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VACUUM CLEANER

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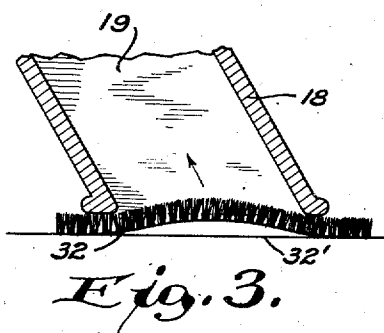
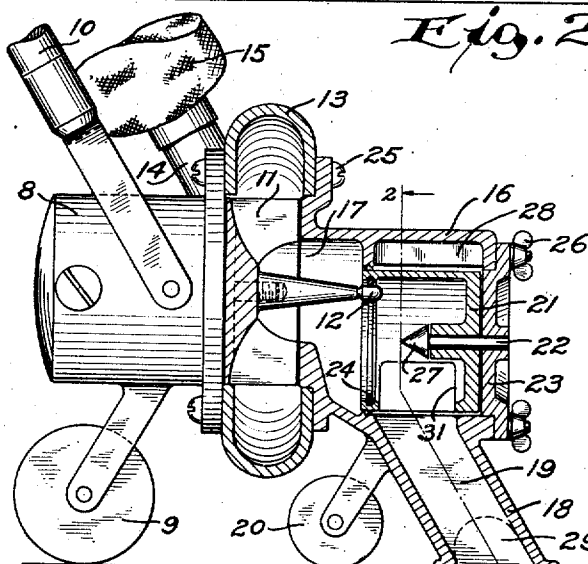
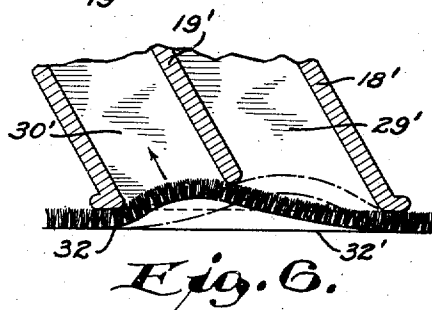
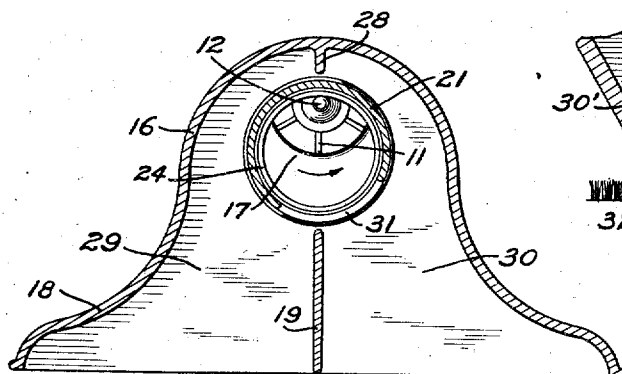
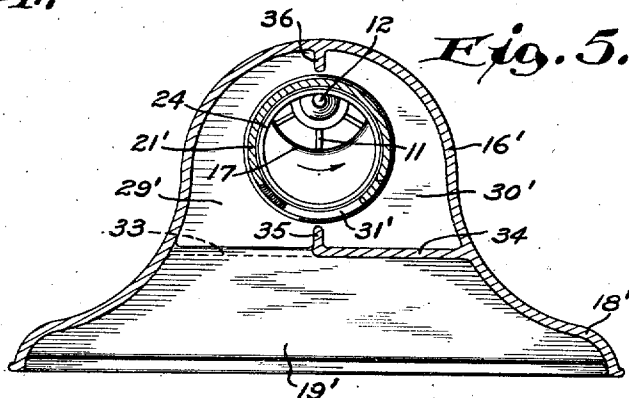
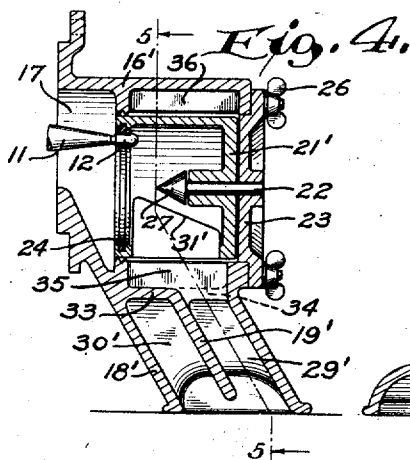


Fig. 1.

