July 12, 1949. F. K. STORM, JR 2,475,808

SELF-CONTAINED SUCTION CLEANER

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Fig. 1.

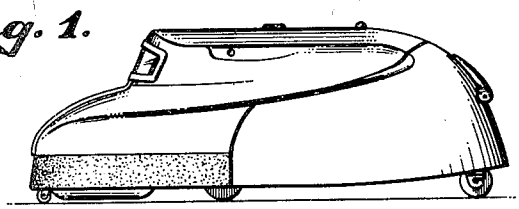


Fig. 2.

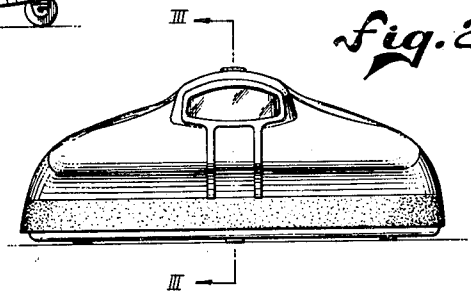
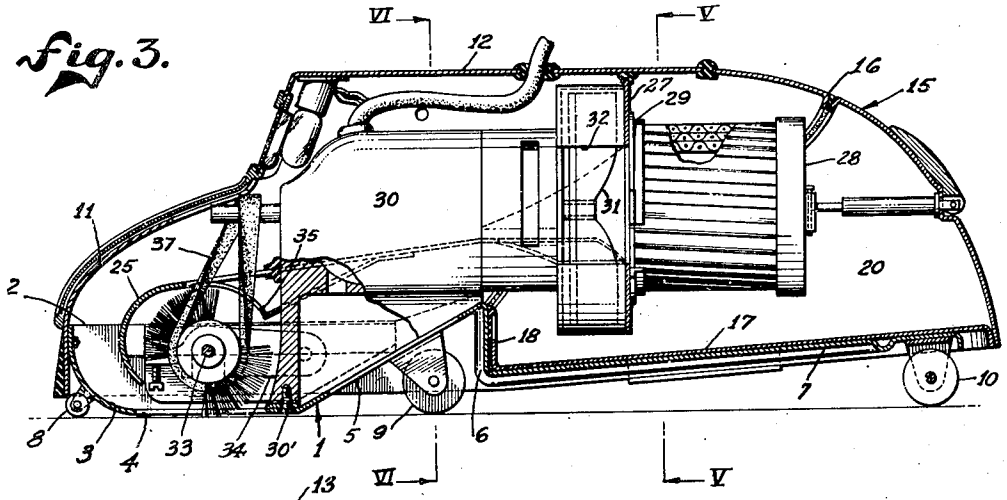


Fig. 3.



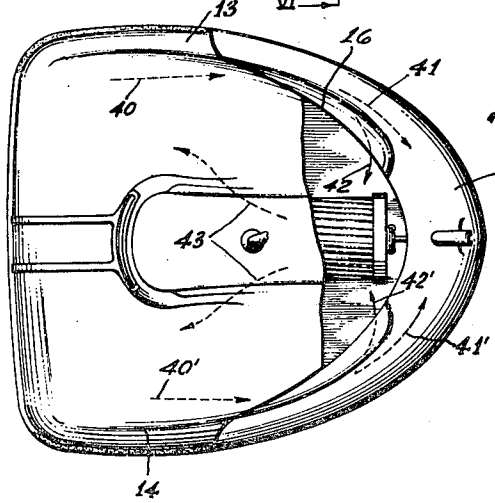


Fig. 4.

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Fig. 5.

