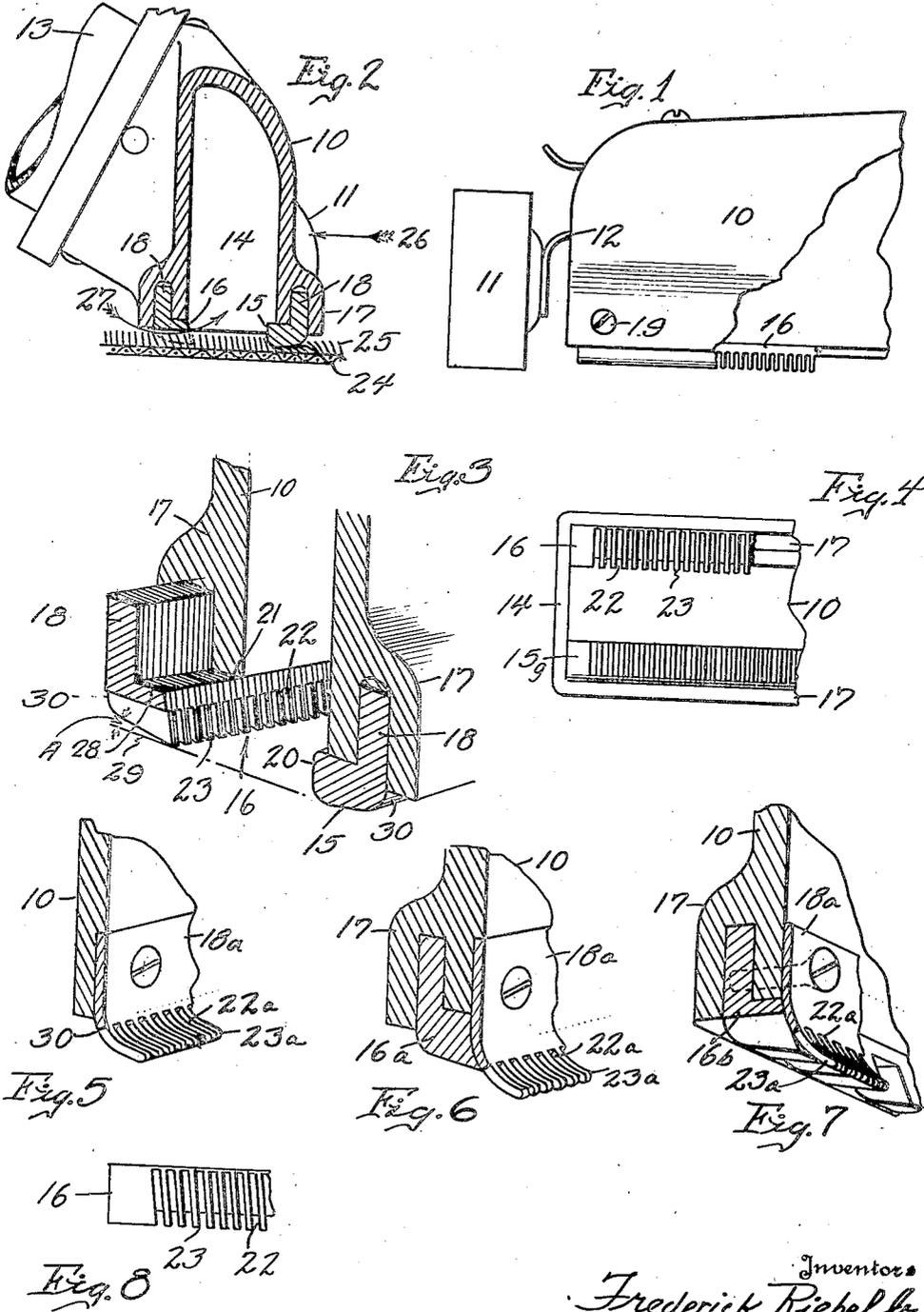


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SUCTION CLEANER FLOOR TOOL

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SUCTION CLEANER FLOOR TOOL

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This invention relates to suction cleaners of the type in which cleaning is effected primarily by the erosive action of air currents passing into the cleaner nozzle or floor tool, and has for its object to provide a floor tool structure having greatly improved cleaning efficiency as compared with prior devices of this kind, particularly in the ability of the cleaner to pick up threads, hairs, lint, etc., that may be engaged in the nap of the rug or carpet to be cleaned.

