduit. The outlet of the air inlet conduit formed by the member 101 is thus normally below the surface of the liquid bath which necessitates the pasage of air through the bath 54 before entering the free space within the pan member 12 within which the separator element 32 is located. This causes the immediate submersion of air to make the separation of dust more positive, and further assures adequate contact of the entering air when a germicidal liquid is used in the receptacle for treating the air. In this structure, although the separator element 32 may be dispensed with, the separator is desirable as it will act to separate out unvaporized particles of water from the air before the air passes through the blower and is redischarged back into the room or space within which the unit is being used. Further, when the centrifugal separator is used with this structure, it need not be rotated at the high speed necessary in the embodiment previously described as the air entering the separator is already free of any foreign materials.

In the embodiment illustrated in Fig. 6 instead of securing the annular resilient member 88 to the annular member 82 by cementing, as the embodiment described above, the member 88 is secured to the annular member 82 by a plurality of annularly spaced rivet members 103 which extend through the member 82 and the resilient member 88.

In another modified structure illustrated in Fig. 7 an element 74, corresponding to the portion 56, defines an air inlet conduit and tangentially enters the chamber within the pan member 12. A short tubular member 105, which is fixed to the partitioning member 82 in the same manner that the tubular member 101 is fixed thereto, is provided. The tubular member 105 is complementary in shape to the tangentially disposed portion 74 and provides an air inlet conduit confining the passage of air into the receptacle 12. The air entering the receptacle 12 through the inlet conduit 105 thus assists the separator element 32 in causing swirling of the liquid bath within the receptacle 12, thereby causing separation of the foreign material carried by the air.

Referring to Figs. 8 to 10, another modified structure is illustrated in which the air inlet portion of the pan member 12 is formed separate from the pan member and is then attached to the pan member. In this embodiment, an opening is provided through the upper portion of the

pan member 12 defining an air inlet opening; and a short tubular conduit member 110 having a lower edge 112 of a shape corresponding to the shape of the opening through the pan member is secured to the pan member by spot welding or the like.

The member 110 thus defines an air inlet conduit within which a short tubular member 114, corresponding to the member 101 previously described, is mounted. The tubular member 114 has a flange 116 around a portion of its upper edge. The flange 116 is adapted to embrace the outer surface of the offset portion 86 of the annular member 82 and the remaining portion of the upper edge of the tubular member 114 is adapted to abut against the under surface of the annular member 82.

The tubular member 114 is of such a length that it extends downwardly beneath the surface of the liquid 54 within the pan member so that the air entering the pan member is caused to pass downwardly through the liquid before passing through the separator structure.

In another modified structure illustrated in Figs. 11 and 12, the tubular member 114 is replaced with another tubular conduit member 118 which may be secured to the annular member 82 in the same manner as the tubular member 114 above described. The tubular member 118 extends downwardly beneath the normal top surface of the liquid 54 to a position closely adjacent the bottom of the pan 12. An offset portion 120 which is substantially semi-circular in cross-section forms the lower part of the tubular member 118. The offset portion 120 is open at its end 122 and also along its bottom edge 124 so that the air passed through the tubular member 118 is free to escape upwardly through the liquid 54 but is confined for a substantial distance around the periphery of the pan 12 adjacent the bottom thereof so as to assist in the separation of the foreign material from the air. The offset portion 120 is preferably tangentially disposed within the pan member so that the entering air assists in effecting a movement of the liquid 54 within the pan which also assists in the separation of the foreign material from the air.

Referring to Fig. 13, another modified structure is illustrated in which the tubular member 114 is provided with a lower end portion 126 which is substantially normal to the longitudinal axis of the tubular member 114. The inlet passage thus formed is substantially L-shaped so that the entering air is confined within the conduit formed by the tubular member 114 and 126 and its direction of movement is changed before being discharged into the main body portion of the liquid 54.

In Figure 14, a modified form of base receptacle is illustrated at 130. The receptacle 130 is generally the same in shape as the receptacle 12 and serves the same purpose. The receptacle 130 is formed by molding a plastic material as rubber or Bakelite into the form shown with an inlet spout 131 and a radially directed ledge 132. The ledge 132 extends substantially completely around the top opening with the exception of the region of the inlet spout 131 of the receptacle 130 in downwardly spaced relation to the top edge.

In Figure 15, a modified structure is illustrated for mounting the partitioning unit 82 in the pan member. In this embodiment, the flange 84 is dispensed with and the member 82 is supported directly upon studs 136 which are threadably mounted to the wall of the receptacle 12 in downwardly spaced relation from the top thereof.

In Figure 16, a modified structure is illustrated for mounting the partitioning unit 82, which includes an annular member 140 having an inwardly and radially directed ledge 142 formed as a flange. The annular member 140 may be fixed to the pan member 12 so that the ledge 142 is spaced downwardly from the upper edge of the pan member by spot welding. In this case also, the flange 84 is dispensed with and the member 82 removably rests on the ledge 142.

A handle 80 may be suitably secured to the cover 14 along the top thereof so that the cleaning unit as a whole may be readily transported from one position to another by hand.

Formal changes may be made in the specific embodiments of the invention described without departing from the spirit and substance of the invention, the scope of which is commensurate with the appended claims.

What we claim is:

1. A vacuum cleaner construction comprising a base constituting a pan member adapted to contain a bath of liquid, a casing disposed above and supported on and secured to said pan member closing the same, a housing within said casing, a motor and fan mounted within said housing serving to draw air upwardly from said pan member through said casing, a resilient partitioning member clamped to said housing and casing, serving to separate said pan member and said casing into upper and lower compartments and providing the sole means interconnecting said housing and casing, and another annular partitioning member mounted within said pan member and disposed under said first named partition member and above said bath, said another partition member having a resilient portion so arranged as to bear against the under surface of said first named partitioning member when the parts are in their assembled positions.

2. In a device of the class described, a portable vacuum cleaner housing having inlet and outlet openings therethrough and including a receptacle adapted to contain a bath of liquid, said inlet opening communicating with said receptacle, a blower within said housing, a rotary centrifugal separator extending into said receptacle above said bath, and an annular, generally disc shaped member mounted within said receptacle transversely thereof above said bath having an inner annular portion extending in close proximity to but slightly spaced from said centrifugal separator in surrounding relation thereto, and means for driving said blower and said separator for drawing air into said housing through said inlet opening, into contact with the liquid of said bath, through the separator, and for discharging the air through the outlet opening.

3. A vacuum cleaner construction comprising a base constituting a pan member adapted to contain a bath of liquid, a housing supported on and secured to said pan member closing the same, a motor and fan mounted within said housing serving to draw air upwardly from said pan member through said housing, a centrifugal separator driven by said motor and extending into said pan member above the normal surface of said bath, and an annular, generally disc shaped partitioning member mounted within said pan member transversely thereof having a resilient portion on the top surface thereof so

arranged as to bear against the under surface of said housing.

4. A vacuum cleaner construction comprising a base constituting a pan member adapted to contain a bath of liquid, a casing disposed above and supported on and secured to said pan member closing the same, a housing within said casing, a motor and fan mounted within said housing serving to draw air upwardly from said pan member through said casing, a resilient partitioning member clamped to said housing and casing serving to separate said pan member and said casing into upper and lower compartments and providing the sole means interconnecting said housing and said casing, and another partitioning member mounted within said pan member and disposed under said first named partitioning member and above said bath, said another partitioning member having a resilient portion so arranged as to bear against the under surface of said housing and being of sufficient strength to support the weight of the first named partitioning member with the motor and fan mounted therein.

5. In a device of the class described, a portable vacuum cleaner housing having inlet and outlet openings therethrough and including a removable receptacle containing a bath of liquid, means forming an air inlet conduit communicating with said inlet opening and directing the air entering said receptacle in a direction tangential to the wall of said receptacle, a blower within said housing, a rotary centrifugal separator extending into said receptacle above the normal surface of said bath, and an annular partitioning member mounted within said receptacle having a resilient portion extending into close proximity to but slightly spaced from said separator in surrounding relation thereto, and means for driving said blower and said separator for drawing air into said housing through said inlet opening, into contact with the surface of said liquid bath, through said separator, and for discharging the air through said outlet opening.

6. A unitary partition construction for use in a vacuum cleaner construction comprising an annular sheet metal member having a central opening therethrough, a depending tubular member connected to said sheet metal member adjacent one edge thereof, a resilient member generally complementary in shape to said sheet metal member and secured to one side thereof, said resilient member extending radially inwardly beyond the edge of said central opening and said resilient member having an upstanding rib formed thereon adjacent said central opening.

7. In a unitary partition construction for use in a vacuum cleaner construction comprising an annular member having a central opening therethrough, a depending tubular member connected to said member adjacent one edge thereof, a resilient member generally complementary in shape to said first named member and secured to one side thereof, said resilient member extending radially inwardly beyond the edge of said central opening and said resilient member having an upstanding rib formed thereon adjacent said central opening.

CLARENCE A. BROCK.
NODIAH E. HUTCHENS.

CERTIFICATE OF CORRECTION.

Patent No. 2,221,572. November 12, 1940.

CLARENCE A. BROCK, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, first column, lines 21 to 23, claim 4, for the words "said housing and being of sufficient strength to support the weight of the first named partitioning member" read --said first named partitioning member and being of sufficient strength to support the weight of the housing--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of December, A. D. 1940.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)