

[54] **SUCTION CLEANING MACHINE**
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[52] **U.S. Cl.**..... **15/363, 15/380**
[51] **Int. Cl.**..... **A47I 9/04**
[58] **Field of Search**..... **15/363, 380, 379, 15/381**

[56] **References Cited**
UNITED STATES PATENTS
1,953,350 4/1934 Kitto 15/380
2,570,679 10/1951 Huber 15/380 X
1,996,921 4/1935 Hoover 15/380 X
FOREIGN PATENTS OR APPLICATIONS
399,174 9/1933 Great Britain 15/363

[57] **ABSTRACT**

An improved suction cleaning machine incorporates a perforated carpet contacting plate exhibiting carpet contacting projections on the rug side, and means to move said plate in a horizontal elliptical, but non-rotating path over an amplitude of 1/32 inch to one-half inch at a frequency of 500 to 14,000 cycles per minute with suction applied to the perforations in the plate.

6 Claims, 3 Drawing Figures

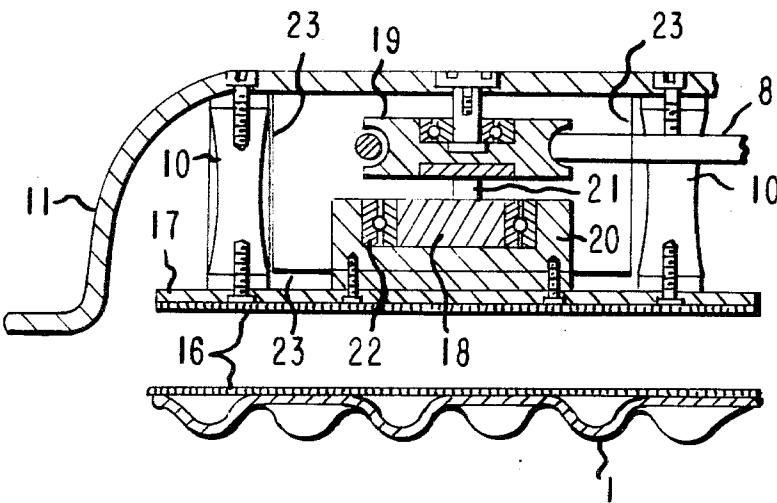


FIG. 1

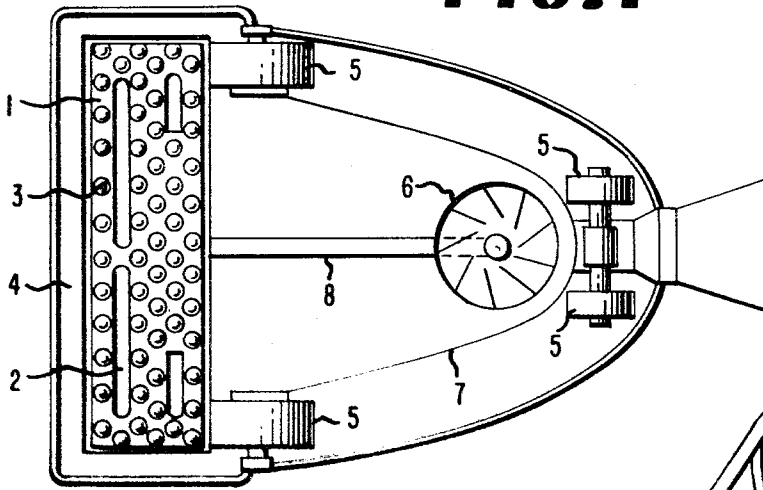


FIG. 2

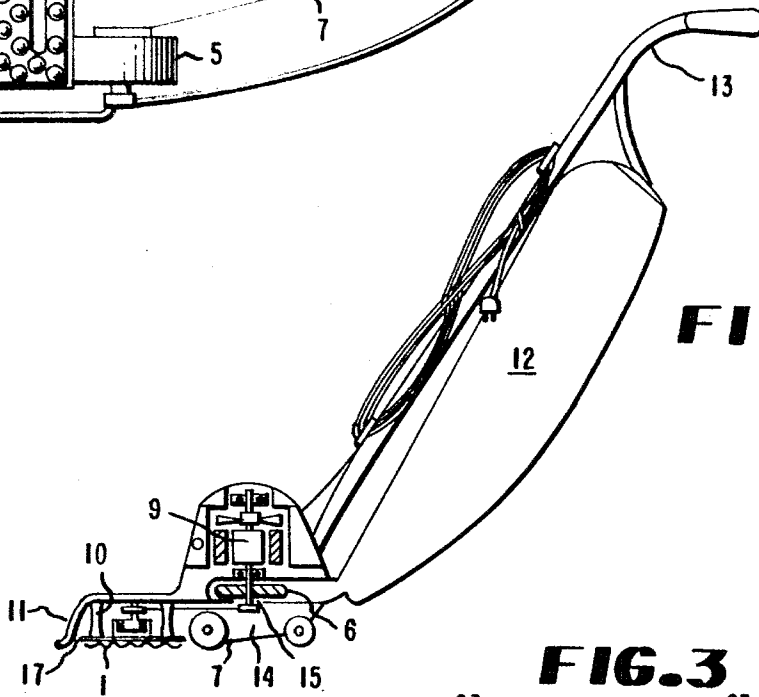
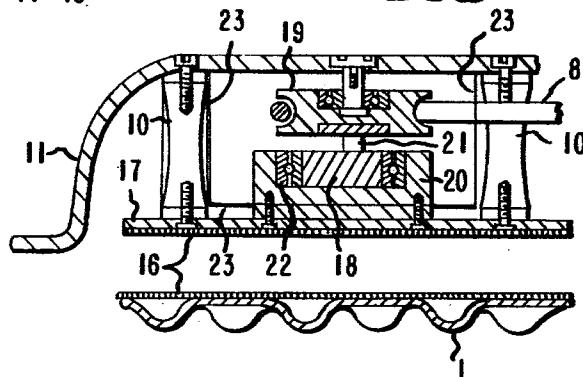


FIG. 3



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SUCTION CLEANING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to machines for suction cleaning textile articles, particularly carpets, and more particularly is directed to an improvement in such machines comprising the incorporation of a carpet contacting plate bearing projections on its lower side and perforated for the application of suction.

2. Prior Art

The use of suction devices for cleaning textile articles and other surfaces is well-known. Most suction devices used in cleaning carpets employ a brush as an agitator to loosen dirt from fibers and interstices. Other suction carpet cleaners are known which employ combs to spread the fibers; or a device to lift and drop a small section of the carpet to give a "beating" effect; or air jets to impinge upon a section of the carpet and thus loosen dirt.

The use of surface contacting plates for scrubbing, sanding, buffing, etc. is also widely disclosed. Some combinations of surface contacting plates and suction devices have been developed for highly specialized use including belt sanders with vacuum bags and the device disclosed in U.S. Pat. No. 2,953,808 which incorporates a vacuum device with resilient fingers for use by barbers in removing loose hair.

The device of this invention incorporates with a suction device an eccentrically driven, projection bearing plate as contacting means and provides a much improved carpet cleaning instrument which imparts unusual carpet fiber agitation.

SUMMARY OF THE INVENTION

