

Feb. 22, 1966

H. WESSEL  
VACUUM CLEANER HEAD

3,235,899

Filed April 16, 1964

3 Sheets-Sheet 1

FIG. 1

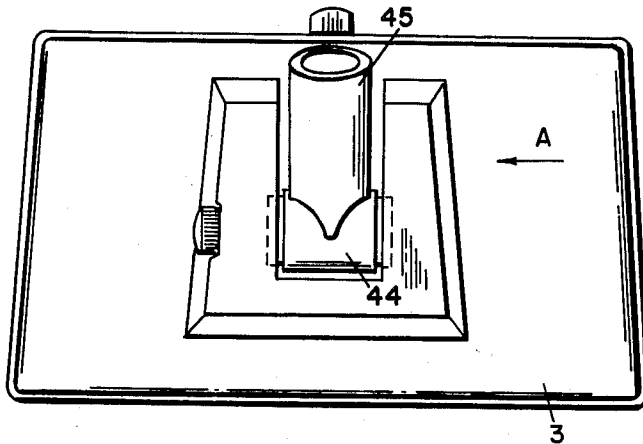


FIG. 2

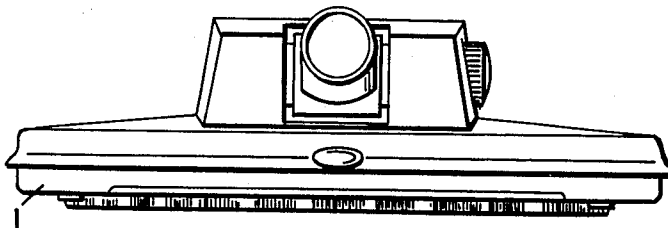
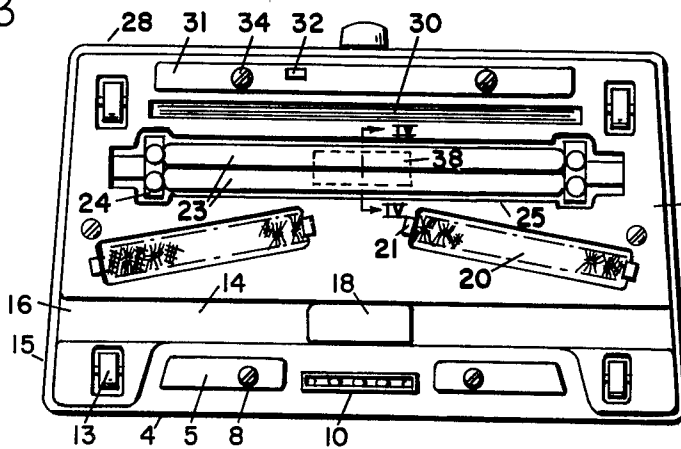


