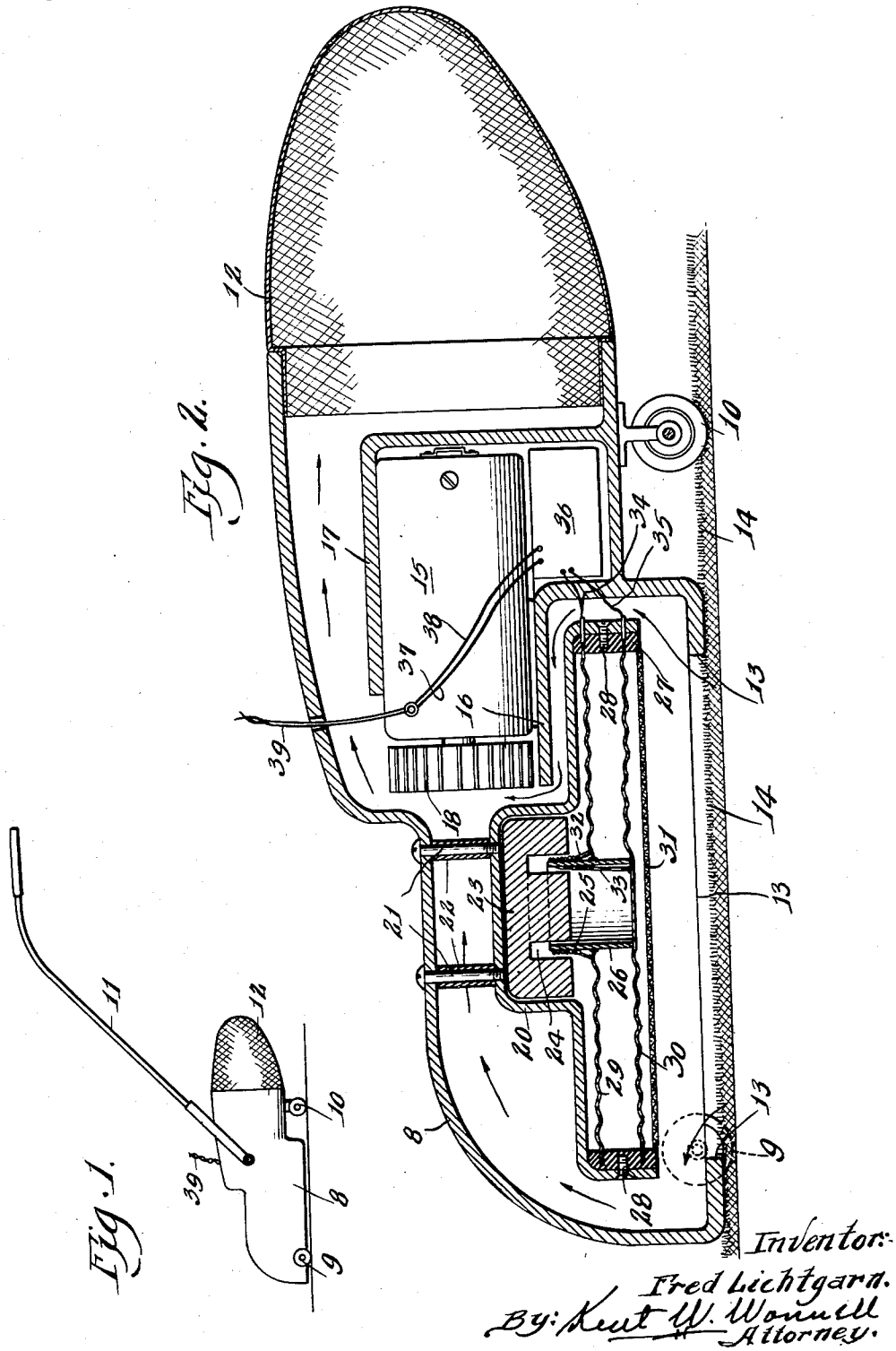
April 12, 1960 F. LICHTGARN 2,932,054

VACUUM CLEANER

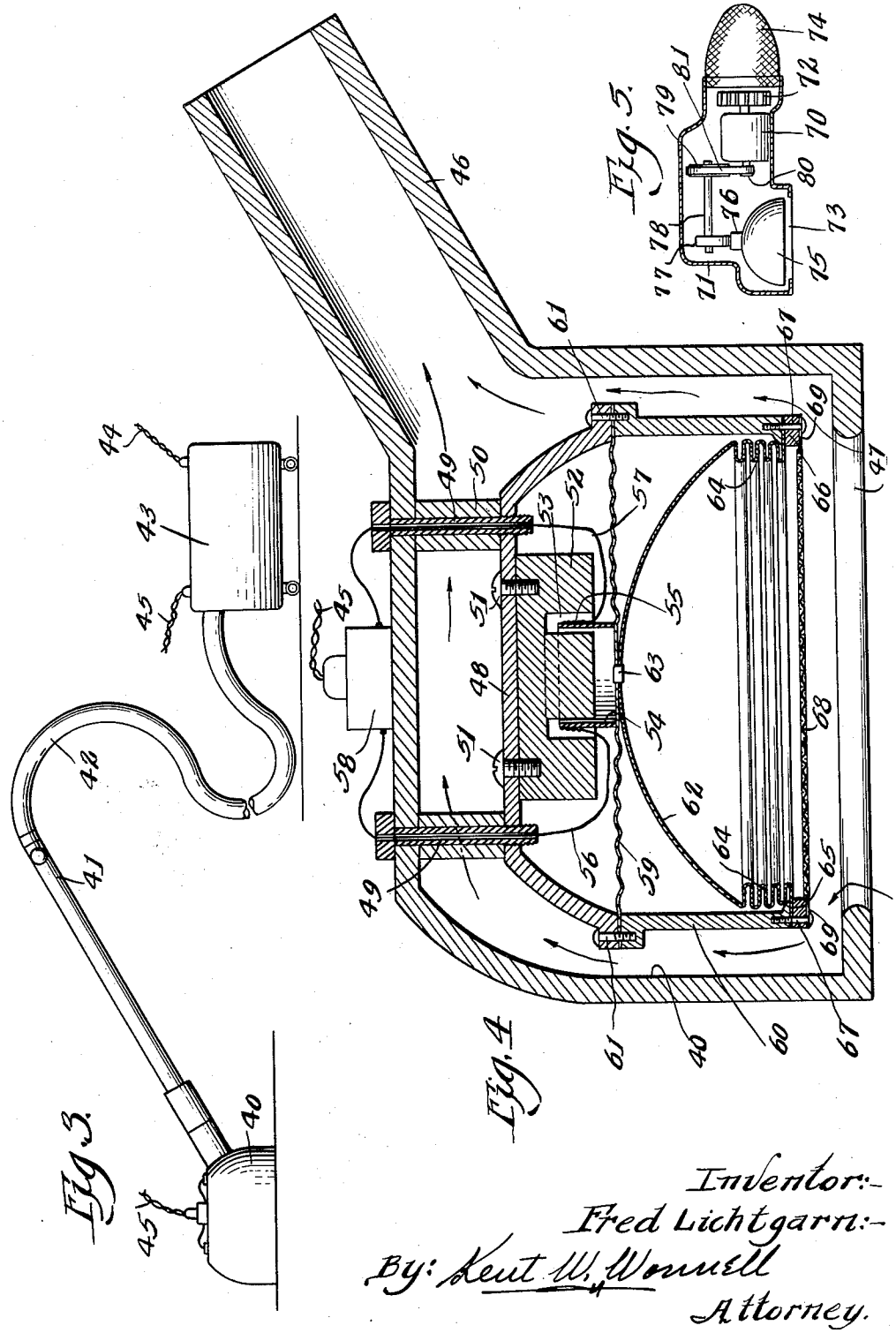
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VACUUM CLEANER

Original Filed April 9, 1953 2 Sheets-Sheet 2



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VACUUM CLEANER

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Continuation of abandoned application Serial No. 347,637, April 9, 1953. This application December 5, 1958, Serial No. 778,385

5 Claims. (Cl. 15—363)

The present invention relates to vacuum cleaners and, more particularly, to suction type cleaners incorporating improved means of vibrating the rug, carpet or other material to which the vacuum cleaner is applied. Specifically, this application is a continuation of copending application Serial No. 347,637, filed April 9, 1953, and now abandoned.

