

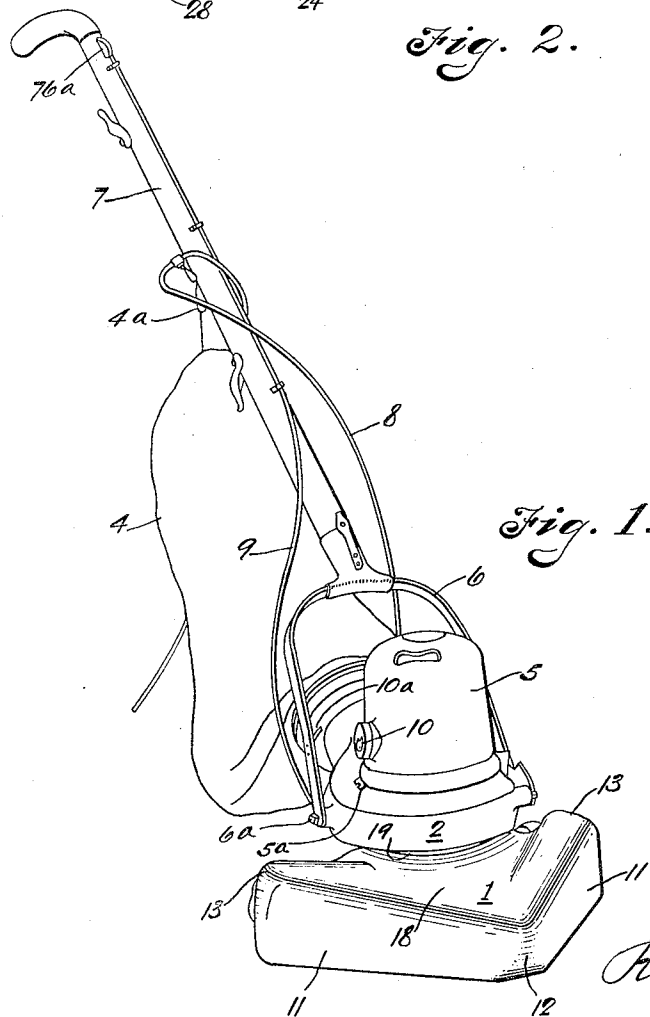
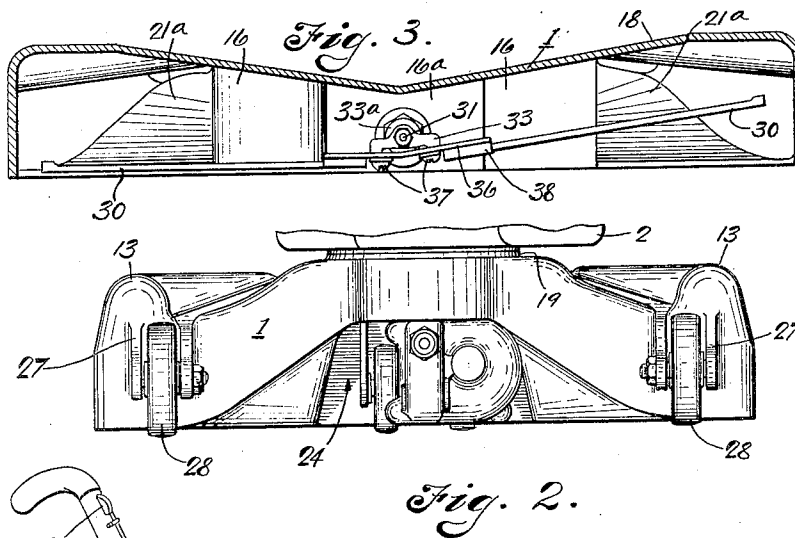
Jan. 22, 1929.

1,699,598

R. L. LEE

DOMESTIC APPLIANCE

Original Filed April 7, 1923 2 Sheets-Sheet 1



Inventor

Ralph L. Lee

By *Spencer, Small & Hardman*
his *Attorneys*

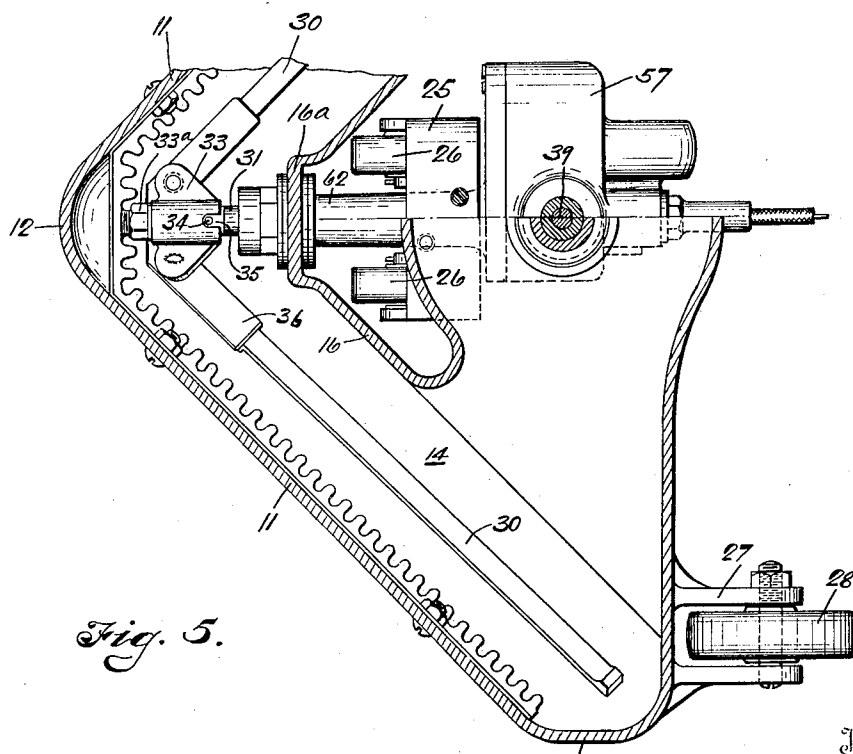
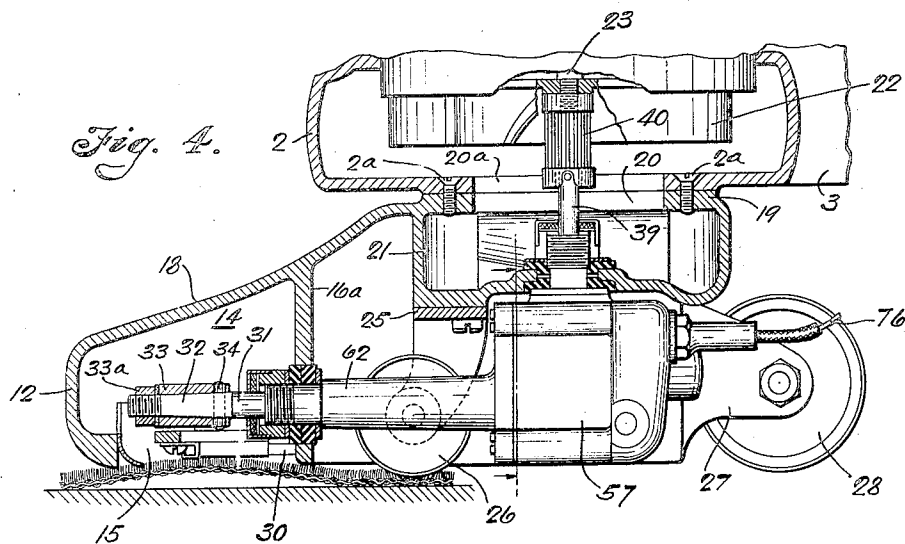
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UNITED STATES PATENT OFFICE.

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DOMESTIC APPLIANCE.

Original application filed April 7, 1923, Serial No. 630,629. Divided and this application filed May 23, 1926. Serial No. 112,256.

This invention relates to machines adapted to travel over a surface, loosen dirt or other foreign matter and remove it in a current of air. The present invention is a division of my copending application Serial No. 630,629, filed April 7, 1923.

Objects of the invention are:—to equalize the pressure of air passing through all points of the air inlet orifice of a vacuum cleaner; to enable a surface to be efficiently cleaned in corners with a minimum of change of position of the machine; to prevent the curling upward of the margins of rugs, loosely laid carpets, or other fabrics by the suction when a vacuum cleaner is moved across their edges; to simplify the assembling and disassembling of the operating mechanism and otherwise to increase the efficiency, improve the operation and simplify the arrangement of parts of traveling vacuum cleaners.

The invention consists in the combinations of elements and arrangement and construction of parts described in detail hereinafter, illustrated in the drawings forming a part hereof, and defined in the appended claims.

In the drawings, in which like parts are designated by like reference characters throughout the several views,

Fig. 1 is a perspective of a vacuum cleaner embodying this invention as it would appear resting upon a floor in normal operating position;

Fig. 2 is a rear elevation of the frame or main housing, the fan casing and parts above it having been broken away;

Fig. 3 is a front elevation of the beaters and beater shaft with the front walls of the housing cut away to expose the interior;

Fig. 4 is a vertical fore and aft central section through the main housing and fan casing, exposing the mechanism within; and

Fig. 5, is a fragmentary view showing the main housing partly in horizontal section, exposing the beaters, beater shaft and lint gathering teeth in plan.

The ensuing description assumes the position of the parts to be in the relation that exists when the cleaner rests in operative position on a floor or other generally horizontal surface, which is the position assumed in the ordinary use of machines of this character.

In the embodiment illustrated, 1 indicates as an entirety a hollow supporting frame and main housing, which incloses a suction

chamber communicating with the exterior by an elongated air inlet or slot, in the under surface of the frame, through which air may be drawn; 2 a fan or air pump casing in communication with said suction chamber, said fan and casing constituting a source or generator of low pressure; 3 an air outlet conduit leading from the fan casing; 4 a dust collector communicating with the air outlet 3, and sustained as at 4^a by the handle of the instrument; 5 a housing for a motor; 6 a bail pivoted as at 6^a at opposite sides of the fan casing; 7 a handle connected to the bail, said handle having means, such as hooks or clips, for sustaining the conductor 8 that supplies energy to the motor, and a means for holding and guiding a flexible actuator indicated as a whole by 9, such as a Bowden wire, for operating a clutch, the position of which determines whether the vacuum cleaner is to be operated with or without beaters. Numeral 10 indicates a pivoted switch adapted to be opened by engagement with the finger 10^a upon movement of handle 7 and bail 6 to an upright position, to which the handle is pushed when the operator wishes to stop the cleaning operation, and to the closed position upon movement of the handle and bail to an inclined position (as shown in Fig. 1) in which it is most conveniently disposed to enable the machine to be manipulated for cleaning purposes. Motor housing 5 may be removed from fan casing 2 after loosening screws 5^a, and fan casing 2 may be released from frame 1 by removing screws 2^a. The frame 1 is pointed or of plow-like form and is preferably triangular in plan and is adapted to be moved point foremost over a surface. The sides 11 of the frame diverge rearward from the forward rounded point 12. The sides 11 may advantageously be at right angles to each other and vary in height from the point 12 to the rear corners 13 of the frame. Within frame 1 is a hollow suction chamber 14, substantially V-shape in horizontal section, said chamber having in its under side a correspondingly V-shaped air inlet orifice or mouth 15. The outer and front sides of the chamber are formed by the inner surfaces of the side walls 11 and rounded point 12 of the frame. Rear walls 16, connected by a transverse partition 16^a, extend parallel with the sides 11 and their

lower edges, together with the lower edges of the closed rear and outer end portions 17 and front walls 11, outline said V-shaped air inlet in the lower side of the frame. The space between the side walls is completely covered by an approximately triangular top plate 18, sloping rearward and upward from point 12, and preferably cast as a part of the frame. An elevated circular boss 19, having a plane top is formed on the rear portion of plate 18, midway between the corners 13, said plane top having an opening 20 connected with a chamber 21 the interior of which is connected by lateral passages 21^a, of equal capacity with the rear outer ends of the limbs or branches of V-shape suction chamber 14.

Mounted on top of boss 19 is the casing 2 which, in this embodiment, incloses a rotary fan 22. The under wall of casing 2 has a hole 20^a in registration with hole 20 in the top of boss 19, the port formed by said registering holes constituting the outlet port for air drawn from the suction chamber 14 into and through chamber 21 by fan 22 the center of this port being equidistant from the passages 21^a.

Thus, air drawn through the air inlet 15 finds its way through lateral passages 21^a into the chamber 21 from the rear ends of the branches of the V-shaped suction chamber 14, and is drawn upward through port 20, 20^a, which is immediately adjacent to the low pressure side of the air pump. The rearward outer extremities of the V-shaped suction chamber 14 and the corresponding ends of the V-shaped inlet 15 are nearest the outlet port 20, 20^a on the low-pressure side of the fan or pump, and the forward angular point of chamber 14 and adjacent portion of the inlet are farthest from said outlet port and the source of reduced pressure. By a gradual reduction of the cross sectional area and cubic capacity of the suction chamber 14 proceeding from the points nearest the outlet port to the points farthest therefrom in proper degree the pressure of the air entering the inlet may be substantially equalized at all points.

Mounted removably on the air pump casing 2 is the motor housing 5 inclosing, in this embodiment, an electric motor (not specifically shown) having an upright armature shaft 23 to which the rotary fan is secured. Air and dust drawn into casing 2 is forced through outlet 3 into the dust collector 4.

The under surface of hollow frame 1 between the branches of V-shaped suction chamber 14 may be recessed as indicated at 24. To the upper wall of this recess may be secured means adapted to carry supporting devices, symmetrically arranged on opposite sides of the fore and aft center line of the frame which passes through the point 12

and bisects the angle formed by the V-shaped suction chamber. Said means may conveniently be a U-shaped bracket 25 to the end of each limb of which a supporting device such as a roller 26 is pivoted. Other brackets 27, which may be formed integral with the frame, extend rearward from the rear corners of said frame, and to which brackets 27, two other supporting rollers 28 may be pivoted. Said four rollers, or equivalent supporting devices, are so disposed as to hold the lower face of the hollow frame and the edges of the air inlet therein, spaced slightly from and parallel with any surface upon which said rollers may rest, or over which the machine may be caused to travel, and to guide it in a path parallel with said fore and aft center line.

In order to loosen sand, dust, mud or the like, that may be embedded in a fabric, mechanical cleaning devices in the form of beaters are provided within the suction chamber 14 and disposed so as to operate lengthwise of the inlet opening and beat and agitate the carpet or other fabric over which the cleaner is being moved. The air pump used is intended to be of such power and the structure and arrangement of parts such that air currents entering the chamber through the air inlet will lift a portion of the carpet or other fabric free from the floor or other surface on which it rests so that the beater arms operating upon this lifted portion will most effectively jar the dirt loose from the fabric throwing the loosened particles into the air currents by which they will be carried to the dust collector.

The beater arms referred to consist preferably of flexible, elastic flattened strips 30 of greater horizontal width than thickness extending oppositely from the under side of one end of an oscillatory beater shaft 31 which projects into the V-shape suction chamber 14 of the frame 1 in a fore and aft direction, substantially at the junction of the two branches of said chamber. The shaft 31 is disposed in a plane parallel with and slightly above the edge of air inlet orifice 15 and its axis intersects the rounded point 12 of the frame. The beater arms 30 extend at an angle to each other in two planes. They are arranged oblique to the axis of the shaft 31 and diverge rearward so that they occupy a position parallel with the branches of the V-shaped chamber and walls 11, (as shown, in Fig. 5) and when vibrated strike with their wider surfaces the crest of the wave of fabric that has been lifted by the suction in a wave like formation. The beater arms are also disposed at an oblique angle to each other measured in a vertical plane or planes at right angles to the axis of beater shaft 31. This relation is clearly shown in Fig. 3, the obtuse reentrant angle formed by the beater arms in this plane being disposed on

the upper side of the beater arms or the side away from the mouth of the air inlet. This arrangement of the flexible, elastic beater arms allows of their striking a blow along the greater part of their length and permitting a very considerable amplitude of vibration.