FIG. 3



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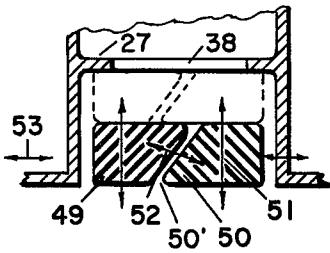
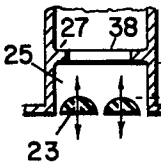
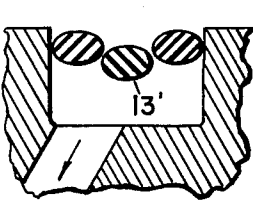
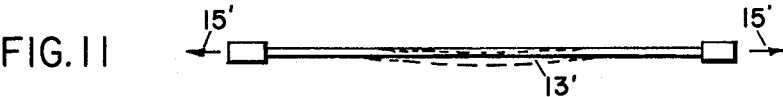
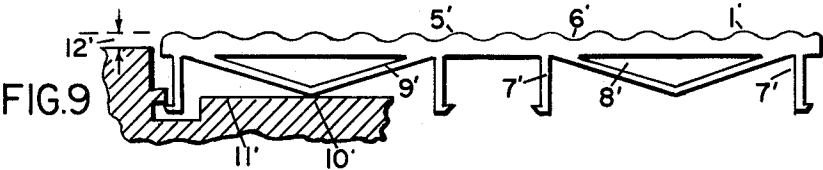
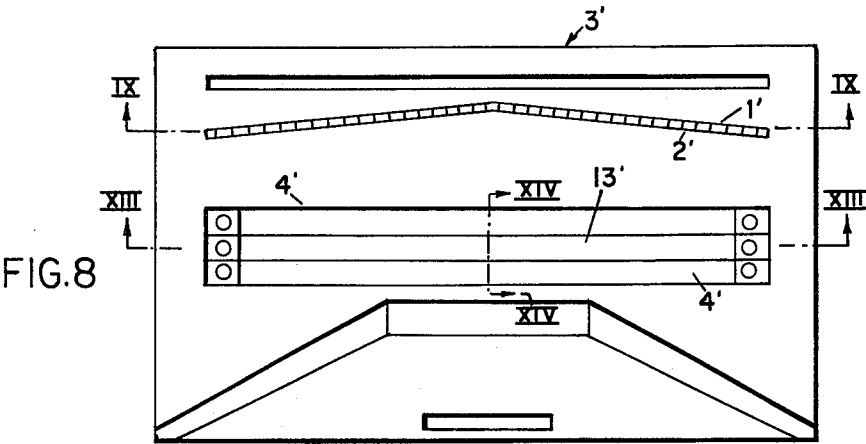


FIG. 12

FIG. 4

FIG. 5

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3 Sheets-Sheet 3

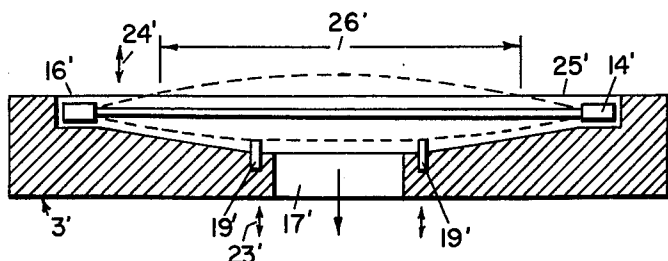


FIG. 13

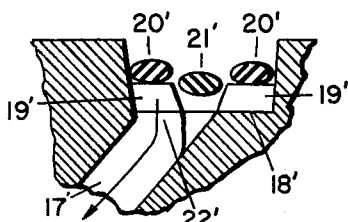


FIG. 14

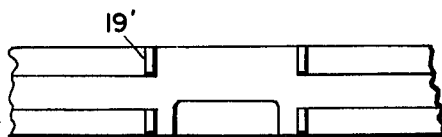


FIG. 15

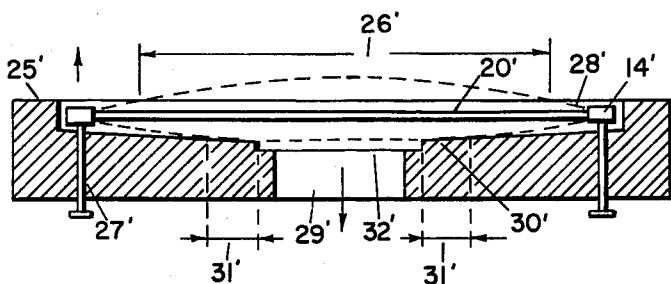


FIG. 16

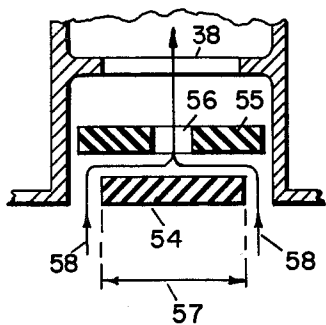


FIG. 6

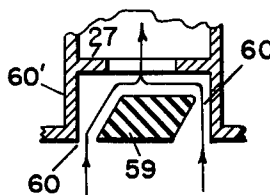


FIG. 7

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## VACUUM CLEANER HEAD

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Claims priority, application Germany, Apr. 27, 1963,

W 34,373; Jan. 29, 1964, W 36,077

4 Claims. (Cl. 15—365)

The invention relates to a universal cleaning appliance usable either for beating carpets or for brushing or vacuum-cleaning carpets and floors. To this end, the underside of the appliance is equipped with brush bars which may be withdrawn into the housing, further rotatable brush rollers, beater bars vibrated by the suction air current, and a suction nozzle, wherein, by the selective switching of some of these elements, some such elements may be switched off and others may be switched on. The appliance has preferably rollers enabling it to be guided over the surface to be cleaned. Near one long edge, a conventional Vulkollan comb may be provided.