Suction or vacuum cleaners are almost universally employed for cleaning rugs and carpets and other surfaces. For many years the so-called upright type cleaner was considered superior for cleaning rugs and carpets because it commonly employed a rotating brush or beater for brushing and beating the surface to be cleaned in addition to applying a strong suction thereto to remove dirt therefrom. The tank type cleaner during that period relied solely upon suction for the cleaning action and was considered less satisfactory for cleaning rugs and carpets. Numerous suggestions have been made to provide means for agitating, brushing or beating a carpet with a tank type cleaner. Such devices have involved turbine driven brushes or beaters or electrically driven brushes or beaters associated with the nozzle of tank type cleaners. Numerous other arrangements for subjecting the carpet to mechanical beating or brushing action have been suggested. Unfortunately, all arrangements heretofore suggested have been of a complicated and expensive nature, and have generally involved mechanical means for driving a rotary brush or beater for engaging the rug or carpet to be cleaned. There has been objection by users of cleaners to the effect that mechanical beating and brushing of rugs and carpets tends to be too violent and destructive. It would be desirable, therefore, to provide means for vibrating or agitating rugs or carpets to be cleaned by a vacuum cleaner without the violent and destructive features of the vacuum cleaner having the rotatable beater or brush, and which means are also readily applicable to tank type cleaners.

Accordingly, it is an object of the present invention to provide a new and improved vacuum cleaner including vibrating means for vibrating the material to be cleaned superimposed on a constant suction.

An important object of the invention is to provide vibratory means in the inlet chamber of a suction or vacuum sweeper for forcing a current or column of air rapidly outwardly and inwardly with a wave action to engage the fibers or threads of a carpet or ruglike material or the contact surface of any material for vibrating and loosening any dirt or foreign particles for removal by the suction of the sweeper.

A further object of the invention is to provide new and improved air vibration means in combination and in conjunction with an air or suction producing device by electrical, mechanical or other means for loosening dirt or foreign particles without actual contact of any mechanical part therewith and removing the particles with a suctional air current.

A further object of the invention is to provide a self-contained suction cleaner and air vibrator in which rapid vibrations of the air similar to sound waves is applied to that portion of a rug, carpet or other surface to which the suction opening is applied for loosening the dirt and foreign material and drawing it inwardly and depositing it within a bag or other container for receiving the dirt.

Still a further object of the invention is to provide an electromagnetic device generating powerful vibratory sound waves of high or low frequency which dislodge and shake dirt loose from a rug, carpet or other material, assisting in the removal of the dirt or foreign material through the ordinary suction of the vacuum cleaning device.

A further object of the invention is to provide a vacuum cleaner having sound waves of low frequency arranged opposite and adjacent the suction inlet opening for loosening dirt from any material over which the suction inlet of the cleaner is passed to aid in loosening and removing the dirt therefrom.

Further objects and advantages of the present invention will become apparent as the following description proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the present invention, reference may be had to the accompanying drawings in which:

Fig. 1 is an elevational view of a suction or vacuum cleaner embodying the present invention;

Fig. 2 is a greatly enlarged sectional view of the vacuum cleaner of Fig. 1;

Fig. 3 is an elevational view of a so-called tank type cleaner;

Fig. 4 is a greatly enlarged sectional view of the suction applying member of Fig. 3; and

Fig. 5 is a somewhat diagrammatic sectional view of a vacuum cleaner including still another embodiment of the present invention.

The present invention overcomes the various shortcomings and objections inherent in the prior devices by providing a vibratory air zone or column, preferably of a low frequency and high amplitude, which dislodges and shakes the dirt loose within the effective suction sphere of the cleaner so that as the dirt is loosened, it is carried off by the suction. The intense vibrations have the effect of alternately compressing and expanding the air contiguous to the article and thereby establishing sympathetic vibration in the article to be cleaned. In a fibrous article such as a rug, curtain or clothing, and the like, this action takes place in and among the fibers and thereby shakes the dirt loose from the fibers. The constant suction superimposed thereon insures very effective dirt removal.

This vibration may be done mechanically without contact with the carpet or other material to be cleaned and it may also be accomplished by electrical vibratory or oscillating waves, the air column or columns being impelled rapidly into and out of or through and returning from a carpet or other material to be cleaned, the rapid vibrations of the air currents thus causing any dirt, fibers or foreign material to be loosened, aiding the removal thereof by means of an ordinary suction current which is constantly applied by any ordinary suction means such as that of an operating or servicing unit as shown in Figs. 3 and 4, or in a self-contained unit as shown by Figs. 1, 2 and 5.