The invention contemplates the provision of a comb on a lip of the floor tool, capable of combing the nap of the rug so as to remove embedded threads, etc. We do not claim the invention to reside broadly in the use of a comb, since many attempts have been made to employ combing means of various kinds in connection with a suction cleaner floor tool, with negative results. Our invention arises from the solution of a number of problems that are found to be embodied in this subject of development. For instance:

One object is to provide a structure in which the comb teeth will wear for a long time without losing thread-picking effectiveness.

Another object is to arrange the teeth to secure maximum avoidance of likelihood of breakage thereof.

A further object is to secure maximum effectiveness in the action of the air currents, particularly in removing deeply embedded dust.

Another object is to secure self cleaning of the spaces between the teeth of the comb. To be more specific in this particular, it is intended that both the nap of the carpet and the air currents shall aid in keeping the comb teeth clean.

Another object is to arrange the comb and the floor tool structure so that the tool may be moved over the carpet or rug with an easy sliding motion.

Another object is to provide an arrangement in which the depth at which the teeth comb the nap may be regulated in the manipulation of the cleaner, and in which it is impossible to catch the points of the teeth in the fabric of the carpet.

With these and other objects in view our invention consists in the combination and construction and arrangement of the various parts thereof, whereby the objects contemplated are attained, as more fully set forth in the accompanying specifications, pointed out in our claims, and illustrated in the accompanying drawing, in which:

Fig. 1 is a front elevation of one end of a floor tool embodying the invention,

Fig. 2 is a sectional view of the same,

Fig. 3 is a perspective sectional view, enlarged,

Fig. 4 is an inverted plan view of the same,

Fig. 5 is a perspective sectional view of a modification of the comb and its mounting,

Fig. 6 is a similar view of another modification of the same,

Fig. 7 is a similar view of a further modification of the same, and

Fig. 8 is a view of another modification of the comb.

The invention embodies a suction head 10 which is provided at its respective ends with rollers 11, whereby the head 10 is mounted for tilting movement around an axis passing longitudinally through its central region. The mounting devices 12 connecting the rollers 11 to the head 10 are resilient to allow depression of the floor tool into cleaning engagement with the carpet or rug.

The head 10 is attached to a suction tube 13, which may be termed a handle, although it may preferably be connected to a handle proper through the medium of a conventional suction fan and motor assembly (not illustrated).

The head 10 has a suction mouth defined between end walls 14, a forward agitator lip 15, and a rear agitator comb 16. In the preferred form of the invention, these agitator members are mounted in sockets 17 formed in the lower portions of the longitudinal walls of the head 10.

The agitator members 15, 16 include the vertical flanges 18 secured in the sockets 17 as by screws 19, and the inturned floor engaging members 20, 21 respectively.

The member 21 of the comb 16 is provided with a series of parallel, transverse slots 22, between which are formed a series of parallel teeth 23.

In operation, the cleaner is grasped by the operator, the handle 13 being employed to tilt the floor tool around the axis of the rollers 11 until the comb 16 is in a position to lightly contact the nap 25 of the carpet 24. In the event that there are threads, lint, or hairs entangled in the nap, the operator may, by bearing down on the forward stroke against the resiliency of the spring supports 12, cause the comb to travel deeper to comb out the entangled material. On the return stroke, which is indicated by the arrow 26, the downward pressure will be relaxed, and the hairs, threads, etc., that have been engaged by the forward faces of the teeth 23 will be left to the action of the air currents travelling into the head 10.

In the preferred form of the invention, the comb 16 is machined in a milling machine from a strip of hard fibre stock in which the laminations lie in planes perpendicular to the longitudi-

nal axis of the comb, i. e., parallel to the teeth 23 as indicated by the shading in Fig. 3, the axis of the comb being maintained rigidly in a straight line by the socket 17. In this form, too, the floor engaging portion 21 of the comb includes an unslotted web 28 bridging the teeth 23 together over their entire length. In the resulting structure, the teeth may be as fine as approximately $\frac{1}{32}$ " thick, and yet be possessed of ample strength in fibre. In metal, with the same bridged structure, the teeth may be somewhat finer. In fibre, the width of the slots 22 and the thickness of the teeth 23 will be approximately the same, whereby the highest ratio between wearing quality and ease of penetration (the inverse of resistance to passage of the comb through the rug nap) is attained.