Fig. 2.

Fig. 6.

Fig. 3.

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VACUUM CLEANER

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4 Claims. (Cl. 15-16)

The present invention relates in general to improvements in the art of utilizing air currents to remove foreign matter such as dust from fabric and other objects, and relates more specifically to improvements in the construction and operation of vacuum cleaners or the like.

Generally defined, an object of my invention is to provide an improved vacuum cleaner which is simple and compact in construction, and which is also highly efficient in operation.

While the ordinary portable vacuum cleaner is quite effective in removing loose dust particles from various objects to which the suction nozzle is applied, it is a well established fact that these ordinary cleaners will not readily dislodge and remove firmly embedded and tightly adhering dirt particles, fragments of thread, lint, or the like. In attempting to improve the effectiveness of such devices, many modifications in nozzle structure and attachments have heretofore been proposed, including the use of brushes, beaters, and mechanism for creating a pulsating flow at the nozzle inlet. While the brushes and beaters do aid in removing some of the foreign matter other than loose dust particles, they obstruct the suction passage and require additional power for operation thereof, and therefore necessitate provision of a larger fan and propelling motor with resultant objectionable increase in weight and cost. The addition of these brushes and beaters also introduces undesirable complication in structure, and requires frequent removal and replacement of driving belts; and these appliances are more or less destructive to the articles being cleaned, and in case of brushes, the attachments themselves wear out rather quickly and require frequent replacement if satisfactory operating conditions are to be maintained. The prior attempts at introducing a pulsating flow in the suction nozzle have been extremely objectionable, because these devices intermittently interrupt the flow of mixed air and foreign particles into and through the final dust collecting bag or other receptacle, thus also producing a pulsating action during final air separation and causing objectionable escape of dust particles with the liberated air. All of the prior attempts and appliances for improving the effectiveness of these vacuum cleaners have therefore been objectionable for diverse reasons, and primarily because they lacked simplicity and effectiveness.

It is therefore a more specific object of my present invention to provide simple and most effective instrumentalities for producing a pulsating intake flow at the cleaner nozzle of a vacuum cleaner, while maintaining an approximately continuous flow of mixed air and foreign particles to the storage receptacle.

Another specific object of this invention is to provide a new and simplified nozzle assemblage

for suction cleaners, which will most effectively dislodge and remove embedded and adhering foreign particles, without danger of damaging the articles being cleaned and with the expenditure of minimum power.

A further specific object of the present invention is to provide an improved portable vacuum cleaner unit of the motor driven fan type and having a dust collecting bag mounted thereon, in which the objects being cleaned are automatically subjected to a rapidly pulsating shaking action while the flow of liberated air from the collecting receptacle is maintained relatively steady and devoid of excessive pulsation.

Still another specific object of my invention is to provide an improved suction cleaner assemblage for most effectively dislodging foreign matter from fabrics by a combined suction and vibratory action, and which is simple and durable in construction making it unnecessary to effect frequent inspections, adjustments or replacement of parts.

An additional specific object of the invention is to provide an improved cleaner nozzle which is beneficial rather than detrimental to fabrics and other articles being cleaned, and which can be readily applied at moderate cost either to new or old vacuum cleaner units or installations.

These and other specific objects and advantages of my invention will be apparent from the following detailed description.