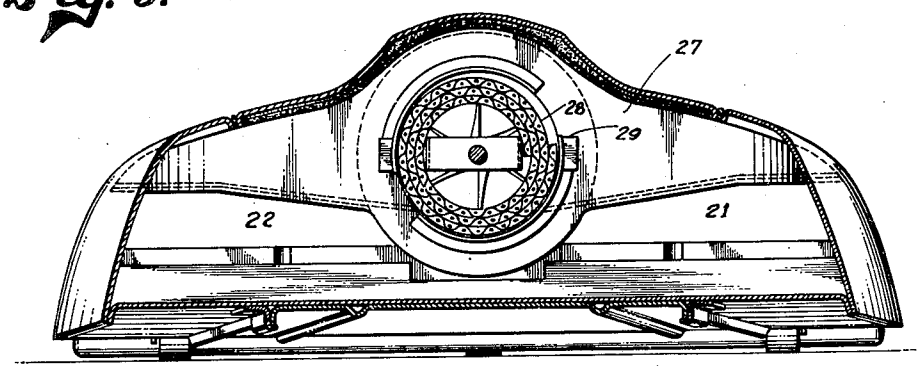
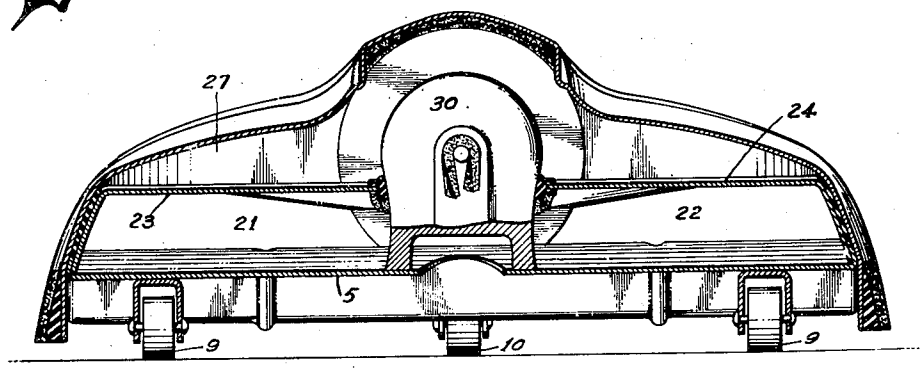


Fig. 6.



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SELF-CONTAINED SUCTION CLEANER

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Application September 24, 1945, Serial No. 618,210

4 Claims. (Cl. 15—346)

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This invention pertains to improvements in vacuum cleaners and is particularly directed to a low, compact, bagless, self-contained vacuum cleaner in which air ducts are arranged so as to efficiently separate foreign matter picked up by the vacuum cleaner from the air stream in which such foreign matter is carried.

The art of vacuum cleaners may be traced back to street-cleaning machines and since early times attempts have been made to recirculate the air used in picking up foreign objects from the ground. After the dirt or foreign objects had been separated from the air stream such air stream was supposed to be returned to the suction nozzle. A household sweeper must be low and compact so as to be able to be used beneath rungs of chairs, under beds, in corners, etc.; it must be sufficiently light in weight and compact so that a housewife may readily and easily move the device. Moreover, the arrangement of ducts within the machine must be such that lint and dust may be effectively picked up from carpets, rugs, etc., and the recirculating air so handled that fine dust particles are not disseminated throughout the room being cleaned.

The present invention is based upon the discovery that an efficient vacuum cleaner of the bagless recirculating type may be formed by employing two, spaced, substantially parallel suction ducts and a single return duct, the minimum cross-sectional area of the suction ducts being approximately twice as great as the minimum cross-sectional area of the return duct. Even though this disparagement in cross-sectional size would normally lead one to believe that the vacuum cleaner would discharge considerable quantities of air into the room being cleaned, in actual practice no such dissemination of dust is observed and instead an efficient cleaning of floors, rugs and carpets is attained. Moreover, by positioning the suction ducts on opposite sides of the main housing of the vacuum cleaner and causing such suction ducts to communicate a virtually flat, transversely extending sweeper port with a suitably rounded, rearwardly disposed housing (approximating a segment of a spherical zone in general form), and by withdrawing the air thus discharged into said rear zone through an aperture or air filter positioned centrally within such zone and spaced from the side walls thereof, dust is readily deposited within such rounded rearwardly extending zone or chamber while the air is returned to the suction port. Furthermore, by positioning a motor, fan and air filter in aligned, horizontally disposed, longitudinally extending

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relationship, the overall height of the vacuum cleaner is materially reduced and by providing the fan with a pair of opposing outlets, the air withdrawn from the rear chamber (through the air filter) is efficiently returned to the sweeper port.

