Jan. 23, 1968 J. WRIGHT 3,364,627

CARPET CLEANING MACHINE

Filed March 2, 1965 3 Sheets-Sheet 1

FIG. 1

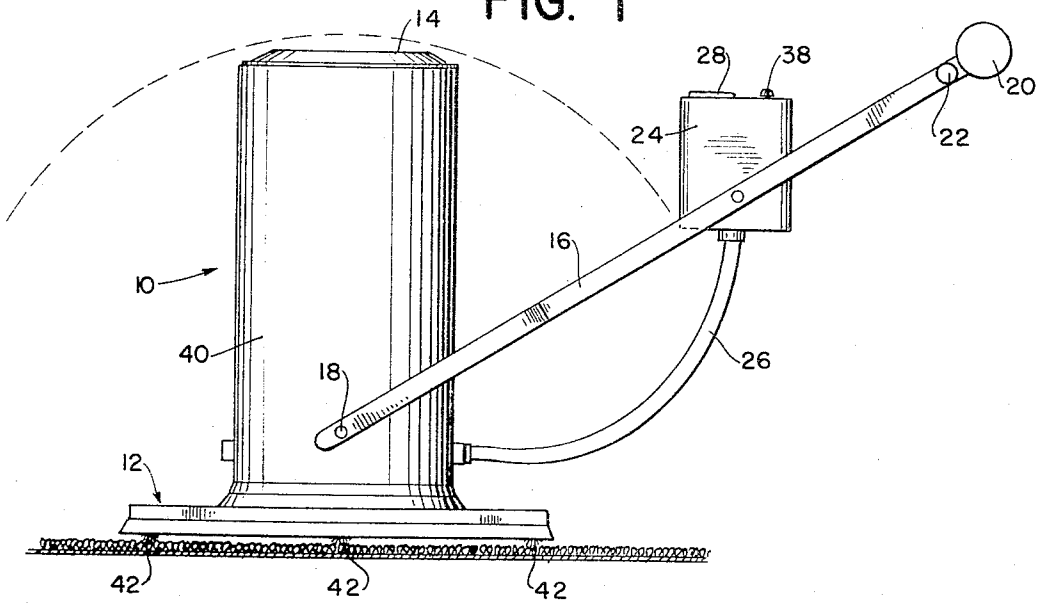
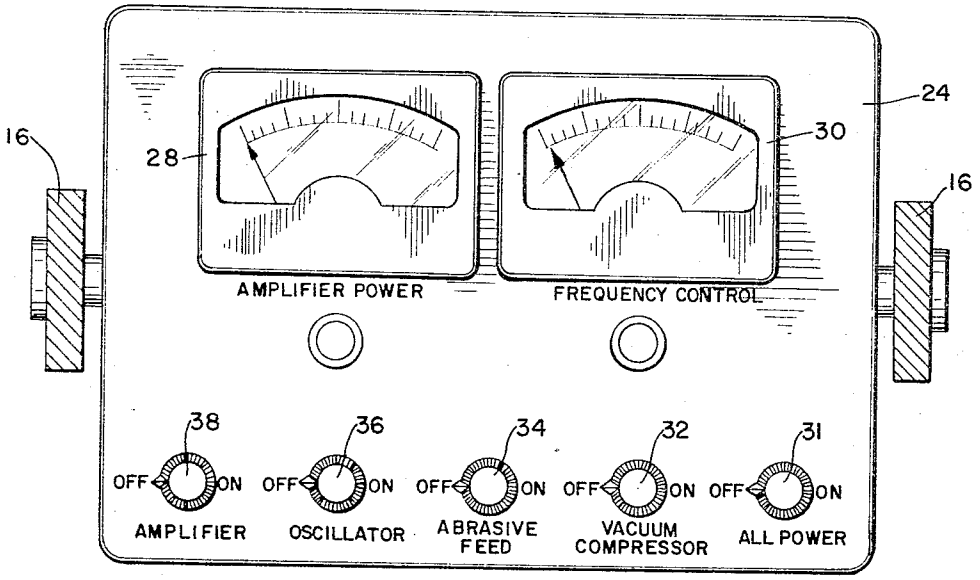