In order to connect the beaters securely to the front end of shaft 31 said front end is tapered as at 32 and threaded at its extremity; and a yoke 33, provided with a correspondingly tapered hub, is sleeved upon said tapered end, relative rotation between said yoke and shaft being insured against by means of a pin 34 passing through shaft 31 and engaging notches 35 in the rear end of the hub of said yoke 33, a nut 33^a on threaded end of shaft 31 holding the yoke so engaged. The laterally extended arms of yoke 33 depend, or are offset toward the lower side of the axis of the shaft 31 and have under surfaces inclined to each other substantially in the same degree as the beaters 30. A correspondingly angled holder plate 36 may be secured to said yoke by screws 37. Said plate 36 may be provided with sockets 38 into which the ends of beater arms 30 may be inserted and from which they may be removed should it be desired to replace them by new ones.

Bamboo is a desirable material from which to form the beater arms since it is of fibrous structure, light, strong, flexible, elastic and does not in operation cut or wear a fabric to a serious extent. As the shaft 31 in operation is oscillated at a high rate of speed the beater arms 30 will flex and operate upon the fabric with an elastic whipping action that is found to be most effective for the purpose of loosening dirt.

The beater arms deliver quick, sharp blows to the raised zone of fabric along lines substantially parallel with the sides of said raised zone, the effect of which is to flex a portion thereof underneath and at each side of the beaters. Each time a beater arm is lifted the zone of fabric beneath the air inlet assumes its fully upward bowed or lifted position under the influence of the air suction. It will be understood that the force of the suction is sufficient at all times to hold the fabric raised from the floor and that while the beaters are in operation the fabric is being continuously flexed. The effect of the blows of the beater arms is transmitted in wave like vibrations to the lifted portion of the fabric on each side and end of and beyond the beater arm, even causing the particles of sand or like extraneous particles held in the fabric outside the edges of the air inlet to become loosened therefrom and bounce or dance above the fabric around the edges of the plow shaped frame. It is to this continuous beating and flexing of the fabric that the superior cleaning capacity of this inven-

tion may be mainly attributed. The beater arms striking the fabric quick, sharp, snapping blows while the fabric is raised and flexibly held away from the floor have the effect of knocking the fabric away from the dust, so to state, and when the fabric rebounds from the flexing due to the blows of the beater arms under the influence of the air suction the dust and heavier particles of matter are thrown upward into the air currents, and being already in motion upward they are the more readily continued in motion and carried off by the air currents. It is thus possible with this apparatus easily to lift and carry off heavy particles, such as sand.

A further advantage of the continuous rapid flexing of the fabric, especially when the fabric is a heavy carpet, lies in the fact that the body of the carpet below the nap is continually worked in such a way as to loosen the extraneous matter embedded therein. While the heavy matter embedded in the texture of a carpet is not ordinarily noticeable and for that reason of little concern to the average user of carpets, it is a fact, nevertheless, that such matter, especially when it is sharp or abrasive like sand, is very detrimental to the life of the carpet. The grinding in of such matter underfoot is accompanied by a relative motion of the sand and fabric which gradually cuts the fibers constituting the nap, and eventually destroys the body of the carpet.

It is obvious from the foregoing description that this invention provides an effective means for removing from carpets and other fabrics extraneous matter.

The armature shaft 23 of the motor constitutes the prime shaft; and said shaft together with the resilient driving member 40 connected therewith and an extension shaft 39 in continuation thereof constitutes a motor driven shaft. Shaft 39 extends within a housing 57 containing suitable speed reduction gearing, mechanism for imparting a vibratory motion to shaft 31, and clutching mechanism for rendering said mechanism operative and inoperative. Said clutching mechanism is controlled by a flexible wire 76 extending to some point on the handle 7 where it can be conveniently reached by the operator and fastened in the desired position, as by a small grooved pulley 76^a held by friction in a slot in the handle, to which the wire is anchored. Housing 57 is suitably secured to the underside of the bottom wall of chamber 21 and also includes a tubular portion 62 for shaft 31 which extends through and is suitably secured to wall 16^a.

By reason of the plow shape or pointed form of the hollow frame 1, with its sides at right angles to each other rounded forward corner and V-shaped air inlet, the cleaner may be pushed into room corners and effec-

tively remove dirt from the floor without marring room walls and without the necessity of the operator changing position, or first advancing the cleaner against one wall, then turning it at right angles and advancing it against the other. Moreover, the oblique disposition or trend of the branches of the air inlet slot with respect to the course or line of direction which the apparatus is adapted to follow in moving over a floor or other surface, enables it to be operated back and forth across the edge of the rug, loose carpet, or other fabric unsecured to the floor or surface over which the apparatus is being moved without curling up the edge of the fabric and interfering with the even travel of the apparatus. This is for the reason that the inlet slot can never be positioned wholly over a narrow zone substantially parallel with an edge of a rug or the like whereby the edge is likely to be lifted by the suction and curled over or dragged by the apparatus in its movements, as is likely to occur in operating with vacuum cleaners wherein the inlet slot is disposed at right angles to the line of travel. In a vacuum cleaner having the air inlet slot obliquely disposed in whole or in part with respect to the line of travel, and particularly where the inlet is V-shaped, the full force of the suction is not applied to the rug or other fabric until the entire under area of the main frame rests upon it and holds it flat except for the portion of area lifted to the slot nor need the width of the swath or space cleaned be narrowed. And in whatever direction the apparatus is propelled across the edge of a rug or the like the latter will be held down while the air inlet slot passes gradually over the edge in a direction either endwise or oblique with respect to at least one of the branches of the slot so that it becomes impossible to concentrate the full force of the suction close to the edge.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a vacuum cleaner, a frame having a substantially V-shaped chamber provided with a correspondingly V-shaped air inlet

orifice in one side of said chamber, and a source of reduced pressure in communication with the rear ends of the branches of said chamber, said branches increasing in cubic capacity from their point of junction toward the ends thereof.

2. In a vacuum cleaner, a frame having branches diverging rearward forming a substantially V-shaped chamber provided with a correspondingly V-shaped air inlet orifice in its under surface and a source of reduced pressure disposed adjacent the rear of the branches substantially equidistant therefrom and in communication with said branches, the sides of said chamber increasing in height from their junction toward the rear and the top thereof being of less height at the front than at the rear in order to equalize the pressure of air entering the air inlet.

3. In a vacuum cleaner, a chambered frame having sides diverging rearward to provide two chamber branches, one end of each branch being joined adjacent the front of the frame and each having its opposite end closed to provide a V-shaped chamber, said frame being slotted in its under face substantially parallel with said sides thus forming a V-shaped orifice to provide for admission of air to said V-shaped chamber, said chamber being arranged to form inwardly extending air passages connected to the rear ends of said branches, and a source of reduced pressure in communication with the passages.

4. In a vacuum cleaner, a frame having a substantially V-shaped chamber provided with a correspondingly V-shaped air inlet orifice in one side of said chamber, a source of reduced pressure in communication with the branches of said chamber, different portions of said branches being disposed at different distances from said source, each of the branches of said chamber tapering from the part adjacent that portion of the inlet nearest the source of reduced pressure to that part of said branches furthest from said source so as to equalize the pressure of the air entering through all parts of said V-shaped inlet.

In testimony whereof I hereto affix my signature.

RALPH L. LEE.