In metal, the comb may be formed from a plate as in Figs. 5, 6, and 7, including the vertical flange 18a and the teeth 23a, separated by slots 22a, and bent inwardly.

In any case, neither the thickness nor spacing of the teeth should exceed approximately $\frac{1}{8}$ ", since the comb functions to comb the nap 25 of the rug 24, as the tool is moved in a direction opposite that indicated by the arrow 27, (the cleaning stroke), and with the finer spacing, the nap will be divided into a greater number of individual tufts projecting upwardly into the slots 22, there will be little lateral bending of the bristles of the nap 25 beneath the teeth, there will be a greater number of more closely spaced air jets to sweep the nap, and the teeth will more efficiently dig out embedded particles of foreign material.

An unexpected result arising from the use of very fine teeth of the type shown in Fig. 3, as compared with teeth of greater than $\frac{1}{8}$ " thickness and spacing, and particularly teeth of triangular shape, is an improvement, rather than the expected decrease, in wearing qualities. This is accounted for by the fact that instead of being dragged bodily under the teeth and caused to drag against the lateral corners of the teeth under lateral bending, the bristles of the nap pass smoothly through the parallel slots in almost uniform upright positions, with less lateral bending and accordingly less wear against the under corners of the teeth, and with little wear against the forward edges and points of the teeth. Thus, the total volume of the teeth remaining constant, the wearing qualities are increased by increasing the fineness of the teeth from points above $\frac{1}{8}$ " toward the lower point of $\frac{1}{32}$ ". This is true irrespective of the direction of the grain of the fibre, although better results are secured by running the laminations as specified.

The teeth 23, 23a project entirely below the plane of the lowest edges of the sockets 17, whereby the slots 22, 22a, are entirely unobstructed. As a result, air currents may freely pass through all regions of the slots 22, 22a.

One desirable result thereby achieved is the complete sweeping of the spaces between the teeth by the air currents so as to prevent accumulation of dust and other foreign matter therein. Since the upper extremities of the slots (as extended beneath the outer socket walls) are substantially parallel to the surface of the carpet 24 when the tool is in normal working position shown in Fig. 2, the bristles of the nap 25 will also sweep through the slots with uniform spacing from the said upper extremities at their tips, aiding in keeping the slots clean. On the return stroke, in the direction of the arrow 26, the air currents and bris-

les 25 will supplement each other in their sweeping action, the air currents carrying away any attached particles that may be dislodged by the bristles.

Another important function of the feature under consideration is the formation of unobstructed air passages between the tips of the bristles 25 and the upper extremities of the slots 22, 22a, when the teeth 23, 23a are embedded in the nap 25, so that the tips of the bristles 25 will be swept by a plurality of fine air streams travelling through said passages as indicated by the arrows 27. Particles of foreign material loosened from the nap by the teeth 23 (or 23a) will be carried by these air streams into the suction head 10.

The air streams travelling through the slots 22, 22a, will also reach into the nap 25, particularly alongside the teeth 23, 23a, and will sweep out embedded dirt and dust.

The lower faces of the teeth 23, 23a are disposed in a plane inclined upwardly and outwardly at an angle "A" of less than 30° to the plane 29 joining the lower extremities of the agitator members 15, 16. In Figs. 6 and 7, these lower faces are considered as the component of the lower surfaces of the metallic teeth 22a and of the smooth agitator member 16a of Fig. 6, or of the notched agitator member 16b of Fig. 7. These lower faces at their outer extremities terminate in upwardly curved shoulders 30, which, by sled-runner effect, facilitate smooth sliding of the agitator which is moving in the direction in which its said shoulder 30 faces.

The handle member 13 and its extended parts are so arranged that in normal operation of the device, the floor tool will be tilted (around the axis of the rollers 11) to a position wherein contact of the forward agitator member 15 with the carpet will limit the possible downward movement of the comb 16 so that the latter cannot be dug into the woven base structure of the carpet 24, although embedded in the nap 25. The depth at which the comb 21 travels may be regulated by tilting the floor tool around its longitudinal axis, or by manually depressing the floor tool against the resilient support of the spring mountings 12. In the latter case, it will be remembered that a lower limit of depression is afforded by engagement of the front agitators 20 with the carpet.

A number of advantages are attendant upon the use of comb teeth having extended lower faces substantially parallel to the plane of engagement with the carpet or rug. These lower faces will slidably contact the nap 25 and derive support therefrom such as to avoid digging of the points of the teeth into the base of the carpet in the event that the cleaner is held in a position such as to bring the points of the teeth below the horizontal plane of the bottom of the forward agitator 15. Because of the gradual upward curve of the teeth at 30, the threads, etc., cannot become hooked behind the teeth, and the action of the nap 25 on the return stroke 26 will be to drag away any threads or the like that may have become entwined around the teeth, since the relative movement of the bristles 25 is toward the points of and substantially parallel to the lower faces of the teeth. The extended lower faces of the teeth, substantially parallel to the direction of movement, provide considerable bearing area to avoid rapid wearing away of the points of the teeth. The wear, instead of occurring at the points, affects their longitudinal edges or lower faces. This wear against the lower faces

tends to keep the points of the teeth sharp, and offsets the blunting of the teeth by contact of their forward edges or points with the bristles of the nap 25.

5 The forward agitator 15 may be either plain or in the form of a comb as at 15g in Fig. 4. In either case, it serves, on the forward stroke, as a bearing member. It also has a tendency to bend the nap in the direction of movement of the tool, making it easier for the rear agitator 16 to comb the nap. Because of their inclined lower faces, both agitators will ride smoothly over the nap when said lower faces are facing the direction of movement.

15 The planes of the teeth 22 may be given a slight inclination to the longitudinal axis of the comb, as shown in Fig. 8, although it is important that they be very nearly perpendicular to said axis.

20 We claim as our invention:

1. In a suction cleaner, a suction head having forward and rear walls, end rollers on which said tool is mounted for tilting movement around a longitudinal axis, a bearing lip at the bottom of one of said walls, and a comb at the bottom of the other of said walls, comprising thin, closely spaced comb teeth having elongated lower faces, lying in a plane substantially parallel to the common plane of the lower extremities of said comb and bearing lip, and thence curved upwardly and outwardly, at their rear extremities, said teeth lying entirely below the horizontal plane of the lower extremity of the suction head wall to which the comb is attached.

2. A suction cleaner agitator of hard fibre, comprising an elongated bar of approximately L shaped cross section, including a vertical flange for attachment to a suction cleaner suction head and a horizontal floor engaging portion, said floor engaging portion including thin, flat, closely spaced teeth lying in parallel planes substantially perpendicular to the axis of the agitator and a web portion bridging said teeth over substantially their entire length, the forward faces of said teeth being substantially perpendicular, the lower faces of said teeth being substantially horizontal, and the angle between said faces being an acute angle, the spaces between said teeth extending unobstructedly from the interior to the exterior of said head.

3. For attachment to a suction cleaner suction head in a position defining one side of the mouth of said head, a lip agitator comprising an elongated body for engagement with a longitudinal wall of said head and a plurality of teeth depending from said body, said teeth being flat, thin and closely spaced, lying in planes transverse to the longitudinal axis of said body, projecting downwardly to a depth several times as great as their thickness, and forming between them air spaces extending unobstructedly from the interior of the head to the exterior thereof.

4. For attachment to a suction cleaner suction head in a position defining one side of the mouth of said head, a lip agitator comprising an elongated body for engagement with a longitudinal wall of said head and a plurality of teeth depending from said body, said teeth being flat, thin and closely spaced, lying in planes transverse to the longitudinal axis of said body, projecting downwardly to a depth several times as great as their thickness, and unconnected below the level of the lower edge of said longitudinal wall.

