This invention concerns a battery-powered clothes brush and, more particularly, a compact, self-powered device for effectively removing dirt and lint particles from garments or other surfaces.

Various mechanically and electrically powered devices have been proposed by the prior art for removing dirt and lint particles from clothing. Although brushes or suction air flow have been employed singly, the most effective removal of particles is accomplished by the combination of both techniques. As a result, an impasse has been encountered in efforts to reduce the size of the cleaner to a more acceptable compact package by the necessity of including a vacuum-inducing fan member in addition to a rotating brush for effectively dislodging and disposing of dirt and lint particles from garments and other surfaces. Furthermore, to achieve improved cleaning effectiveness it would be desirable to have a substantially self-cleaning brush so that dirt or lint particles which tend to adhere to the brush would be eliminated therefore. It would also be desirable to be able to clean entangled threads from the brush while the brush is mounted within the cleaner, or to be able to easily withdraw the brush for cleaning or replacing the same. An additional improvement would be to substantially neutralize the static electric charge on the rotating brush produced by the brush contact with a surface.

It is therefore one object of this invention to provide an improved, more compact cleaner for effectively removing dirt and lint particles from surfaces.

Another object is to provide clothes cleaning apparatus which employs a unique structure for establishing an air flow pattern for effectively sweeping up and depositing lightweight dirt and lint particles into a collection-chamber.

A further object is to provide a clothes cleaning apparatus having a brush which is easily cleaned while mounted within the apparatus, or easily withdrawn for cleaning or for inserting a replacement.

Still another object is to provide a clothes cleaning apparatus which neutralizes the effect of static charge produced by brushing contact with garments.

In accordance with this invention in one form thereof, a palm-size molded plastic housing is structurally designed to receive a rotating brush which projects outwardly through a nozzle in one wall of the housing. Air ingestion means and a discharge gap are disposed relative to the rotating brush and the nozzle to achieve a pumping or vacuum effect which assists the brush in sweeping up lightweight dirt and lint particles and disposing of these particles which are normally unaffected by conventional centrifugal discharge apparatus. The housing is also structurally arranged to define a collection-chamber adjacent the discharge orifice into which the dirt and lint particles are deposited, and a series of filtered outlet passages through the housing are provided to enable a continuous air flow through the clothes cleaner.

The invention encompasses the features of a clothes cleaner housing in combination with the compact arrangement of internal components which will be more fully understood by reference to the following detailed description taken in connection with the accompanying drawings, of which:

FIG. 1 is a perspective view of the compact clothes brush when manually grasped during operation thereof.

FIG. 2 is an elevation view in section showing the components and their arrangement within the compact clothes brush.

FIG. 3 is a vertical section view along the lines 3-3 of the elevation view of FIG. 2.

FIG. 4 is a perspective view in section illustrating the air flow pattern through the clothes cleaner as induced by the unique construction thereof.

FIG. 5 is an enlarged elevation view in section of the brush retainer member which is releasably secured to the housing for permitting manual rotation or withdrawal of the brush.

FIG. 6 is a left end view of the battery-powered clothes brush with the brush retainer member removed.

Referring to FIG. 1, the compact clothes cleaner is illustrated being manually held by the housing during normal operation. It can readily be appreciated that the relative compacness and the self-powered aspect facilitates convenient use of the clothes cleaner under a wide range of conditions.

The arrangement of the components which permits such a compact cleaner are more clearly indicated in the remaining figures. The housing 1 is composed of a housing base-portion 1a and a housing cover-portion 1b between which the cleaner components are secured. FIG. 2 illustrates the components as they are mounted on the housing base-portion 1a with the housing cover-portion 1b removed. A cylindrical brush 2 is disposed within the housing 1 along the top wall Wt thereof. The brush consists of a plurality of bristles b secured between a pair of helically twisted wires w2.

The left end of the brush 2 is releasably supported in a brush retainer member 3 which is, in turn, releasably attached in an aperture 3a through the left wall Wl of the housing 1. As indicated in FIG. 5, the retainer member 3 is comprised of a hollow retainer casing 3a which has spherical bearing pocket 3d within the hollow central portion thereof. The bearing pocket 3d supports a spherical journal portion of a rotator member 3c. The rotator member 3c has an outwardly directed face plate 3b which can be manually turned for rotating the brush 2. One end of the brush wires w1 and w2 are releasably secured within the opposite end of the rotator member 3c which has a first thread guard 3t positioned thereon for preventing threads or thread particles from entering the bearing pocket 3d. A pair of studs 3e are positioned on the outer peripheral surface of the retainer casing 3a and project through the recess r1 and r2, as indicated in FIG. 6, on the peripheral edge of the housing aperture A8 for
engaging the inner surface of the housing left wall \( W_1 \) when the retainer is twisted after being inserted into the aperture \( A_p \). The engagement between the studs 3e and the inner surface of the housing left wall \( W_1 \) operates to secure the retainer 3 within the housing 1. The right end of the brush 2 is releasably hinged and latched thereto for providing ready access to the collection-chamber 16 for disposing of the accumulated particles. A plurality of air exhaust slots 24 are provided through the clean-out door 23 and a first filtering membrane 25 on the inner surface of the door 23 covers the door slots 24 to preclude discharge of particles out through the door slots to prevent their redistribution on the garment. A second plurality of slots 26 are disposed through the housing base-portion 1a above the horizontal partition member 18 and below the scroll member 22 through which air may be exhausted from the collection-chamber 16. A second filtering membrane 27 on the inner surface of the housing base-portion 1a covers the base-portion slots 26 for excluding discharge of dirt particles therethrough.

The brush 2, when rotating counterclockwise as indicated in FIGS. 3 and 4, establishes a rotating air-flow pattern which is exhausted through the tangentially oriented discharge gap G. A suction force is created at the nozzle N by virtue of the Bernoulli-effect produced by fluid flowing thereby. The suction tends to draw the garment into the nozzle, thus cutting off the air flow around the brush 2. The lightweight dirt and lint particles are not thereafter carried through the discharge gap G, but remain on the rotating brush to be deposited back on the garment and to carry with them the accumulated static electric charge.

To provide a continuous supply of air for sweeping past the nozzle to aid in extracting particles from a garment, a first plurality of air inlet apertures 28 are provided through a first canted surface portion \( S_1 \) on the top wall \( W_1 \) of the housing 1 adjacent the nozzle side 21 where the brush periphery leaves the housing. The canted orientation of the surface \( S_1 \) relative to the nozzle N insures that the garment will not cover the first inlet apertures 28. The inlet apertures 28 have their axes \( a_1 \) oriented radially inwardly to also insure that the air is not impelled outwardly therethrough. If desired, a similarly oriented slot may be used instead of a plurality of apertures.

To provide an additional supply of air for sweeping the dirt and lint particles from the brush 2 to effect self-cleaning, a second plurality of air inlet apertures 29 are provided through a second canted surface portion \( S_2 \) on the top wall \( W_1 \) adjacent the nozzle side 21 where the brush periphery re-enters the housing. The canted orientation of the surface \( S_2 \) similarly insures that the garment will not cover the second inlet apertures 29, and the axes \( a_2 \) of the apertures 29 are also radially oriented relative to the brush 2.

The unique structure comprising the air inlet apertures 28 and 29 adjacent the nozzle N, the tangentially oriented discharge gap G between the brush enclosure extension 17 and the scroll 22, the accessible collection-chamber 16, the filtering membranes 25 and 27, and the discharge slots 24 and 26 capitalizes on the rotary motion of the brush to provide a continuous filtered flow of air through the cleaner. The air flow continues through the first inlet apertures 28 and 29 even while the nozzle N is completely covered by the garment being cleaned. It can also be appreciated that the bristle sweeping action against the cloth in combination with air flow induced through the first inlet apertures 28 by the rotating brush operates to pick up dirt and lint particles from the garment, and the additional air flow induced through the second inlet apertures 29 aids in the brush and the dirt and lint particles of small mass which are normally retained in the brush and are deposited back on the garment where they build up a static electric charge at the nozzle. The static electric charge is also aided by the apertures 28 and 29 to enhance the amount of possible surface contact between the garment and the cleaner. The structural feature of the retainer 3 and the cleaner with the housing portions 1a and 1b assembled, the housing cover-portion 1b has a clean-out door 23 releasably hinged and latched thereto for providing ready access to the collection-chamber 16 for disposing of the accumulated particles. A plurality of air exhaust slots 24 are provided through the clean-out door 23 and a first filtering membrane 25 on the inner surface of the door 23 covers the door slots 24 to preclude discharge of particles out through the door slots to prevent their redistribution on the garment. A second plurality of slots 26 are disposed through the housing base-portion 1a above the horizontal partition member 18 and below the scroll member 22 through which air may be exhausted from the collection-chamber 16. A second filtering membrane 27 on the inner surface of the housing base-portion 1a covers the base-portion slots 26 for excluding discharge of dirt particles therethrough.