It is an object of the present invention, therefore, to provide an improved type of vacuum cleaner which is low, compact and self contained.

A further object of the invention is to provide a bagless, self-contained vacuum cleaner in which a plurality of suction ducts are utilized, these ducts discharging into a relatively large, rounded, dust-collecting chamber wherein centrifugal force and opposing air currents efficiently remove dust from the air streams and permit such air streams to be withdrawn as a single, clean, air stream for use in picking up additional dirt.

A still further object is to provide a vacuum cleaner including a pair of horizontally spaced, substantially parallel duct means for simultaneously admitting two confluent streams of dust-laden air into opposite sides of a single dust-collecting chamber, and a single suction means, positioned between said ducts, for withdrawing dust-free air from the dust-collecting chamber in a direction opposed to the direction of flow of dust-laden air through the ducts.

Again, an object of the invention is to disclose and provide a method of operation whereby dust may be removed from streams of dust-laden air in an efficient manner without the use of baffles or elaborate dust collectors and without imposing a heavy load upon an air filter.

These and other objects of the invention will become apparent from the following description, reference being had to the appended drawings illustrating an exemplary form of device embodying the invention.

In such drawings:

Fig. 1 is a side elevation of the vacuum cleaner, the handle and lead-in wires being omitted.

Fig. 2 is a front view of the device shown in Fig. 1.

Fig. 3 is a longitudinal section taken along the plane III—III of Fig. 2, the motor, fan and air filter being shown in elevation.

Fig. 4 is a plan view with a part of the cover broken away.

Fig. 5 is a transverse section taken along the plane V—V in Fig. 3.

Fig. 6 is a transverse section taken along the plane VI—VI in Fig. 3.

It will be evident from Figs. 1, 2 and 4 that the vacuum cleaner of the present invention is rela-

tively low and flat, and is provided with a substantially straight front and rounded rear portion. The housing or case of the vacuum cleaner may be contoured in a variety of ways and in so far as the present invention is concerned, the contours of the front portion of the vacuum cleaner are not important. It is essential, however, that the front portion be provided with a substantially flat, horizontal, transversely extending sweeping port and that the rear portion of the vacuum cleaner form a rounded chamber approximating the shape of one-half of a spherical segment.

In the example illustrated, the device includes a base 1, the frontal portion of such base having upstanding sides 2, an upwardly curving front edge portion 3, and a transversely extending, horizontal sweeping port 4. The base 1 may be provided with an upwardly inclined portion 5 leading to a vertically disposed step 6, the base then continuing rearwardly in a virtually horizontal plane as indicated at 7. Suitable supporting wheels may be provided at 8, 9 and 10. The wheels 8 and 10 may be mid way of the sides of such base, whereas the wheels 9 may be positioned adjacent the sides of the base.

The housing is suitably attached to this base and may include a rearwardly curving front portion 11, a substantially horizontal top 12, and rearwardly extending sides 13 and 14, these sides curving upwardly and inwardly so as to form a rounded rear portion, generally indicated at 15. This rounded rear portion 15 may be separable from the rest of the housing and be parted therefrom along a line of juncture 16. Moreover, this rounded rear portion 15 may be connected to a bottom 17 adapted to rest upon or interlock with the rearward extension 7 of the base 1. The bottom 17 may be provided with an upstanding frontal lip 18 adapted to abut the step 6 formed in the base member 1. In effect, therefore, the rear, rounded, dust-collecting portion of the vacuum cleaner (including the members 15, 17 and 18) constitutes a dust pan which may be removably connected to the rest of the device in any suitable manner.

The vacuum cleaner is provided with a pair of horizontally extending, substantially parallel, transversely spaced duct means for simultaneously admitting two substantially parallel cofluent streams of dust-laden air from the sweeping portion 4 into the dust-collecting chamber 20 in the rear of the vacuum cleaner. Such ducts are generally indicated at 21 and 22, the bottom of such ducts being formed by the portion 5 of the base whereas the top of such ducts consists of the virtually horizontal, transversely extending partition members 23 and 24. The frontal portions of such partition members 23 and 24 merge above the sweeper port 4 into a downwardly and rearwardly curving edge portion 25 spaced from the upwardly curving edge portion 3 of the base and the front housing 11.

The rearward edge of these virtually horizontal, transverse partitions 23 and 24 merge with or are connected to a substantially vertical, transverse partition 27 positioned within the middle third of the entire device. The transverse partition 27 does not extend below the horizontal partitions 23 and 24.

The transverse partition 27 is provided with an axial port over which a suitable air filter or air cleaner 28 may be removably attached as, for example, by means of a bayonet point fitting 29. In the drawings, the air filter is shown provided with a porous, woven, wire pad or filtering surface.

The lower suction ducts 21 and 22 are spaced and separated by a mounting block which supports a motor 30. The mounting block may either be solid or may comprise a virtually U-shaped extension of the motor housing, such downward extension being connected to the base member 1 as indicated at 30'. The motor 30 is provided with a fan 31 having an axial inlet cooperating with the port in the transverse vertical partition 27. The motor 30, fan 31, and air filter 28 are therefore in alignment and are centrally positioned with respect to the side walls of the device. The fan 31 is provided with a pair of opposed outlets, such as 32, such outlets discharging into the return duct forwardly of the transverse partition 27 and above the substantially horizontal partitions 23 and 24.

The motor 30 not only drives the fan 31 but also may be used to drive a brush carried upon a shaft 33 journaled in vertically adjustable bearings mounted in levers 34 attached to the sides 2 of the base member 1. Since the suction ducts 21 and 22 should not contain dead air spaces, Fig. 3 shows a filler 35 carried by the lower surface of the partitions 23 and 24 immediately in the rear of the upper portion of the brush. The brush may be driven by means of a flexible belt 37 from the shaft of the motor 30.

It will be noticed that in the arrangement described the suction ducts 21 and 22 direct the dust-laden air tangentially into the rounded, rear, dust-collecting zone 20 and discharge into such zone at opposite sides thereof. In this manner the dust-collecting zone 20 is concurrently supplied with two virtually parallel streams of dust-laden air flowing in the same general direction. These two streams of air are caused to turn toward one another by reason of the rounded, curving rear portion 15 of the housing. Simultaneously, air is withdrawn from the dust-collecting chamber at a central point through the air cleaner.

As shown in Fig. 4, therefore, dust-laden air enters the dust-collecting chamber as indicated by the arrows 40 and 40', dust and large foreign particles continuing along the walls of the dust-collecting chamber in opposing directions as indicated by the dash lines 41 and 41', whereas the air and some fine dust quickly reverse their direction as indicated by the arrows 42 and 42' and are moved frontally through the air cleaner and fan as indicated by the arrows 43. The heavy dust will be found to collect in the rear, rounded portion of the housing or dust-collecting chamber. A very small amount of light dust will be found on the surfaces of the air cleaner. The centrifugal motion imparted to the dust-laden air throws dust particles out of the air streams and thereby reduces the load upon the air filter. It will be noticed that a complete reversal in direction of the air streams is obtained in substantially the same plane horizontally.

The clean air returned above the transverse partitions 23 and 24 is directed by the front curving portion of the housing 11 onto and across the sweeper port 4. It may be noted that this return duct is of narrowest or smallest cross-section adjacent the sweeper port. For some reason not fully understood it has been found desirable that suction ducts 21 and 22 be of smallest cross-sectional area at their point of discharge into the enlarged dust-collecting chamber 20.

Moreover, it has been found that the cross-

sectional area of each of the suction ducts (at its zone of minimum area) should be substantially the same as the minimum area of the return duct so that the two suction ducts have a cross-sectional area approximately twice as great as the cross-sectional area of the return duct at its minimum. The area of the sweeper port does not appear to be critical and exceeds the total minimum areas of both suction ducts and return duct.