5. For attachment to a suction cleaner suction

head in a position defining one side of the mouth of said head, a lip agitator comprising an elongated body for engagement with a longitudinal wall of said head and a plurality of teeth depending from said body, said teeth being flat, thin and closely spaced, lying in planes transverse to the longitudinal axis of said body, and projecting below the body portion to substantial depth over substantially their entire length, thereby forming between them air spaces extending unobstructedly from the interior to the exterior of said head.

6. For attachment to a suction cleaner suction head in a position defining one side of the mouth of said head, a lip agitator comprising an elongated body for engagement with a longitudinal wall of said head and a plurality of teeth depending from said body, said teeth being thin and closely spaced and projecting transversely of the longitudinal axis of the body and projecting for substantially their entire length in a horizontal direction, to a substantial distance below said body portion and said longitudinal wall, whereby to form between them air spaces projecting unobstructedly from the interior to the exterior of said head.

7. For attachment to a suction cleaner suction head in a position defining one side of the mouth of said head, a lip agitator of hard fibre comprising an elongated body for engagement with a longitudinal wall of said head and a plurality of teeth depending from said body, said teeth being flat, thin and closely spaced, lying in planes transverse to the longitudinal axis of said body and projecting below the body portion to substantial depth over substantially their entire length, thereby forming between them air spaces extending unobstructedly from the interior to the exterior of said head.

8. For attachment to a suction cleaner suction head in a position defining one side of the mouth of said head, a lip agitator comprising an elongated body for engagement with a longitudinal wall of said head and a plurality of teeth depending from said body, said teeth being thin and closely spaced and projecting transversely of the longitudinal axis of the body and projecting for substantially their entire length in a horizontal direction, to a substantial distance below said body portion and said longitudinal wall, whereby to form between them air spaces projecting unobstructedly from the interior to the exterior of said head, the lower faces of said teeth being inclined downwardly and inwardly relative to the suction head mouth.

9. For attachment to a suction cleaner suction head in a position defining one side of the mouth of said head, a lip agitator comprising an elongated body for engagement with a longitudinal wall of said head and a plurality of teeth depending from said body, said teeth being thin and closely spaced and projecting transversely of the longitudinal axis of the body and projecting for substantially their entire length in a horizontal direction, to a substantial distance below said body portion and said longitudinal wall, whereby to form between them air spaces projecting unobstructedly from the interior to the exterior of said head, the lower faces of said teeth being inclined downwardly and inwardly relative to the suction head mouth at an angle of less than 30° to the horizontal.

10. For attachment to a suction cleaner suction head in a position defining one side of the mouth of said head, a lip agitator comprising an elon-

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gated body for engagement with a longitudinal wall of said head and a plurality of teeth depending from said body, said teeth being flat, thin and closely spaced, lying in planes transverse to the longitudinal axis of said body, and projecting below the body portion to substantial depth over substantially their entire length, thereby forming between them air spaces extending unobstructedly from the interior to the exterior of said head, the forward faces of said teeth being inclined downwardly and inwardly relative to the suction head mouth.

11. For attachment to a suction cleaner suction head in a position defining one side of the mouth of said head, a lip agitator comprising an elongated body for engagement with a longitudinal wall of said head, and a plurality of teeth depending from said body in planes transverse to the longitudinal axis thereof, said teeth being approximately between $\frac{1}{2}$ " and $\frac{1}{8}$ " thick and being spaced approximately between $\frac{1}{2}$ " and $\frac{1}{8}$ " apart so that the suction producing means of the cleaner will create, in the interspaces be-

tween said teeth, a large number of fine air streams which will also penetrate the nap and sweep between the tufts of fibres separated by the teeth, major portions of said teeth projecting sufficiently below said body portion and said longitudinal wall so that said air streams may flow freely through said interspaces.

12. For attachment to a suction cleaner suction head in a position defining one side of the mouth of said head, a lip agitator of hard fibre comprising an elongated body for engagement with a longitudinal wall of said head and a plurality of teeth depending from said body, said teeth being flat, thin and closely spaced, lying in planes transverse to the longitudinal axis of said body, projecting below the body portion to substantial depth over substantially their entire length, thereby forming between them air spaces extending unobstructedly from the interior to the exterior of said head and substantially entirely bridged over by said body.

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