The brush 2, when rotating counterclockwise as indicated in FIGS. 3 and 4, establishes a rotating air-flow pattern which is exhausted through the tangentially oriented discharge gap G. A suction force is created at the nozzle N by virtue of the Bernoulli-effect produced by fluid flowing thereby. The suction tends to draw the garment into the nozzle, thus cutting off the air flow around the brush 2. The lightweight dirt and lint particles are not thereafter carried through the discharge gap G, but remain on the rotating brush to be deposited back on the garment and to carry with them the accumulated static electric charge.

To provide a continuous supply of air for sweeping past the nozzle to aid in extracting particles from a garment, a first plurality of air inlet apertures 28 are provided through a first canted surface portion \( S_1 \) on the top wall \( W_1 \) of the housing 1 adjacent the nozzle side 21 where the brush periphery leaves the housing. The canted orientation of the surface \( S_1 \) relative to the nozzle N insures that the garment will not cover the first inlet apertures 28. The inlet apertures 28 have their axes \( a_1 \) oriented radially inwardly to also insure that the air is not impelled outwardly therethrough. If desired, a similarly oriented slot may be used instead of a plurality of apertures.

To provide an additional supply of air for sweeping the dirt and lint particles from the brush 2 to effect self-cleaning, a second plurality of air inlet apertures 29 are provided through a second canted surface portion \( S_2 \) on the top wall \( W_1 \) adjacent the nozzle side 21 where the brush periphery re-enters the housing. The canted orientation of the surface \( S_2 \) similarly insures that the garment will not cover the second inlet apertures 29, and the axes \( a_2 \) of the apertures 29 are also radially oriented relative to the brush 2.

The unique structure comprising the air inlet apertures 28 and 29 adjacent the nozzle N, the tangentially oriented discharge gap G between the brush enclosure extension 17 and the scroll 22, the accessible collection-chamber 16, the filtering membranes 25 and 27, and the discharge slots 24 and 26 capitalizes on the rotary motion of the brush to provide a continuous filtered flow of air through the cleaner. The air flow continues through the first inlet apertures 28 and 29 even while the nozzle N is completely covered by the garment being cleaned. It can also be appreciated that the bristle sweeping action against the cloth in combination with air flow induced through the first inlet apertures 28 by the rotating brush operates to pick up dirt and lint particles from the garment, and the additional air flow induced through the second inlet apertures 29 aids in the brush and the dirt and lint particles of small mass which are normally retained in the brush and are deposited back on the garment where they build up a static electric charge at the nozzle. The static electric charge is also aided by the apertures 28 and 29 to enhance the amount of possible surface contact between the garment and the cleaner. The structural feature of the retainer 3 and the
manual rotator face plate \( F_2 \) enable manual rotation of the brush \( 2 \) to enable removal of threads that have become tangled between the bristles. The removable feature of the retainer also enables easy removal of the brush for more thorough cleaning or for replacing the brush without disassembling the housing 1.

By employing the unique structure of this invention, the brush is self-cleaned, static electric charge is reduced, and a vacuum-effect is achieved without having to employ a separate pumping member, thereby providing a more compact, effective clothes cleaner which is easily handled and stored.