Referring now more particularly to Figs. 1 and 2 of the drawings, a suction cleaner of the self-contained portable type is shown by way of illustration, which has a casing 8 usually supported upon wheels 9 and 10 with a propelling handle 11 hinged at opposite sides of casing

8. Such cleaner normally includes a removable dirt collection bag or container 12.

In the bottom of the casing is a suction opening 13 adapted to lie closely against the upper surface of a rug or carpet 14, or any other material to be cleaned, the wheels 9 and 10 supporting the casing at an elevation suitable for cleaning the material to which the cleaner is applied. In the casing is an electric motor 15 suitably held by a partition 16 and a support 17. The motor 15 is illustrated as driving a fan 18 for creating suction within the casing 8 which is directed from the opening 13 into the bag 12.

In accordance with the present invention, there is mounted in the air inlet portion of the casing 8 above the inlet opening 13 an air vibrator comprising a support 20 which may be circular or oval and supported by bolts 21 insertable from the upper side of the casing 8 through spacing sleeves 22 into the top of the support 20. In the central portion of the support 20 is a permanent magnet 23 having a circular ring recess 24 in its underside for receiving a magnet winding coil 25 supported at the upper end of a cylindrical sleeve 26, the coil extending partially within the recess. Seated within the lower portion of the support 20 is an insulating block 27 secured thereto by fastening screws 28 or other suitable fastening means and mounted in the block are parallel vibration discs 29 and 30, one secured to the outer end of the cylindrical sleeve 26 and the other secured to the outer surface of the sleeve intermediate the ends thereof. Covering and protecting the outer or lower edge of the support 20 is a guard screen 31 which prevents any material from coming in contact with the lower disc 30.

The ends of the coil 25 are suitably connected by conductors 32 and 33 with the discs 29 and 30 respectively and suitably insulated conductors 34 and 35 are connected to the discs 29 and 30 respectively and thence to a transformer 36 suitably mounted in the casing 8 below the motor 15 and being connected by conductors 37 and 38 with the same electrical conductors 39 which supply current for operating the motor. Thus, coil 25 is energized from a suitable source of alternating current potential.

With this construction the application of an alternating or oscillating current to the winding 25 located in the permanent magnet 23 causes a vibration of the sleeve 26 which imparts a vibratory movement to the corrugated discs 29 and 30, thereby producing a high or low oscillating or vibrating column or columns of air below the vibrator and directly over the inlet opening of the suction cleaner. This vibratory movement causes an oscillating vibratory air column which penetrates the carpet 14 or any other surface or material to be cleaned, imparting an up and down, in an out pumping movement which vibratorily agitates and moves the material, loosening any dirt or foreign substances that may be contained therein so that they will be loosened and taken up by the air suction stream caused by the motor fan 18.

The present invention is especially adaptable to tank type vacuum cleaners and in this connection attention is directed to Figs. 3 and 4 of the drawings. As there illustrated, a suction unit 40 having an upwardly extending handle 41 may be connected by means of a flexible hose 42 with a tank type operating unit 43. The operating unit usually comprises a suction fan and a dust receiving bag similar to that shown in Fig. 2 but suitably housed in a wheeled cabinet which has an electrical supply cord 44 for connecting it with a suitable source of current and also an electrical cord 45 for connecting it with the unit 40.

This unit 40 comprises an outer casing having a handle receiving stem 46 and a suction inlet opening 47 at the bottom of the casing. Within the casing is an electrical air vibrating unit comprising an upper hollow support 48 suspended within the unit by hollow bolts 49 extending downwardly through the top of the unit casing and through the top of the support 48, each having a separating sleeve 50 through which it passes for separating the support 48 in the top of the casing. Mounted within the support 48 by screws 51 or other suitable fastening means is a permanent magnet 52 having a circular ring recess 53 in its lower surface. Extending into the circular recess 53 is a cylindrical sleeve 54 having an electrical coil winding 55 with conductors 56 and 57 extending from opposite ends of the coil through the hollow bolts 49 and into an electrical terminal receptacle 58 from which the conductor wires 45 lead to a suitable source of current supply.

Connected to the lower end of the cylindrical sleeve 54 is a corrugated disc or diaphragm 59, the outer edge of which is clamped between the lower edge of support 48 and a cylindrical extension 60 of the support attached thereto by fastening screws 61. Within the cylindrical extension is a vibratory dome 62 the central portion of which is connected by suitable fastening means 63 with the central portion of the corrugated diaphragm or disc 59 so that any movement of the diaphragm is imparted to this portion of the dome. The lower portion or outer edge of the dome is formed with bellows folds 64 to permit a considerable movement or vibration of the dome and the outer edge 65 is secured between the end of the cylindrical portion 60 and a clamping ring 66 by fastening screws 67. An outer protecting guard or screen 68 is also held in place over the outer or lower end of the clamping ring by a protecting ring 69 through which the fastening screws 67 are also inserted.