FIG. 2



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FIG. 3

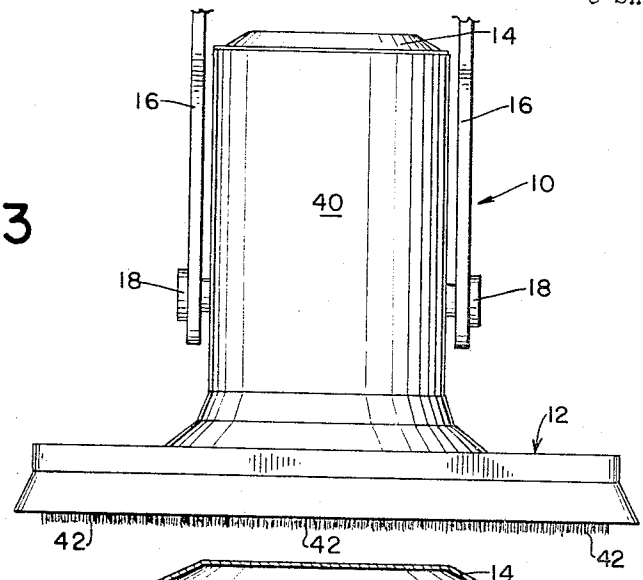
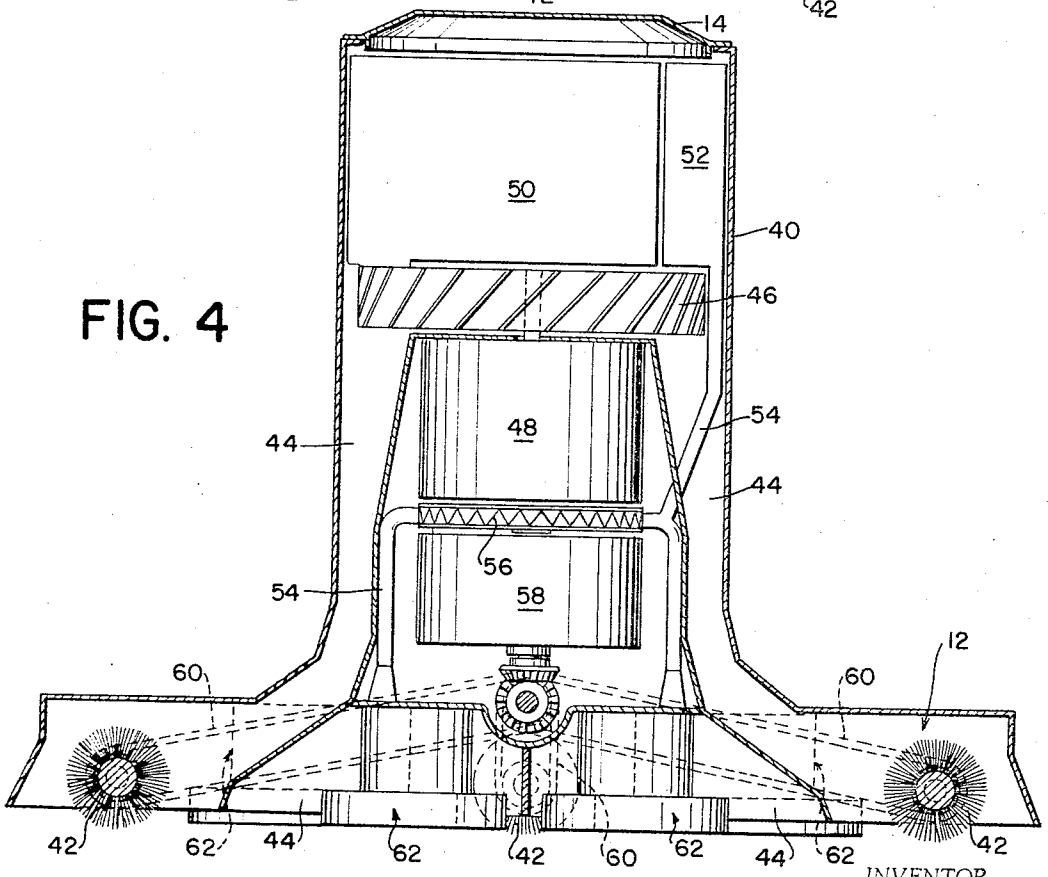