In a suction cleaning device comprising a housing, a motor, a suction fan and means for transferring air-borne dirt from a carpet to a dirt collector the improvement comprising, within the perimeter of said housing, a carpet-contacting plate which comprises an essentially flat base with a plurality of carpet contacting projections and suction openings, and means for imparting to said carpet contacting plate a horizontal, oscillatory non-rotating motion with an amplitude of 1/32 inch to one-half inch at a frequency of from 500 to 14,000 cycles per minute.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood by reference to the drawings, which illustrate one embodiment of the concept of the invention.

FIG. 1 is a view of the carpet-facing side of a machine of this invention.

FIG. 2 is a cut-away side view of a machine of this invention.

FIG. 3 is a cut-away detail view of the drive mechanism of a machine of this invention.

DESCRIPTION OF INVENTION

Suction cleaning machines for rugs and carpets consist essentially of two parts, a component for agitating the rug or carpet and loosening dirt and a second component to provide suction and air flow to remove dirt from the rug or carpet and deposit the dirt in a collection bag. The agitating component of this invention imparts a self-scouring action to the fibers in a rug or carpet that is very efficient in loosening dirt. The agitating

component is a carpet contacting plate which imparts the self-scouring motion to the fibers of a carpet through projections from a surface essentially parallel to and very close to or even in contact with the surface of the carpet. For the purposes of the following description and claims the term "carpet" will be used to include rugs, carpets and similar fiber assemblies.

Referring again to the drawings, in FIG. 1, the carpet-contacting plate 1 has several suction openings 2 and many carpet contacting projections 3. The lower portion of the machine is partly enclosed in the housing 11 and the machine rolls over a carpet surface on the wheels 5. An internal suction fan 6 is driven by means such as a motor armature 9 and there is a spaced opening 4 between the housing and carpet contacting plate 1.

In FIG. 2, 9 represents a motor and the carpet contacting plate 1 is shown attached to the housing 11 by means of resilient connectors 10 and coupling attachment plate 17. The suction fan 6 is shown attached to the drive motor 9 and positioned above the suction chamber 14 and communicating with the chamber 14 through a suction opening 15. The collection bag 12 and handle 13 are also shown.