Fig. 1 is a central longitudinal vertical section through a fragment of a portable vacuum cleaner having one of my improved suction nozzles and flow pulsators applied thereto, the nozzle having a central longitudinal partition therein;

Fig. 2 is a transverse section through the assemblage of Fig. 1, taken along the irregular line 2-2;

Fig. 3 is an enlarged fragment of the nozzle section shown in Fig. 1, depicting the action thereof on an ordinary rug;

Fig. 4 is a central longitudinal vertical section through a fragment of another portable vacuum cleaner having a modified type of my improved suction nozzle applied thereto, the modified nozzle having a transverse partition therein;

Fig. 5 is a transverse section through the assemblage of Fig. 4, taken along the irregular line 5-5; and

Fig. 6 is an enlarged fragment of the nozzle section of Fig. 4, showing the action thereof when applied to a rug.

While I have shown and described my invention as being especially applicable to an ordinary portable household vacuum cleaner equipped with an electric motor driven suction fan, it is not my desire or intent to unnecessarily restrict the scope or utility of the improvement by virtue of such specific embodiment.

Referring to Figs. 1 to 3 inclusive of the draw-

ing, the improved portable vacuum cleaner shown therein comprises in general, an electric motor 8 transportable upon a roller 9 and having a transporting handle 10 swingably suspended from its housing; a suction fan 11 adapted to be direct driven by the motor 8 at relatively high speed and having a concentric driving wheel 12 at the overhanging end of its driving shaft, the fan rotor being housed within a casing 13 having an axial inlet and a tangential discharge 14 communicating with an air permeable dust receptacle or bag 15 suspended from the handle 10; a nozzle member or casing 16 secured to the fan housing casing 13 and having an air delivery opening 17 at one end in open communication with the axial fan inlet, and a suction nozzle 18 at its opposite end provided with a central partition 19, the medial portion of the casing 16 forming an enlarged chamber and being transportably supported on a roller 20; and a rotary drum valve 21 rotatably supported upon a stub shaft 22 secured to a closure cover 23 for the casing 16, the valve 21 having a friction driving ring 24 cooperable with the fan wheel 12 and being cooperable with the partition 19 to alternately connect the suction passages on opposite sides thereof with the outlet opening 17.

The motor 8, handle 10, fan 11, casing 13 and bag 15 are all of relatively old and well known construction, except that the fan rotor has the driving wheel 12 associated therewith, and while this wheel is shown as having frictional driving engagement with the rubber or other resilient valve driving ring 24, this friction drive may obviously be replaced by a positive gear drive. The nozzle casing 16 while being of special construction, is preferably adapted for attachment to a standard fan casing 13 with the aid of removable screws 25; and the closure cap or cover 23 which rotatably supports the valve 21 may be held in place by means of thumb nuts 26 and provides means for effecting ready removal of the valve 21. The end of the valve supporting shaft 22 remote from the cover 23, may be provided with a conical head 27 as shown, and the partition 19 has an aligned top section 28 which cooperates with the main lower section to divide the nozzle into two segregated passages 29, 30 which are alternately communicable with the valve interior through a rectangular lateral valve opening 31. While only one partition 19 forming two segregated passages 29, 30 has been shown, it is obvious that more than one partition forming more than two passages may be utilized if so desired, and the width and length of each passage may be varied throughout a considerable range.

During normal operation of the vacuum cleaner specifically shown in Figs. 1, 2 and 3, the motor 8 may be placed in operation in the usual manner to rotate the fan 11 at relatively high speed; and the entire assemblage may be transported over a rug 32 or other object to be cleaned, with the aid of the manipulating handle 10. As the fan 11 revolves, the rotating wheel 12 coacts with the valve driving ring 24 and thereby also causes the valve 21 to revolve about the shaft 22 at somewhat slower speed. The optimum speed for the valve is best determined by experiment and depends on the sizes of fan passages, and of the dust receptacle. During this rotation of the valve 21, the lateral opening 31 revolves about the axis of the shaft 22 and alternately connects the nozzle passages 29, 30 on opposite sides of the partitions 19, 28 with the axial inlet of the fan 11 through the opening 17 with which