For the operation of the appliance, for example, a brush bar may be pushed out of the slot for the brushing operation. In order to switch off the beating elements, during this operation, a valve is provided in the articulated part of the connecting socket to the vacuum cleaner conduit for closing the suction air current against the suction air orifice for the beating elements, and connecting it to the suction nozzle. During this operation, the brush bar and the brush roller are operated, and the loosened dirt is sucked into the suction nozzle.

For pure suction operation, the brush bar is withdrawn into the housing so that only the Vulkollan comb and the two brush rollers protrude beyond the lower surface and are effective. The appliance may be then used for vacuum cleaning carpets as a normal carpet cleaner, or for cleaning floors by sucking up the dirt.

If the appliance is to be used as carpet beater, the valve is reversed so that the suction nozzle is closed and the suction air current is drawn through the beater orifice, causing the beater elements to be vibrated because of the suction of the flow of air, over the bar, and to beat the carpet.

According to the invention, the switching of the appliance from suction to pure beating operation by means of a valve is a very simple operation, and has the further advantage that the appliance may be moved over the surface to be treated always in the same position. The appliance according to the invention need not be rotated through 360° in order to deflect the air suction current so as to switch from suction to beating.

The outer rim of the appliance is an isosceles trapezium with wide leading edge and slightly inclined two side edges. This configuration has the advantage of making possible better evacuation also in corners than with an appliance with rectangular outline.

In a further embodiment of the subject-matter of the invention, instead of the two brush rollers on the underside of the cleaning appliance one or more combs can be disposed in recesses or slots of the appliance housing which take over the task of the rotating brush rollers.

In the practical development of this universal cleaning appliance it has been seen that by the beating action alone, the dirt, and in particular the cottons, threads and similar textile elements, cannot be provided adequately with suction, and accordingly brush rollers have been provided which are loosely and rotatably disposed and the task of which is to loosen up such threads and the like and pull them up out of the carpet as the appliance moves over it, and accordingly during the subsequent beating and suction operation these threads can be substantially completely removed from the carpet.

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With these brush rollers, the loosened threads may adhere to the brushes of the brush rollers or in particularly unfortunate cases even wind round the brush rollers and become fixed with the result that blockage clamping or even locking of the rollers can arise, in time. The brush rollers can be cleaned by hand, but this is very inconvenient, as the operator is forced to remove the separate threads from the brush rollers.

The comb used instead of the rollers may have a serrated edge on the side towards the carpet, or in a preferred embodiment may have a wavy contour, and consists of resilient material, such as Vulkollan. It can be adjusted in height inside the slot in the appliance.

In particular, the comb is resiliently borne in the slot, so that on a certain pressure, and this can be quite light, of the appliance onto the carpet the comb is pressed onto this and with the movement back and forth of the appliance over the carpet the projecting serrated edge of this comb loosens up any threads and places them to a position in which by the subsequent beating and suction operation they are removed from the carpet.

According to a further embodiment of the invention the beating bars consist of elastic bands.

It has been found that on occasion, due to the effect of certain elements on the vibration of the elastic bands, these, on vibrating, are sucked up by the suction flow of the air into the suction slit above the said bands, and become firmly wedged in this slit, so that the beating effect is cancelled out. This disadvantageous effect can be avoided by switching the vacuum off for a short time, so that the suction effect is broken off and the elastic bands are released from the opening of the suction slit and return to their original, flat position, but the trouble can be repeated and can lead to inconvenient interruption of the cleaning.