In FIG. 3 the upper machine housing 11 is shown spaced away from the carpet contacting plate 1. The carpet contacting plate 1 is connected to the attachment plate 17 by any suitable means 16. Preferably the attaching means permit for easy attachment and disengagement of alternate plates. The resilient connectors 10 are fixed to the upper housing 11. In this embodiment is shown a motor driven pulley 19, a drive belt 8 and an eccentric cam 18 driven by a shaft 21 from pulley 19 and rotating in bearings 22 mounted in connecting block 20. The drive mechanism is shown shielded by a shroud 23 from the dirt being carried by an air stream from the carpet to the collection bag.

In operation the air and air-borne dirt are drawn into suction chamber 14 around the edge of the machine as at spaced opening 4 and through suction openings 2 in carpet contacting plate 1. The air and air-borne dirt then pass through opening 15 and are driven under pressure into collection bag 12. The motor 9, while driving suction fan 6, also drives a pulley 19 shown in FIG. 3 via a drive belt 8. The pulley 19 carries a center mounted shaft 21 which is eccentrically mounted in a cam 18 which turns in bearings mounted in connecting block 20. A circular, horizontal, oscillatory motion is thereby imparted to the connecting block 20 and thus to attachment plate 17 and carpet contacting plate 1. The motion is transferred to the carpet fibers, thereby loosening dirt particles, allowing them to be swept up by the air current through the described openings 2 and 4 through suction chamber 14 and suction opening 15, and thence to collection bag 12 where the dirt is retained.

The embodiment represented in the figures confers a circular motion on the carpet contacting plate through the agency of a cam 18 turning in bearings 22 in a connecting block 20 which is attached through an attachment plate 17 to a carpet contacting plate 1. Alternate motion can be conferred on the attachment plate and carpet contacting plate. For example, an elliptical motion results if, in FIG. 3, the connecting block 20 is activated by means of an eccentric and slotted arm as disclosed in FIG. E, pages 158 and 159 of

Herbert Herkimer's "Engineers Illustrated Thesaurus," Chemical Publishing Co., New York, N.Y.

Any motion can be used in place of those shown within the prescribed limits of art known means for providing rectilinear, circular or elliptical amplitude and frequency, however circular or elliptical motion is preferred.

The movement provided to the fibers preferably has a large element that is essentially perpendicular to the length of the fiber, although an up-and-down or parallel movement will also impart the desired fiber flexing action. The frequency of oscillation of the motion is important and should be between about 500 and 14,000 cycles per minute, and preferably between 3000 and 5000 cycles per minute. Lower rates do not seem to provide sufficient scouring action and result in decreased cleaning efficiency as compared with higher oscillation rates. On the other hand, with oscillations above 14,000 cycles per minute, fiber damage may result without any significant improvement in cleaning performance. The fibers need undergo the oscillatory motion for only a very short time such as a few seconds to achieve impressive cleaning results. However for best results the device of this invention ordinarily is moved slowly over the rug or carpet.

The principal motion of the carpet contacting surface can be characterized as that of an ellipse of eccentricity of 0 to 1. This includes variations from a straight line rectilinear motion to one that is circular. The amplitude of the motion described is from about 1/32 inch to about one-half inch, and preferably from 3/16 inch to 9/32 inch. An element of vibratory movement perpendicular to the plane of the fiber-contacting means can optionally be added.

The surface of the carpet-contacting plate is provided with protuberances which may take the form of knobs, bumps, ridges or cleats and can be of almost any shape such as rounded, conic, pointed, cylindrical or otherwise. The protuberances need not be so long as to extend deeply into the rug or carpet fibers, but need only contact the fibers sufficiently to transfer the oscillatory motion thereto. The protuberances can extend from about 1/32 inch to about two inches, and preferably from 1/32 inch to 3/8 inch, from the surface of the contacting plate.

The carpet-contacting plate of the invention can be constructed of any suitable material such as metal or plastic. Plastic compositions such as polyvinyl chloride, polystyrene and many others can be readily molded to form carpet contacting plates of satisfactory shape and strength. The carpet contacting projections 3 can be made of metal, plastic or of an elastomeric material. The carpet contacting plate 1 can be cast with the projections 3 and suction openings 2 incorporated therein, or can be punched out or constructed in other known manner. The contacting plate can be attached to the motion producing means in a semi-permanent manner or by means allowing easy removal and replacement with other carpet contacting plates or different configuration which may be more satisfactory for the specific cleaning task at hand.

Attachment of carpet contacting plate 1 to attachment plate 17 can be made in a permanent, semi-permanent or detachable manner. FIG. 3 illustrates a means 16 by which the two plates can be easily and quickly engaged by pressing the two together or disengaged by parting them with a peeling motion. This de-

vice for connecting two flexible parts is disclosed in U.S. Pat. No. 3,076,244. Carpet contacting plate 1 and connecting plate 17 can also be glued together or fastened together by screws or attached in any operable manner. Alternatively the two plates can be combined into one for direct attachment to resilient connectors 10.

The suction openings 2 through which dirt laden air is sucked by the suction fan should be large enough to allow passage of objects commonly found as dirt in carpets. Preferably these openings have a shortest dimension of at least one-eighth inch. They can be of any convenient shape, circular, elliptical or otherwise and the total area of the openings should not exceed 40 percent of the base area of the plate 1, and will preferably be between 20 percent and 35 percent of the total area of plate 1. The carpet contacting projections 3 can occupy from 15 percent to 55 percent of the total plate area, calculating the horizontal projection-area at one half the distance from the end of the projections to the base of the plate. At least 10 percent of the area of plate 1 must be preserved as a base to provide structural strength.

The position of the carpet-contacting plate 1 in the housing 11 should be such as to allow sufficient space 4 between the inner edge of housing 11 and the outer edge of the plate 1 so that relatively large pieces of refuse and dirt can be passed therethrough to the suction chamber 14. The space between the housing 11 and the carpet contacting plate 1 should be at least about one-half inch.

The resilient connectors 10 which couple the moving mass which includes the carpet contacting plate 1 to the housing 11 can be of an elastomeric material or can be metal springs or any other means which provide firm attachment but at the same time allow freedom of movement in the prescribed oscillatory mode.

The shroud 23 can be constructed of metal or plastic material and is disposed in a fashion to effectively shield the eccentric cam 18, bearings 22 and pulley 19 from the dirt being carried by air flow from the carpet to suction chamber 14. The shroud can be conveniently attached to the upper machine housing 11.

Suitable devices for use in the process of this invention can of course vary greatly in size, weight and means of activation. Electric motors, compressed air motors, or internal combustion engines can be used as activation means where circumstances are suitable.

While the invention has been illustrated by a machine incorporating both agitation and dirt removal in a single structure, the two functions can be performed by separate machines. In other words the carpet contacting plate can be used to treat a carpet, loosening the dirt and making it available for easy removal via suction provided simultaneously by a separate machine. The device can be moved over a rug on wheels or by runners, as with a sled. It can be propelled manually, with a handle, or it can be self-propelled by providing means to drive at least some of the wheels.

Use of the suction cleaning machine of the invention has provided effective cleaning of most common kinds of carpeting presently available. Examination of cleaned carpets indicates that dirt is removed from the entire length of the fibers and from the base to which the fibers are attached. The fiber assemblies that can be effectively cleaned by the process of the invention include wool, cotton, nylon, polyester, acrylics, rayon

and polypropylene. Also woven carpets such as chenille, axminster and wilton, tufted, knitted and felted carpets can all be cleaned efficiently. The process of this invention works particularly well with carpets of tufted synthetic fibers.

The embodiments of this invention in which an exclusive property or privilege is claimed are as follows:

1. In a suction cleaning device comprising a housing, a motor, a suction fan and means for transferring airborne dirt from a carpet to a dirt collector the improvement comprising

a. a carpet contacting plate within the perimeter of said housing, said plate comprising

1. an essentially flat base, with
2. a plurality of carpet contacting projections, and
3. suction openings; and

b. means for imparting to said carpet contacting plate a horizontal, oscillatory, non-rotating elliptical motion with an amplitude of 1/32 to 1/2 inch at a frequency of from 500 to 14,000 cycles per minute.

2. The device of claim 1 wherein the carpet contact-

ing projections extend between 1/32 and 2 inches from the base of the contacting plate, the amplitude of the oscillatory motion is between 3/16 and 9/32 inch and the frequency is from 3000 to 5000 cycles per minute.

3. The device of claim 2 wherein the carpet contacting projections extend between 1/32 and 3/8 inch from the base of the contacting plate.

4. The device of claim 1 wherein the suction openings in the carpet contacting plate have a total open area of no more than 40 percent of the total area of the plate, the carpet contacting projections occupy from 15 percent to 55 percent of the total area of the plate and at least 10 percent of the plate area is intact.

5. The device of claim 4 wherein the suction openings have a total open area of between 20 percent and 35 percent of the total plate area.

6. The device of claim 1 wherein the non-rotating elliptical motion imparted to said carpet contacting plate is circular.

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