It will be obvious to those skilled in the art that the details of construction shown incidentally in the drawings appended hereto may be materially varied. The essential characteristics of the present invention lie in the provision of a pair of substantially parallel spaced suction ducts discharging simultaneously in opposing tangential directions into a common, rounded, enlarged, dust-collecting chamber from which air is removed at a centrally positioned zone spaced from the side walls, top and bottom of the dust-collecting chamber, so that the two incoming, dust-laden air streams discharge heavier particles by centrifugal action and opposition along the walls of the rounded, dust-collecting chamber, while a single clean air stream is discharged from such chamber in a direction directly opposed to the direction of movement of the incoming dust-laden streams.

Although the method of operation has been described as it specifically pertains to vacuum cleaners of the household type, the same mode of operation may also be used in dust collectors or air cleaners of a stationary type and not of the portable type required for a vacuum cleaner.

All changes and modifications coming within the scope of the appended claims are embraced thereby.

I claim:

1. A compact, low, self-contained vacuum cleaner comprising: a housing having a substantially straight transverse front portion and rearwardly extending sides, said sides curving upwardly and inwardly to form a rounded rear portion; a base for said housing, said base having a frontally positioned, transversely extending sweeping port; a portion of the side walls constituting the rounded rear portion of the vacuum cleaner being integral with a bottom for said rounded rear portion and selectively removable from the vacuum cleaner; a pair of substantially parallel spaced suction ducts within the housing, the suction ducts communicating the sweeper port with opposite sides of the rounded rear portion, the said rounded portion directing the air flow from the suction ducts in opposite and opposing directions; means including a motor, fan and air filter in horizontal, axial, longitudinal alignment within the housing, said air filter extending into the rounded rear portion but spaced from the walls thereof, whereby foreign matter carried by air streams entering the rear portion through said parallel spaced ducts is deposited in the rounded portion while the air is axially and forwardly withdrawn from the rear portion through said air filter; and a return duct within the housing extending from said fan to a position in advance of the sweeper port for returning the air and distributing the same along the transverse width of said sweeper port.

2. In a vacuum cleaner including a housing having a front portion and a rear portion, said rear portion having sides curving upwardly and inwardly to form a rounded rear wall for said housing, a base for said housing, a transversely extending sweeping port adjacent the forward end of said base, a rotatable brush mounted above and extending within said sweeping port, a pair of longitudinally extending transversely spaced suction ducts connecting the said sweeping port with opposite sides of the said rear portion of said housing to cause the air flow from the suction ducts to oppose one another, means for setting up a suction of air through said ducts and rotating said brush, an air filter associated with said means, and a single return duct connecting the said rear portion of said housing with the said sweeping port, the said return duct terminating in a transversely rearwardly extending jetting port located within said housing and above the lowermost plane of said sweeping port.

3. A compact, low, self-contained vacuum cleaner comprising: a housing having a substantially straight transverse front portion and rearwardly extending sides, said sides curving upwardly and inwardly to form a rounded rear portion; a base for said housing, said base having a frontally positioned transversely extending sweeping port; a pair of substantially parallel spaced suction ducts within the housing, the suction ducts communicating the sweeper port with opposite sides of the rounded rear portion to cause the air flow from the suction ducts to oppose one another; an air filter unit centrally positioned and longitudinally disposed in the rear portion and spaced from the walls thereof; a single return duct in communication with the frontal portion of the sweeper port and overlying the suction ducts; a motor and an associated fan, said motor, fan and air filter unit being disposed in horizontal, axial, longitudinal alignment within the housing, said fan including an axial inlet in communication with the air filter unit and including outlets in communication with the return duct, foreign matter carried by the air stream from the suction ducts being deposited in the rounded rear portion while the air stream returns through the filter, fan and return duct to the sweeper port.

4. A vacuum cleaner of the character stated in claim 3, characterized in that the area of each of the suction ducts at its minimum cross-section is at a ratio of about 1:1 to the minimum cross-sectional area of the return duct adjacent the sweeper port.

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