Apparently this phenomenon results from the fact that—possibly quite by chance or because of certain vibration conditions—the bands vibrate synchronously, even if only for a period, and furthermore, have the same amplitude, so that all the bands to a certain extent function as a single broad band and are sucked into the suction opening by the air stream.

To overcome these disadvantages, the separate bands are made of material of various elastic strengths, that is to say some bands are less strongly elastic than others, and as a result of this their vibrations as far as concerns vibration number or frequency, phase and amplitude, are different, and the possibility of there arising the above-mentioned phase and amplitude synchronisation is not very likely.

A further solution offered by the invention is to manufacture the separate bands of the same elastic material, of equal elasticity and elastic strength, but to make them of differing lengths, and so to adjust them in relation to each other while not yet installed in the appliance that in the stretched position of one or more bands, other bands sag a little because of their greater length. When the bundle of bands is installed in the appliance and stretched a little, even the bands which were sagging in unstressed condition will be stretched to a certain extent, but, however far the stretching process is carried on, will remain either sagging a little or, some of them, will flatten themselves out. However, as some of the bands are strongly tensioned, others—the bands which originally were sagging a little—are subjected to somewhat lesser tension, and the separate bands will not only have differing phase vibrations but also differing amplitudes, and accordingly the danger of all the bands being simultaneously lodged in the slot by the suction effect is reduced.

The invention provides furthermore the further possibility of preventing the wedging action of the suction,

by disposing on both sides of the suction slit which is above the bends, ribs, shoulders and projections of this nature, so that one band or a few bands collectively rest on the support during the vibrating. This means that, on the arising of synchronisation of phase and amplitude, the blocking to a certain extent of the suction mouth by all the bands is avoided. The bands, in this maximum-state vibration i.e. maximum amplitude, are spaced from each other so that there is sufficient space between the separate bands for the air to enter, and the suction locking of the bands is thereby avoided. It is of significance here that by this, the suction effect is at the same time intensified, as because of the differing tensions and elasticities in the beating bands and on account of the webs or projections for the support of the separate bands, the amplitude is even greater than with the elastic bands of the main patent. Thus, with one and the same measure, the double advantage of the prevention of sucking up and the preventing of interruption of the beating effect is achieved on the one hand, and an increase in the beating effect on the other hand.

The invention will be further described, by way of example, with reference to the accompanying drawing in which:

FIGURE 1 is a top plan view;

FIGURE 2 is a side view;

FIGURE 3 is a bottom view;

FIGURE 4 is a partial cross-section of the lower part of the appliance within the zone of the beater bars along the line IV—IV in FIGURE 3 with a semi-circular section of the beater bars;

FIGURE 5 is a similar partial cross-section with trapezoidally shaped beater bars;

FIGURE 6 is a similar cross-section with beater bars arranged one above the other;

FIGURE 7 is an embodiment similar to FIGURE 5 in which the two beater bars have a triangular cross-section;

FIGURE 8 is a bottom view of the cleaning appliance;

FIGURE 9 is an elevation of the comb in part section along the line IX—IX of FIGURE 8;

FIGURE 10 is a side elevation of the bundle of bands in untensioned state showing bands of differing lengths;

FIGURE 11 is the same side elevation but with the bands tensioned;

FIGURE 12 is a cross-section through the appliance along the line XIV—XIV of FIGURE 8;

FIGURE 13 is a longitudinal section through the appliance along the line XIII—XIII of FIGURE 8 in accordance with a further embodiment of the invention, in which the support webs are disposed on both sides of the slot sucking up the bands;

FIGURE 14 is a partial cross-section along the line XIV—XIV of FIGURE 8 but in the variant with webs;

FIGURE 15 is a partial bottom view of the appliance in the region of the elastic bands after installation of the bands in the appliance; and

FIGURE 16 is a longitudinal section similar to FIGURE 13 but with support shoulders for the elastic bands instead of the webs.