FIG. 4



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FIG. 5

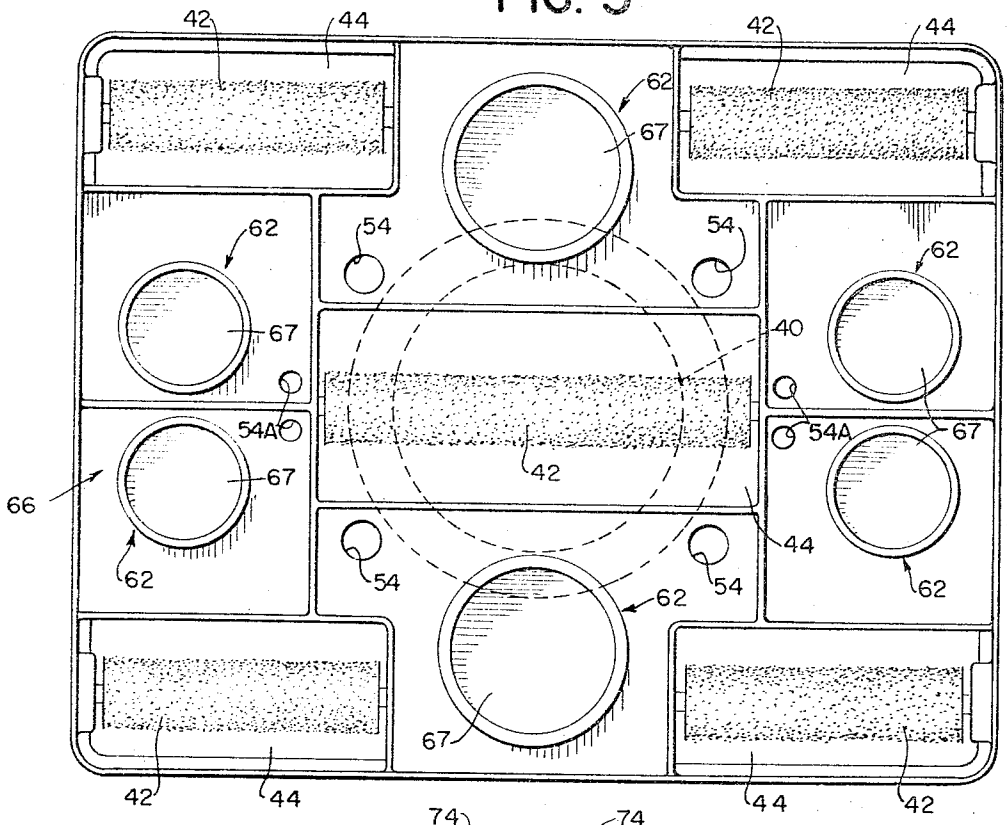
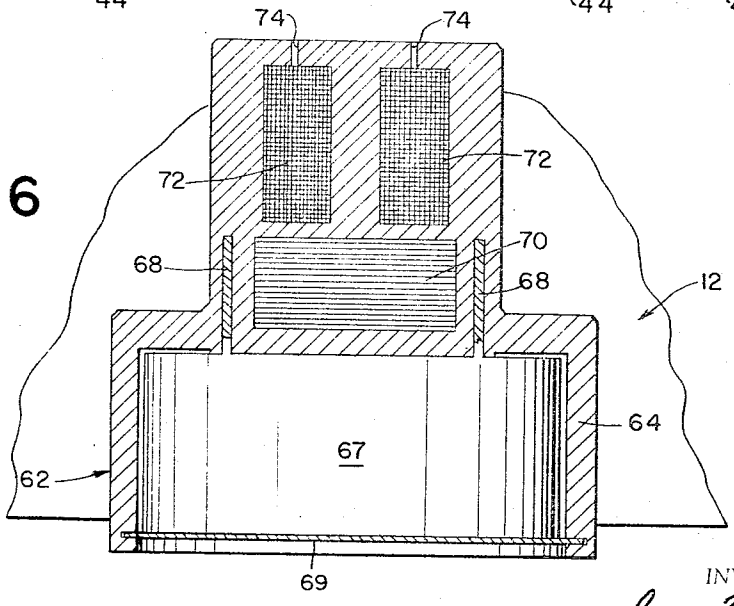


FIG. 6



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CARPET CLEANING MACHINE

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11 Claims. (Cl. 51—174)

ABSTRACT OF THE DISCLOSURE

A carpet cleaning machine is disclosed having a supporting frame, and means carried by first areas of the supporting frame for supplying compressed air to areas on the carpet located beneath the first areas and from which foreign particles are to be removed. The carpet cleaning machine also includes in the supporting frame means for causing ultrasonic vibratory movements in the compressed air so as to detach the foreign particles from the carpet areas and suspend the same in the compressed air. Finally, the supporting frame carries suction or vacuum means at second areas spaced and separated from the first areas of the supporting frame for removing the detached foreign particles when the carpet cleaning machine is moved forward or backward so that the second areas are above the carpet areas to be cleaned.

The present invention relates to carpet cleaning machines.

More particularly, the present invention relates to that type of carpet cleaning machine which is adapted to be used in situ.

Although carpet cleaning machines of this general classification are indeed very well known and highly developed, nevertheless they suffer from various defects. In the first place, it is still extremely difficult to thoroughly remove dirt particles from a carpet. It is, of course, known to apply a rotary brush to a carpet, but experience has proved that this alone will not effectively eliminate the dirt even when used in connection with a vacuum which withdraws the particles raised from the carpet by the brush. Also, it is known to provide devices which are capable of mechanically beating a carpet simultaneously with the brushing thereof and the application of a vacuum thereto, but such devices also have not proved to be very effective and at the same time create a considerable amount of wear on the carpet in connection with the cleaning thereof. In addition, these devices make the carpet cleaner difficult to move about and also create the danger of undesirable impacts on areas adjoining the carpet, such as thresholds which, if made of marble or the like, can be seriously damaged by the beaters.

Another serious drawback which is encountered with conventional carpet cleaning machines is that from time to time there are encountered localized areas on the carpet which have hard-to-clean spots, stubborn dirt or stains, and since it is not worthwhile to clean the entire carpet, as by conventional foam or drycleaning processes to which the entire carpet must be subjected, the stains or stubborn dirt remain in the carpet until such a time as it is decided that it is worthwhile to effect a major cleaning operation on the entire carpet.

It is accordingly a primary object of the present invention to provide a carpet cleaning machine which will avoid the above drawbacks.

In particular, it is an object of the present invention to provide a carpet cleaning machine which is capable of very thoroughly and effectively raising, into the immediate atmosphere of a carpet, particles which are embedded therein, without, however, physically beating the carpet with solid beaters or the like.

Furthermore, it is an object of the present invention to

provide a carpet cleaning machine which will not only very effectively raise, into the immediate atmosphere of the carpet, particles to be cleaned away from the latter, but which in addition will reliably carry away these particles with a suitable vacuum.

Furthermore, it is an object of the present invention to provide, for a machine of this type, rotary brushes capable of brushing the pile of the carpet, if the carpet is of the type which has a pile, as well as capable of propelling the machine along the carpet, so that the operator of the machine need not exert any particular physical energy beyond that required to guide the machine along a desired path.

In addition, it is an object of the present invention to provide a carpet cleaning machine of the above type which makes it possible for the operator to selectively apply to localized areas of the carpet, or to the whole carpet, a drycleaning agent which will effectively eliminate stubborn dirt or stains, so that the operator, when using the machine of the invention, has the option of providing localized cleaning action with drycleaning agents to selected areas of the carpet.

Furthermore, it is an object of the present invention to provide a carpet cleaning machine which can be applied to a carpet which is being cleaned without any preliminary preparation of the carpet and which at the same time leaves the carpet in a condition where the carpet is ready to be used immediately after the carpet has been acted on by the machine of the invention.

In particular, it is an object of the present invention to provide a structure capable of applying to the immediate atmosphere in which a carpet is situated ultrasonic vibratory energy which will very effectively suspend in the immediate atmosphere of the carpet particles to be cleaned away from the latter.

Thus, the invention primarily relates to a carpet cleaning machine in which a vibration means is provided for producing ultrasonic vibratory motion in the immediate vicinity of the carpet for suspending into the immediate atmosphere of the carpet, particles to be cleaned away from the latter, and a vacuum means cooperates with this immediate atmosphere of the carpet for drawing away the particles suspended by the means which produces the ultrasonic vibratory motion in the immediate atmosphere of the carpet. This vibration means takes the form of an electrical transducer capable of converting electrical energy into mechanical or vibrational energy.

The invention is illustrated by way of example in the accompanying drawings which form part of the application and in which:

FIG. 1 is a side view of one possible carpet cleaning machine according to the present invention;

FIG. 2 is a top plan view of a control box, FIG. 2 illustrating the various controls accessible to the operator at the top of the control box;

FIG. 3 is a front view of the machine of the invention on an enlarged scale as compared to FIG. 1;

FIG. 4 is a longitudinal sectional elevation of the machine illustrating the various components thereof;

FIG. 5 is a plan view of the machine of FIGS. 1–4 as it appears when looking at the underside of the machine;

FIG. 6 is a schematic sectional elevation of one possible structure of an electromagnetic transducer forming part of the machine of the invention.

The carpet cleaning machine of the present invention is capable of being used for all carpets and utilizes ultrasonic frequency agitation in a compressed air medium, with or without an abrasive agent or liquids, to vacuum and dryclean a carpet in one operation, and after the carpet has been cleaned by the machine of the invention it can be used immediately.

The ultrasonic carpet cleaning machine of the present invention incorporates the principle of cavitation. The machine includes an oscillator-amplifier which produces a sound wave in the medium of transmission, which will almost invariably be compressed air. The vibrations of the oscillator cause molecules of the surrounding air to vibrate back and forth about an average position. Each particle transmits motion to an adjoining particle and then returns to approximately its original position. Therefore, while the particles in the atmosphere, which are set into vibratory motion, move back and forth in the same localized space, nevertheless the sound wave continues to travel away from the oscillator, and since each particle transmits motion to an adjoining particle the particles are very effectively suspended, so that when this type of influence is applied directly to the surface of a carpet which is to be cleaned, the atmosphere in the immediate vicinity of the surface will have particles to be cleaned from the carpet suspended into this atmosphere. In order to achieve this latter type of ultrasonic vibration the structure of the invention includes a transducer which converts electrical energy into mechanical or vibrational energy.

In order to remove the particles which are suspended in this way the machine of the invention uses the vacuum cleaner principle, and in addition to utilizing ultrasonic vibration for suspending particles in a compressed air medium the machine of the invention is capable of applying a dry catalyst to the pile or flat fabric of a carpet in order to clean the latter without the use of liquid solvents.

Thus, the machine of the present invention is capable of vacuuming, cleaning, pile brushing, and revacuuming a carpet in one operation in such a way that the carpet can be used immediately upon completion of the cleaning operation without any additional preparation for use.

Referring now to the drawings, the structure illustrated in FIG. 1 includes the carpet cleaning machine **10** which has a lower support means **12** provided with a hollow underside to be directed toward and to be located immediately over the carpet which is to be cleaned. The machine **10** can have a generally cylindrical configuration extending upwardly from the flat lower head portion or support means **12**, and the top of the machine can be provided with a cover **14** which can be removed in any suitable way so as to provide access to a vacuum canister which can be removed from time to time and in which the removed dirt accumulates. In addition, removal of the cover **14** gives access to a container for a supply of abrasive, as described below.

A pair of parallel elongated handlebars **16** are pivotally connected at **18** to directly opposed parts of the machine **10** at the exterior thereof, and the connection **18** is preferably one which permits the handlebars **16** to be removed whenever desired. The handlebars **16** thus have a common turning axis and are capable of swinging completely over the machine **10** so as to be situated on either side thereof, which is to say either at the front or the rear thereof. The outer ends of the handlebars **16** are interconnected by a transverse guide handle **20**, and one of the handlebars **16** carries a suitable abrasive control **22** which is adjacent transverse guide handle **20** so that the hand of the operator which engages the guide handle **20** can also very conveniently actuate the abrasive control **22**.

Mounted between and carried by the handlebars **16** is an ultrasonic oscillator **24** of known construction, this unit **24** including, an amplifier, in addition to the ultrasonic oscillator, so that this unit **24** is capable of controlling the frequency and power of transducers located in the operating head **12**. On the top face of the unit **24** are situated various dials, meters, and controls for all of the electronic operations, as will be apparent from the description of FIG. 2 below.

It is to be noted that when the handlebars **16** are swung over the top of the machine **10** so as to be situated in a reverse position, the unit **24** is capable of swinging without interfering with the machine **10** so that the unit **24** is always situated at a location accessible to the operator. The ends of the unit **24** are pivotally connected to the handlebars **16** and the unit **24** is connected to the structure in the operating head **12** through a coaxial cable **26** which has plugs enabling the separate units to be very easily transported. The unit **10** contains the operating movable parts of the machine. The unit **24** has a frictional fit at its pivotal connections with the handlebars **16** which enables the coaxial cable **26** to maintain the unit **24** in a substantially upright attitude irrespective of the angular position of the handlebars **16**.

Referring now to FIG. 2, it will be seen that there are situated at the top of the control unit **24**, which is an ultrasonic oscillator and amplifier for control of frequency and power, as pointed out above, a pair of meters **28** and **30** for respectively indicating amplifier power and frequency control. Also, there are accessible at the top of the unit **24** several on-off switches. Thus, there is shown at the lower right portion of FIG. 2 an on-off switch **31** capable of switching the entire power on or off. Next to the switch **31** is situated a switch **32** for the vacuum and compressor. Next to the switch **32** is situated an abrasive feed switch **34** which is connected with the abrasive control **22** through suitable electrical conductors. An on-off oscillator switch **36** is located next to the switch **34**, and finally there is situated at the other end of the top face of the unit an on-off amplifier switch **38** enabling the amplifier to be turned on and off.

Referring to FIG. 3, where the machine is shown in a front elevation on an enlarged scale as compared to FIG. 1, it will be seen that the machine **10** is provided with a cylindrical shielded cover **40** for the cannister and for the vacuum structure and motors. The handlebars **16** are fragmentarily illustrated in FIG. 3, and any suitable known pivot assemblies **18** enable the handlebars **16** to be turned through a very large angle which is substantially more than 180° so that the handlebars **16** can be swung over the top of the machine to extend either forwardly or rearwardly.

FIG. 3 also shows the operating head or support means **12** which has a hollow underside directed downwardly toward the carpet which is to be cleaned, and in addition there may be seen in FIG. 3 portions of rotary brushes **42** which engage the carpet for brushing the pile thereof, and which also act to direct suspended particles to the vacuum means to be withdrawn by the latter.

As may be seen from FIG. 4, the lower operating head or support means **12** supports several brushes **42** for rotary movement, and these brushes, by frictional engagement with the carpet, are capable of propelling the machine so that the operator need only guide the machine by the handles **16** and need not exert the power required for advancing or retracting the machine. The vacuum means includes a plurality of vacuum ducts **44**, extending upwardly from the interior hollow space of the operating head **12**, this latter interior space of course being directed downwardly to the rug which is to be cleaned, and the vacuum means includes a vacuum impeller **46** driven by a motor **48** carried by the support means **12** between the ducts **44** on any suitable supporting structure. The shaft of the motor **48** is of course directly connected to the coaxial vacuum impeller fan **46**, and this fan when rotating sucks air up through the ducts **44**, so that particles suspended in the immediate atmosphere of the carpet will be sucked up through the ducts **44**. The rotary vacuum impeller fan **46** delivers the particles into a vacuum tank or cannister **50** situated underneath the removable cover **40** and supported over the impeller on a suitable supporting framework in a manner enabling an opening of the container or cannister **50** to communicate with the pressure side of the impeller from which the particles sucked through the ducts **44** are delivered into the cannister **50**, this cannister itself being of well known structure.

Situated beneath the cover 40, beside the cannister 50, is a container 52 which contains a supply of abrasive, and a duct means 54, 54A in the form of a suitable system of tubes extends downwardly from the container 52 and communicates with the hollow underside of the support means 12. The system is such that whether the abrasive is being supplied or not, ducts 54A supply compressed air only while ducts 54 supply compressed air or abrasive under air pressure as desired.

The motor 48, in addition to driving the vacuum impeller 46, drives an abrasive impeller 56 which is situated just beneath the motor 48 and which is also coaxially fixed to the shaft thereof, and of course this impeller communicates with the duct system 54, 54A and withdraws abrasive from the container 52 and delivers it under pressure through the ducts 54 onto the carpet for cleaning the latter while continuously feeding air under pressure to the carpet area within the space (FIG. 5) defined by the head 12.