the interior of the valve 21 is always in open communication. At the time that the valve opening 31 is in communication with either of the passages 29, 30 alone, the entire flow of mixed air and dust entering the nozzle 18, will pass through the communicating passage, and the other passage will have practically no flow of air therethrough; but when the valve opening 31 is passing either of the partitions 19, 28, there will be some flow through both passages 29, 30. The total volume of mixture delivered to the fan 11 through the opening 17, and therefore the volume delivered to the receptacle or bag 15 through the fan outlet 14, will be approximately constant at all times, thus insuring a relatively steady flow of separated air through the permeable wall of the bag 15. The alternate establishment and stoppage of air flow in each passage 29, 30 will however produce a whipping or shaking action on the portion of the rug 32 exposed to the nozzle 18 at the lower end of each passage 29, 30, and as illustrated in Fig. 3, the rug portion thus exposed will be alternately elevated from the floor 32' and permitted to drop thereby producing a pulsating or vibratory action which effectively shakes the rug fibres and structure and permits the passing air to thoroughly pick up and remove all foreign matter. While the valve 21 is in fact revolving somewhat slower than the fan 11, the pulsation or vibration thus produced is quite rapid, but the flow of mixed air and foreign matter from the fan to the bag 15 is steady and substantially devoid of pulsation or vibration due to the nozzle action.

In the embodiment of the invention shown in Figs. 1 to 3 inclusive, the passages 29, 30 will obviously cause waves or undulations in the rug 32, which travel across the path of advancement of the nozzle 18, but these rug undulations may be caused to travel in the direction of advancement of the cleaner by forming the nozzle structure in the manner illustrated in Figs. 4 to 6 inclusive. In the modified assemblage, the motor 8, fan 11, fan housing 13, handle 10 and bag 15 may be the same as previously described, but the nozzle casing 16' has a somewhat wider nozzle 18' which is segregated by a transverse partition 19' into separated passages 29', 30'. The drum valve 21' of the modified structure is rotatably supported upon a stub shaft 22 carried by a closure cover 23, and is adapted to be revolved by a fan driven wheel 12 coacting with a driving ring 24 as previously described, but the lateral valve opening 31' in developed condition is formed as an oblique angled parallelogram, rather than as a rectangle as in the case of the opening 31. This formation of the opening 31' will produce somewhat smoother transition of the opening from one passage 29', 30' to the other, and in the modification several horizontal partitions 33, 34, and central vertical partitions 35, 36 are formed within the casing 16' and cooperate with the lower transverse partition 19' to form the irregular passages 29', 30' leading from the nozzle inlet to the valve chamber.

During normal operation of the modified type of nozzle illustrated in Figs. 4 to 6 inclusive, the portable unit may again be transported over a rug 32 or other article to be cleaned, and when the motor and fan are operating, the passages 29', 30' will be alternately connected with the suction side of the fan 11 by the revolving valve 21', and will be intermittently disconnected from the fan so as to produce the desired pulsating action in these passages. This pulsation of the

flow in the passages 29', 30' will cause the portion of the rug 32 which is exposed to the nozzle inlet orifice, to be shaken or whipped by an undulating or wave action as depicted in dot-and-dash and solid lines in Fig. 6. This rapid and violent agitation of the rug and its fibres quickly loosens and dislodges the dirt particles and threads so that the foreign matter will be most effectively removed by the air currents. It is to be noted, that while the modified structure produces a pulsating flow through the nozzle passages, the flow from the fan 11 to the bag 15 is practically steady and of constant volume.