The cleaning appliance according to FIGURES 1 to 7 consists of several parts, made preferably of a hard thermoplastic, such as, for example, shockproof polystyrene. These parts are the lower part 1, and the upper part 3,

Near its leading edge 4, the flat housing 1 has two slide plates 5, engaging into slots in the bottom of the lower part, and screwed to the bottom part by means of counter-sunk slotted-head screws 8. Between the slide plates, there is located a Vulkollan comb 10 which is mounted in pins. In the four corners of the lower part 1 of the appliance, having a trapezoidal outline, there are rollers 13. Behind the guide plates, there is a suction nozzle 14 extending over the entire width of the underside of the appliance which becomes flatter towards

the narrow sides 15. Towards the center, a suction slot 18 is formed in the bottom of this groove. Substantially centrally, there are located in semi-cylindrical recesses brush rollers 20 which are freely rotatable on stub axles 21 in respective bearings.

Further towards the rear, there are two or more vibratory bands 23, extending over the entire width of the appliance, and mounted at their end by clips 24 so in a channel 25 on the underside of the appliance that these bands are spaced at a certain distance from the passage at the base of this groove when they are in the rest position (FIGURE 4).

Yet further towards the rear of the appliance, near the edge 28, there is a retractable brush bar 30, disposed in a slot and likewise extending over practically the entire width of the appliance, which may be pushed out of this slot at choice.

Finally, near the rear edge 28, there is a similar guide plate 31, but extending over the entire width of the appliance and can be fitted by means of tongues 32 into slots in the underside of the appliance, where it is fixed by slotted head screws 34. The three slide plates 5, 31 are of metal in contrast to the rest of the parts of the appliance, in order to prevent the appliance from acquiring an electrostatic charge due to friction.

During the beating operation, air is sucked in only through the slit 38. The air current, flowing between and outside the beater bars 23 from the bottom through the slit 38, causes the elastic beater bars 23 to approach this opening 38. The increasing elastic tension in these resilient flexible members gives rise to a counter-acting force which stops the deflection of these bars in the direction towards the suction slit 38. Owing to the changing flow resistances, the inner tensions in the beater bars, and the mass effect, there occur fast vibratory movements which produce the beating effect.

The beater bars 23 have a semi-circular profile, causing a variation of the vibratory movement, since the flow conditions with these profiles differ.

The semi-circular profiling of the beater bars has the advantage that suction fixing at the base of the slit 38 cannot so easily take place, as the air, on account of the arching on the rear side of the beater bars, can still very easily pass between the not always completely juxtaposed edges of the two beater bars, and said bars accordingly do not wedge together by suction as in practice they can touch each other only on a narrow edge on the front side.

According to the embodiment shown in FIGURE 5, the beater bars 49 have an irregular trapezoidal cross-sectional configuration so that the facing edges of the trapezium 50 have between them a narrow slot of uniform width when they are at rest. By reason of this trapezoidal shape, there occurs during the vibration in the direction of the twin arrow 51 an impact between the two surfaces 50, because the vibratory movements of the two beater bars is not uniform. This gives rise to pressure forces 52 on the two surfaces 50 of variable magnitude. These pressures cause the beater bars 49 to have additional side vibrations not only in the direction of the twin arrow 51, but also normal thereto, that is to say, horizontally in the direction of the twin arrow 53.

This has the advantage that the beater movements take place not only vertically to the bars, but that additionally to this purely beating movement a movement in the horizontal plane 53 is carried out. In consequence, there results a particularly good beating action and cleaning of the carpet, and suction fixing at the base 22 of the slit is avoided, since the air can still penetrate into the slot 50' opening between the two obliquely running surfaces 52, 50.

According to the embodiments of FIGURE 6 the two beater bars 54, 55 are formed by flat bars, one above the other, of which the upper bar 55 has a centre slot 56 and the lower bar 54 has a width 57 which is smaller than that of the upper bar. This construction produces special

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beating effects because the air current has the flow shown at 58 in FIGURE 6. The heating effect is particular, because the two beater bars do not pass through a synchronous movement and this, further, has the advantageous effect that suction fixing of the elastic beater bars at the suction opening 38 is not possible.

FIGURE 7 is an embodiment similar to that of FIGURE 5, in which both beater bars 59 have a triangular cross-section which brings the advantage that narrow gaps arise only at the points 60 between the side walling 60' and the beater bars. The current of air, therefore, as can be seen from the arrows, has a large space available, particularly at the left beater bar, between the corner 60 and the lower surface 27, so that the danger of suction fixing can be checked.