As is evident from the foregoing description, certain aspects of my invention are not limited to the particular construction details of the example illustrated, and I contemplate that various and further modifications and applications will occur to those skilled in the art and to those who employ my invention. It is therefore my intention that the appended claims shall encompass such modifications and applications which do not depart from the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A compact cleaner apparatus comprising:
   (a) a hollow housing having an inside surface and an outside surface, said housing having a nozzle opening therethrough; a brush chamber, a dirt collecting chamber, and a motor chamber located in said housing;
   (b) a rotatable generally cylindrical brush mounted within said housing and positioned adjacent said nozzle so that a peripheral portion of said brush projects outwardly through said nozzle; a motor whose sole output is connected to said shaft;
   (c) the inside surface of said housing conforming to the shape of said brush and said brush establishing a rotating air flow pattern within said housing;
   (d) first aperture means in said housing for admitting a first air flow into the portion of said housing adjacent said brush, said first air flow being caused as a result of a suction force created by said rotating air flow pattern, said first air flow being impelled past said nozzle by the rotation of said brush for ingesting dirt particles from said housing and said brush;
   (e) second aperture means in said housing for admitting a second air flow into the portion of said housing surrounding said brush, said second air flow being caused as a result of a suction force created by said rotating air flow pattern;
   (f) means for discharging the combined first and second air flows and said dirt particles away from said brush into said dirt collecting chamber;
   (g) means for filtering said dirt particles from said combined first and second air flows; and
   (h) aperture means extending through the inside and outside surfaces of said housing for exhausting said combined first and second air flows from said housing.

2. A compact surface cleaner apparatus as recited in claim 1 wherein said means in said housing adjacent a first side of said nozzle for admitting a first air flow into said housing comprises at least one aperture through said housing, said aperture having its axis substantially radially oriented relative to said brush whereby the rotary motion of said brush draws air into said housing through said aperture.

3. A compact surface cleaner apparatus as recited in claim 1 wherein said means in said housing adjacent a first side of said nozzle for admitting a first air flow into said housing comprises a plurality of apertures through the surface of said housing adjacent said first side of said nozzle, said surface being canted away from said nozzle and from the surface being cleaned, and said apertures having their axes radially oriented relative to said brush whereby the rotary motion of said brush draws air into said housing through said apertures.

4. A compact surface cleaner apparatus as recited in claim 3 wherein said apertures for admitting said first air flow into said housing are spaced from said nozzle in a direction opposite to the direction of rotation of said brush whereby said first air flow induced through said apertures is impelled past said nozzle by the rotation of said brush.

5. A compact surface cleaner apparatus as recited in claim 1 wherein said means in said housing adjacent a second side of said nozzle for admitting a second air flow into said housing comprises at least one aperture through said housing, said aperture having its axis substantially radially oriented relative to said brush whereby the rotary motion of said brush draws air into said housing through said aperture.

6. A compact surface cleaner apparatus as recited in claim 5 wherein said aperture for admitting said second air flow into said housing is spaced from said nozzle in the direction of rotation of said brush whereby said second air flow combines with said first air flow.

7. A compact surface cleaner apparatus as recited in claim 1 wherein said means in said housing adjacent a second side of said nozzle for admitting a second air flow into said housing comprises a plurality of apertures through the surface of said housing adjacent said second side of said nozzle, said surface being canted away from said nozzle and from the surface being cleaned, and said apertures having their axes radially oriented relative to said brush whereby the rotary motion of said brush draws air into said housing through said apertures.

8. A compact surface cleaner apparatus as recited in claim 7 wherein said apertures for admitting said second air flow into said housing are spaced from said nozzle in a direction opposite to the direction of rotation of said brush whereby said second air flow is impelled past said nozzle by the rotation of said brush.

9. A compact surface cleaner apparatus as recited in claim 1 wherein said means for exhausting said combined first and second air flows from said housing comprises a plurality of apertures through the surface of said housing adjacent said second side of said nozzle, said surface being canted away from said nozzle and from the surface being cleaned, and said apertures having their axes radially oriented relative to said brush whereby the rotary motion of said brush draws air into said housing through said apertures.
(e) a generally circular closure member for insertion within said circular aperture;
(f) means on the outside surface of said closure member for locking said closure member within said generally circular aperture;
(g) an enlarged shaft mounted for rotation within said closure member; and
(h) means for removably fixing said brush shaft to one end of said enlarged shaft as said closure member is locked to said housing, the other end of said enlarged shaft being accessible from outside of said casing to permit manual rotation of said brush by rotation of said other end of said enlarged shaft.