With this construction the action is similar to that described in connection with the other form of the invention shown in Figs. 1 and 2 of the drawings, that is, when the electrical coil winding 55 is energized by a suitable alternating or oscillating current, a rapid vibration is caused in the coil by the permanent magnet 52. The vibration of the coil is communicated by the cylindrical sleeve 54 to the corrugated vibratory disc 59 and this movement is imparted to the dome 62 which moves upon its bellows 64 causing an inward and outward passage of air due to its vibration, thereby forming vibratory columns of air which impart oscillation and vibration to any particles located below the inlet opening 47, thereby assisting in loosening the particles so that they may be taken up by the suctional air stream. It will be understood that the constant suction produced by the elements in tank unit 43 is always present in suction nozzle 47 when cleaning is to be done.

Another modification of the present invention is illustrated in Fig. 5 of the drawings. As there illustrated, vibrating air movement is mechanically produced by means of a motor 70 in a suction cleaner casing 71 operating a suction fan 72 for drawing air through an inlet 73 and discharging it into a bag or container 74. Located within the casing but spaced from the inlet 73 is a vibratory dome 75 suitably supported for vibrating movement and having a central contact member 76. Engaging the contact is an eccentric 77 mounted on a shaft 78 and rotated by a wheel 79 connected to a motor pulley 80 by a belt 81. The rotation of the motor 70 will cause the fan to suck air through inlet 73 and at the same time to rapidly agitate the vibrator 75 by means of the eccentric 77 so that a wave-like pulsating, alternating, vibrating column or columns of air traverse rapidly in both directions through the inlet. This action agitates the material or surface to which the cleaner is applied without actual contact of the vibrator with the material or surface but still loosening and assisting in removing any dirt or foreign material which may be present.

From the above description of various embodiments of the present invention it will be appreciated that the vibrator is separate and free from any direct contact with the surface or material to be cleaned. Moreover, the air waves shake the material, such as a rug or carpet, by the rapid reversal of the air forced down and then pulled up, thereby causing the fibers of the rug or carpet to

vibrate in unison with the repetition of the air vibration or sound wave which is imparted by the vibrator. Furthermore, while this is going on a high and constant suction is continually applied.

Various other independent electric, electronic and mechanical vibratory air currents and sound waves may be similarly set up for effecting the rapid agitation and vibration of a material to be cleaned without actually engaging or being in contact with the material and thus producing a pumping or flow and return action of the air which agitates and vibrates the material to be cleaned and under the suction inlet and in a manner to successfully and effectively loosen and assist in removing dirt and foreign particles with the normal air suction of the cleaner.

Although I have shown the invention as embodied in carpet sweeper types of devices, it is obvious that the invention is applicable to any form of suction air cleaning apparatus operative to dislodge and remove dirt or other matter from an object or a surface.

While there have been illustrated and described several embodiments of the present invention, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the invention in its broader aspects, and it is, therefore, contemplated in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a vacuum cleaner, a suction nozzle having a suction opening therein, means for producing an uninterrupted relatively constant flow of air thruogh said suction opening to provide a relatively constant suction at said opening, vibrating means disposed on the suction side of said opening and in spaced relation thereto, and means independent of the flow of air through said opening for actuating said vibrating means to produce a vibrating air column in said opening superimposed on said relatively constant flow of air.

2. The vacuum cleaner of claim 1 wherein said vibrating means and said last mentioned means comprise an electroresponsive source of sound waves.

3. In a vacuum cleaner for rugs, carpets and the like, a casing, a suction nozzle connected to said casing for applying suction to a surface to be cleaned, suction producing means for producing a relatively constant suction in said casing and hence in said nozzle, a vibrating member supported in said casing and physically spaced from said nozzle, and means for vibrating said member at a frequency within the sonic range to produce vibrations in said nozzle superimposed on the relatively constant suction produced therein.

4. The vacuum cleaner of claim 3 wherein said suction producing means includes an electric motor, and said motor actuates said means for vibrating said member.

5. A suction cleaner comprising, a casing, a suction opening connected to said casing, said suction opening being adapted to lie closely against a surface to be cleaned, suction producing means connected to said casing for producing a relatively constant suction at said suction opening, vibrating means mounted in said casing and spaced from said suction opening, and means independent of the suction produced at said opening for actuating said vibrating means to produce a vibrating air column in said suction opening thereby to loosen dirt and the like from the surface to be cleaned.

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