These beater bars are of an elastic material, such as particularly soft rubber, having preferably a Shore hardness of 50 to 60°. The two bars may also be made of rubber materials having different Shore hardness so that the vibrations of both beater bars are different and can be adjusted one to the other, in order to produce particularly favourable beating effects.

In the embodiments of FIGURES 8 and 9, instead of the brush rollers 20 of FIGURE 3, a comb 1' made of Vulkollan is inserted in a slightly arched slot 2' of the housing 3' of the cleaning appliance. The slight arching of the slot 2' is for the purpose of ensuring that, with the uprighing, scratching or scraping action on the separate threads, these are better put in the way of the beater bars 4'.

The scraper comb 1' has undulations 6' on the outside edge 5', and also separate hook-like formations 7' by which it is hooked on to the interior of the appliance on projections. In the vicinity of the two end regions, by flat triangular punchings 8', flat angular spring means 9' are formed from angularly adjoining struts, with the pointed teeth of which the comb abuts on the base 11' of the housing. In untensioned state the comb 1' projects, by an extent shown at 12' out beyond the slot 2' of the appliance housing 3'. When the appliance is set on the carpet, this distance 12' is reduced by the pressing, and the comb is partially pressed back into the interior of the housing, this being possible because the springy parts 9' of the comb are deformable and take up a position something similar to that shown in dotted lines in FIGURE 9.

By the undulated shape of the outer edge on the one hand, and the easy deformability of the comb on the other, the carpet in being treated in this way is not only protected but care is moreover taken that the threads, simply because this protective treatment, due to the light pressure are better loosened from the carpet and made to stand on end as was the case with the previously used brush rollers. The advantage of the comb of the invention furthermore consists in that it does not have to be subsequently cleaned, as was the case with the brush rollers, as no hairs or threads or other dirt can attach themselves to the comb.

The two outer bands, of the elastic bands 4' as can be seen in FIGURE 10 are, in tensioned state, shorter than the middle band, so that in the stretched position of the outer bands 4' this band sags a little. When the bands with their clamps 14' are installed in the recess 16' of the appliance housing 3' they have to be stretched for this purpose, as FIGURE 11 shows by the arrow 15', and by this action, the middle band shown in dotted lines in FIGURE 11 straightens itself out a little from the hanging down position of FIGURE 10, so that the sagging is now very slight. This position in the mid-region can be seen in cross-section in FIGURE 12.

In the embodiment of FIGURES 13 to 15 on both sides of the suction channel 17' disposed underneath the bands there are provided webs 19' on the base 18' of the recess 16' of height and width such that only the two outer bands 20' in vibrating, come to rest on them below, thereby

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being restricted in amplitude from below, whereas the middle elastic band 21' can vibrate unimpeded with greater amplitude between the two webs 19'. This ensures that on unfavourable conditions arising, two or even all the bands simultaneously, shall not vibrate up into the mouth 22' of the suction channel 17' and completely close this mouth, remaining sucked in it.

With the embodiment with the webs it is not essential to have differing elasticity for the separate bands; on the contrary, all three bands can be manufactured of equally elastic material and can have the same lengths when extended, so that in the tensioned state the three bands have the same inner tension, and even so it is possible very effectively to prevent the suction fixing, by the arrangement of the shoulders or webs.

It can be expedient in accordance with the invention, for reasons of adjustment possibilities, to adjust the height of the webs 19' in accordance with the double arrow 23', and, further, the clamps 14' can be height adjustable in the recess 16' of the housing 3 in accordance with double arrow 24', as a result of which the part 26' of the bands, projecting over the under edge 25', can, on the vibrating of the elastic bands, be adjusted, and according to the beating effect also.

FIGURE 16 shows that the projecting part 26' of the bands can be made larger if the clamps 14' are pushed in nearer to the under edge 25' of the housing, this being done by means of the adjusting screw 27'.