The support means 12 supports below the abrasive impeller 56 a second electric motor 58 which is connected through a suitable transmission 60, including pulleys and belts, to the rotary brushes 42 for rotating the latter. Also situated at the underside of the support means 12, in the hollow interior thereof, are three pairs of ultrasonic transducers 62.

The arrangement of the structure at the hollow underside of the support means 12 is apparent from FIG. 5 which shows the peripheral edge of the operating head which forms the outer periphery of the machine at its bottom end and which defines the outer limits of the hollow interior space 66 which communicates with the atmosphere immediately over the carpet which is to be cleaned. As is apparent from FIG. 5, the several rotary brushes 42 are arranged at the corners and at the center of the space 66 while the vacuum ducts 44 are arranged in pairs at the front and rear, and it is clear that the rotary brushes 42 will direct particles into the vacuum ducts 44. The bottom open ends of the abrasive ducts 54 are illustrated in FIG. 5 in the immediate vicinity of the central rotary brush unit 42. Also, FIG. 5 illustrates the arrangement of the transducers 62 surrounded by the entry ends of vacuum ducts 44 which extend downwardly to the lowermost place of the transducers 62 and adjacent brush assembles 42. The entire area bounded by the peripheral downwardly directed wall of the operating head 12, so as to define the space 66, is under vacuum and in effect forms one large vacuum duct communicating with the several individual ducts 44.

Referring to FIG. 6, it will be seen that the details of one of the transducers 62 are illustrated therein. Each transducer is situated in the wall of the operating head 12 and includes a suitable outer housing 64 carrying at its bottom end a diaphragm assembly 66. This diaphragm assembly is fixed with a cylindrical ring 68 which surrounds a primary coil 70. Situated over the coil 70 are a pair of field coils 72, and the top end of the unit 62 extends just above the top surface of the operating head 12 and is provided with air outlets 74 communicating with the atmosphere over the operating head 12. The field coils 72 and primary coil 70 are connected via electrical conductors (not shown) through the outer housing 64 to make suitable connection to the coaxial cable 26.

In each electromagnetic transducer 62, voltage is induced in the primary moving coil 70 by transformer action between the coil 70 and the cylindrical ring 68. The primary coil 70 receives a signal from the oscillator, and this signal is induced in the ring 68 by transformer action so as to cause the diaphragm 69 to vibrate. The field coils 72 receive direct current and thus provide a steady magnetic field.

In operation, current (115 volts AC current at 60 cycles, for example) is sent to the oscillator of the unit 24 and is transformed to ultra-high frequency which is fed to the transducer 62. At the same time the current is fed to the motors 48 and 58 causing the impeller fan 46 to rotate so as to produce a vacuum which will suck up particles which have been suspended by the transducers 62. The motor 58 drives the brushes 42 which in addition to brushing up the pile, if there is a pile, serve to direct suspended particles, which have been placed in suspension by the transducers, into the vacuum ducts 44.

The motor 58 preferably drives the brushes by clutch type control belt assembly which allows the pushing and pulling of the machine by the operator, although the machine does not require the physical force by the operator to proceed in any particular direction because the brushes are directly in contact with the carpet and therefore propel the machine by friction. Any suitable wheels may be carried by the operating head 12 at its exterior for supporting the machine, and the elevation of the wheels could be such that the rotary brushes can directly engage the carpet so as to frictionally propel the machine.

At the same time as the vacuum pressure is being created and the brushes rotated, impeller 56 supplies air under pressure into space 66 through ducts 54 and 54A. The pressurized air is then supplied in the area of the transducers and acts as the medium in which the vibrational energy of the transducer operates. Ducts 54 communicate with the container 52 of the supply of abrasive and are capable of delivering a catalyst in the form of a silicone based powder, for example, and through these ducts 54 it is possible for the operator to selectively apply to the carpet or to areas thereof a drycleaning agent of the above type which will effectively clean localized areas, for instance.

The feeding of the abrasive is determined by manipulation of the control 22 shown in FIG. 1, so that the operator of the machine determines the feeding of the abrasive. However, it is not possible to feed any abrasive until after the abrasive feed switch 34 on the control unit 24 has been turned on by the operator, and such a control by the switch 34 is necessary in order to prevent continual feed of abrasives when feeding thereof is not desired.

What I claim is:

1. In a carpet cleaning machine, support means having a hollow underside adapted to be placed over a carpet which is to be cleaned, a plurality of rotary brushes carried by said support means in said hollow underside thereof at first areas and adapted to engage a carpet for brushing the latter as well as for advancing the machine along the carpet, means carried by said support means in said hollow underside thereof at second areas spaced and separate from said first areas for supplying compressed air to areas of said carpet beneath said second areas, ultrasonic transducer means carried by said support means also at said hollow underside thereof adjacent said second areas for providing ultrasonic vibratory movements in the compressed air so as to suspend therein particles to be cleaned away from the carpet, and vacuum means carried by said support means adjacent said first areas for carrying away particles suspended by said ultrasonic means.

2. In a machine as recited in claim 1, said vacuum means including ducts carried by said support means, communicating with the hollow underside thereof, and extending upwardly from said support means, said brushes directing particles suspended by said ultrasonic transducer means to said ducts, and a removable canister for receiving the particles, said ducts being situated beneath said canister.

3. In a machine as recited in claim 2, motor means carried by said support means between said ducts, vacuum impeller means driven by said motor means and located over said ducts between the latter and said canis-

ter for sucking air up through said ducts and delivering it into said canister, said motor means and impeller as well as said ducts forming part of said vacuum means, and transmission means transmitting a drive from said motor means to said rotary brushes for rotating the latter.

4. A movable carpet cleaning machine, which comprises: support means, means carried in first areas of said support means for supplying compressed air to areas of said carpet located beneath said first areas and from which foreign particles are to be removed, means carried by said support means adjacent said first areas for providing ultrasonic vibratory movements in the compressed air so as to detach foreign particles from said carpet areas and suspend the same in said compressed air, and suction means carried by said support means at second areas spaced and separated from said first areas, said suction means removing the detached foreign particles from said carpet areas when said machine is being moved so that the second areas are above said carpet areas.

5. A carpet cleaning machine according to claim 4, which includes: rotary brush means cooperating with said suction means for directing suspended particles to said suction means.

6. A carpet cleaning machine according to claim 5, wherein said rotary brush means are adapted to brush the pile of the carpet.

7. A carpet cleaning machine according to claim 4, which includes means for selectively applying a dry catalyst to the carpet for cleaning the same.

8. In a carpet cleaning machine as recited in claim 7, said dry catalyst being in the form of an abrasive.

9. In a carpet cleaning machine as recited in claim 8, said abrasive being in the form of a silicone based powder.

10. In a carpet cleaning machine, support means having a hollow underside adapted to be placed over a carpet which is to be cleaned, a plurality of rotary brushes carried by said support means in said hollow underside thereof and adapted to engage a carpet for brushing the latter as well as for advancing the machine along the carpet, ultrasonic transducer means carried by said support means also at said hollow underside thereof for providing ultrasonic vibratory movements in the immediate atmosphere of the carpet to be cleaned so as to suspend in this atmosphere particles to be cleaned away from the carpet, vacuum means for carrying away particles suspended by said ultrasonic means, said vacuum means also being carried by said support means, said vacuum means including ducts carried by said support means, communicating with the hollow underside thereof, and extending upwardly from said support means, said brushes directing particles suspended by said ultrasonic transducer means to said ducts, a removable canister for receiving the particles, said ducts being situated beneath said canister, motor means carried by said support means between said ducts, vacuum impeller means driven by said motor means and located over said ducts between the latter and said canister for sucking air up through said ducts and delivering it into said canister, said motor means and impeller as well as said ducts forming part of said vacuum means, transmission means transmitting a drive from said motor means to said rotary brushes for rotating the latter, container means situated adjacent to said canister, means for containing a supply of abrasive, duct means extending from said container means to said hollow underside of said support means, and second impeller means driven by said motor means and communicating with said duct means for withdrawing abrasive from said container and transporting it through said duct means to the hollow underside of said support means to be applied to a carpet for drycleaning the latter.

11. In a machine as recited in claim 10, handle means operatively connected to said support means for controlling the direction of movement thereof along a carpet to be cleaned, and means carried by said handle means at a location accessible to the hand of the operator controlling the flow of abrasive through said duct means at the option of the operator.

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