From the foregoing detailed description it will be apparent that my present invention provides an improved vacuum cleaner assemblage which besides being simple and compact in construction, is highly efficient and most effective in operation. The improved assemblage actually possesses all of the advantages of the brush and beater types of attachments, without requiring increased power for operation of the unit, and the pulsating action which facilitates removal of dirt and threads does not noticeably affect the delivery of mixed air and dirt particles to the air permeable bag 15, nor does it affect the final discharge of separated air from the bag. Because of this fact the dust and foreign matter are permitted to accumulate within the bag 15 in a relatively quiescent state, and no objectionable quantities of dust will be returned to the ambient atmosphere through the permeable walls of the collecting receptacle. Since the volume of air withdrawn by the fan through the nozzle is always maintained constant, and since only approximately one-half of the nozzle orifice is effective at any given time, the power required to drive the fan 11 will obviously be maintained constant and at minimum value. While the pulsating valve is normally thoroughly confined within the nozzle casing, this valve may be readily removed for inspection and cleaning, and the valve assemblage will seldom require replacement of parts although it may be necessary to replace the rubber driving ring in order to maintain a suitable driving connection with the fan wheel 12. The improved assemblage can obviously be manufactured at a moderate cost and the improved nozzles may be readily applied to standard vacuum cleaner motors and fans, and the device has proven highly satisfactory and most effective in actual commercial use. It has been found that the improved nozzle and valve structure will remove dirt particles which cannot be removed with the ordinary vacuum cleaner and that the intermittent flow through the nozzle passages creates a vibration which quickly removes fibres such as threads from rugs and other fabrics.

It should be apparent that the lengths and the areas of the various passages and chambers should be properly proportioned so as to give the best possible results, and it may in some cases be desirable to divide the nozzle into more passages than shown in the drawing, by providing additional partitions. This increase in the number of passages for a nozzle of the same size will obviously increase the velocity of the air pulsations, and various types of valves other than the rotary drum type shown herein may be utilized to produce the pulsating flow while maintaining steady delivery of mixture from the fan. By providing thumb nuts 26 for effecting rapid removal of the valve and closure plate 23, these parts may be con-

veniently removed and replaced by a hose attachment having a tubular delivery end located within the casing 16 near the fan inlet, and provided with a flange cooperable with the bolts and clamping nuts 26. The valve while being preferably operated directly by the fan 11, may be rotated in some other manner and a special driving motor for this valve may be used if so desired.

All of these various modifications are within the contemplation of the present invention, and it is to be understood that it is not desired to limit the invention to the exact details of construction shown and described herein, for various other modifications within the scope of the claims may occur to persons skilled in the art.

I claim:

1. A vacuum cleaner comprising, a rotary fan for creating a constant flow of air and having a direct driven co-axial pulley at its inlet end, a nozzle for delivering dust laden air to said fan and being divided into segregated inlet sections, an annular hollow valve interposed between said nozzle and fan and being rotatable about an axis approximately parallel to the fan axis to produce alternating pulsating flows of air into the several inlet nozzle sections, and an annular driving member carried by said valve near the periphery thereof and frictionally engaging said fan pulley to provide a direct frictional driving connection between said fan and valve.

2. A vacuum cleaner comprising, a rotary fan for creating a constant flow of air and having a direct driven co-axial pulley at its inlet end, a nozzle for delivering dust laden air to said fan and being divided into segregated inlet sections, an annular hollow valve interposed between said nozzle and fan and being rotatable about an axis approximately parallel to the fan axis to produce alternating pulsating flows of air into the several inlet nozzle sections, said valve having a peripheral inlet port alternately communicable with said nozzle sections and an axial discharge in constant open communication with said fan through said annular valve, and an annular driving member carried by said valve near the periphery thereof and frictionally engaging said fan pulley to provide a direct frictional driving connection between said fan and valve.

3. A vacuum cleaner comprising, a rotary fan having a direct driven coaxial friction element near its inlet end, a nozzle for delivering air to said fan and having segregated inlet sections, an annular hollow valve interposed between said nozzle and fan and being rotatable about an axis approximately parallel to the fan axis to alternately connect said nozzle sections with the fan inlet, and an annular driving member carried by the peripheral portion of said valve and engaging said element to provide a direct frictional driving connection between said fan and valve.

4. A vacuum cleaner comprising, a rotary fan having a direct driven coaxial friction element near its inlet end, a nozzle for delivering air to said fan and having segregated inlet sections, a hollow cylindrical valve interposed between said nozzle and fan and being rotatable about an axis approximately parallel to the fan axis to alternately connect said nozzle sections with the fan inlet, and an annular driving member carried by and within said valve and engaging the periphery of said element to provide a direct frictional driving connection between said fan and valve.

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