Instead of the webs 19', the recess 28' for the bands 20', 21' on both sides of the mid-suction slit 29' can have stepped shoulders 30', and by this, in a way similar to that achieved with the webs 19', some of the elastic bands are restricted in amplitude whereas others can vibrate up to the mouth of the slit 31'. This possible embodiment affords a wider surface in the restricting of amplitude, these surfaces being shown in FIGURE 16 by the arrow 31'.

I claim:

1. A vacuum-cleaner head connectable with the suction line of a vacuum cleaner and selectively operable for vacuuming and beating carpets, rugs and like surfaces to be cleaned, said head comprising:

a generally flat housing connectable with said suction line and having a bottom face juxtaposable with the surface to be cleaned;

means forming a suction nozzle in said face extending longitudinally therealong transverse to the direction of movement of said head;

a longitudinally extending channel formed in said face and opening thereat while being transverse to said direction;

duct means for selectively connecting said nozzle and said channel to said suction line for inducing a flow of air alternatively through said nozzle and said channel, said duct means including a passage formed in said housing and communicating with said channel at a location spaced from the mouth thereof and from said face;

a plurality of elongated flexible resilient members in said channel anchored at the ends thereof while spanning said mouth and having a collective breadth at least equal to the width of said passage;

at least one of said flexible members upon its movement in the direction of said location for preventing jamming of said passage by said flexible members;

and a comb member extending longitudinally across said face and movably received therein, said comb member having a multiplicity of projections along a lower longitudinal edge engageable with said surface for loosening recement thereon, and spring means in a one-piece construction with said projections for biasing said comb member downwardly from said face into engagement with said surface, said projections constituting a sinuous surface of

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said longitudinal edge, said comb member being composed of resilient material and being of bowed configuration, said spring means including a pair of spring members longitudinally spaced apart along said comb member and each constituted by a pair of angularly adjoining struts depending from the comb member, said comb member further having hook-like portions engageable with said housing for retaining said comb member therein.

2. A vacuum-cleaner head as defined in claim 1 wherein said flexible resilient members have different natural frequencies of oscillation.

3. A vacuum-cleaner head connectable with the suction line of a vacuum cleaner and selectively operable for vacuuming and beating carpets, rugs and like surfaces to be cleaned, said head comprising:

a generally flat housing connectable with said suction line and having a bottom face juxtaposable with the surface to be cleaned;

means forming a suction nozzle in said face extending longitudinally therealong transverse to the direction of movement of said head;

a longitudinally extending channel formed in said face and opening thereat while being transverse to said direction;

duct means for selectively connecting said nozzle and said channel to said suction line for inducing a flow of air alternatively through said nozzle and said channel, said duct means including a passage formed in said housing and communicating with said channel at a location spaced from the mouth thereof and from said face;

a plurality of elongated flexible resilient members in said channel anchored at the ends thereof while spanning said mouth and having a collective breadth at least equal to the width of said passage;

at least one formation in said channel between said flexible members and said location for intercepting at least one of said flexible members upon its movement in the direction of said location for preventing jamming of said passage by said flexible members;

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and a comb member extending longitudinally across said face and movably received therein, said comb member having a multiplicity of projections along a lower longitudinal edge engageable with said surface for loosening recement thereon, and spring means in a one-piece construction with said projections for biasing said comb member downwardly from said face into engagement with said surface, at least three of said flexible resilient members being provided and at least two of said flexible members being engageable with respective ones of said formations for preventing jamming of said flexible members in said channel.

4. A vacuum-cleaner head as defined in claim 3 wherein said projections constitute a sinuous surface of said longitudinal edge, said comb member being composed of resilient material and being of bowed configuration, said spring means including a pair of spring members longitudinally spaced apart along said comb member and each constituted by a pair of angularly adjoining struts depending from the comb member, said comb member further having hook-like portions engageable with said housing for retaining said comb member therein.

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ROBERT W. MICHELL, *Primary Examiner.*

CHARLES A. WILLMUTH, *Examiner.*

UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 3,235,899

February 22, 1966

Hans Wessel

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 62, strike out "of said flexible members upon its move-" and insert instead -- formation in said channel between said --.

Signed and sealed this 10th day of October 1967.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents