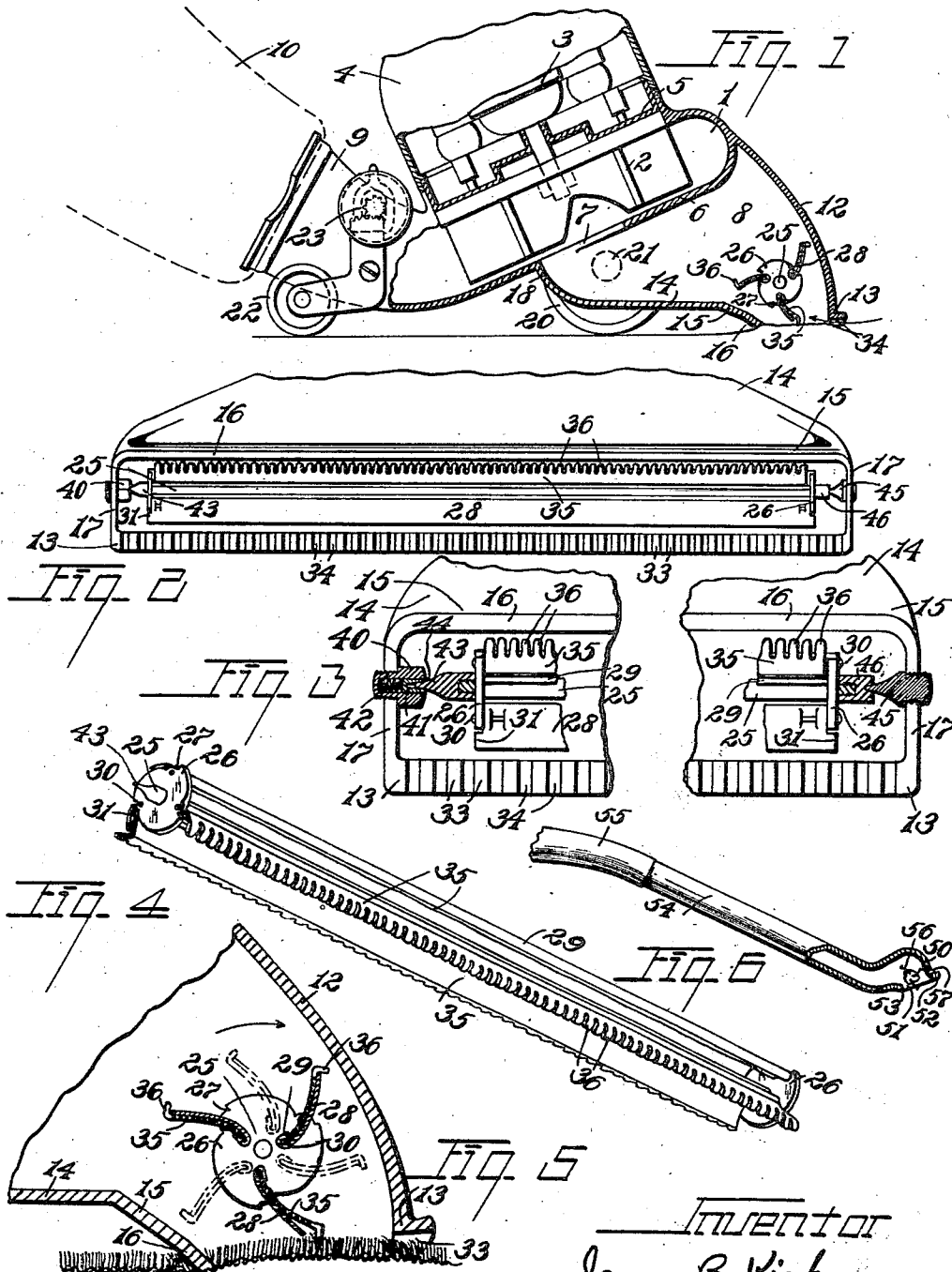


J. B. KIRBY.
 AGITATING DEVICE FOR VACUUM CLEANER NOZZLES.
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Patented May 14, 1918.



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AGITATING DEVICE FOR VACUUM-CLEANER NOZZLES.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JAMES B. KIRBY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Agitating Devices for Vacuum-Cleaner Nozzles, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to suction cleaners and has for its object the provision of a device of this character which will clean rugs, carpets, and other floor coverings, rapidly and efficiently. The principle of my invention consists in this, that toothed floor engaging devices, located within the inlet mouth of the apparatus, are arranged to be moved during the operation of the device so as to comb or scrape the surface operated upon, thereby loosening and pulling up and disengaging particles of lint, threads, scraps of cloth, coins, sheets of paper, and the like particles which are not readily displaced by the suction alone; according to a further refinement such teeth are made of flexible material so as not to catch upon the seams, etc., and render the apparatus ineffective and so as to prevent undue wear or abrasion of the floor covering; also the toothed members are so supported as to remain in contact with the carpet or floor covering for an appreciable time, and in addition to this combing or sweeping action to exert a beating action thereon; means are also provided for lifting these teeth from the floor periodically so that the air stream may remove adherent refuse, while the shape of the inlet mouth in which the device is located is preferably such as to permit the particles displaced by the combing action to be thrown upon a suitable receiving part or ledge whence they may be swept away by the air stream. Subsidiary objects of the invention relate to the mode of constructing, supporting, and operating the said agitating devices, all of which will more clearly appear as the description proceeds.

In the performance of my said invention I preferably employ a suction cleaner of the type comprising a hollow casing containing a generally cylindrical fan chamber provided with a rotatable fan mounted coaxially therewithin and connected directly to

an electric motor supported above the fan chamber; the lower face of the fan chamber concentrically with the fan communicating with a downwardly facing laterally elongated inlet mouth, and the peripheral portion of said fan chamber communicating through a suitable outlet neck with a porous bag or receptacle adapted to retain the dust and dirt while allowing the escape of the air therethrough. However my invention is not restricted to cleaners of this type as will be hereafter explained, notwithstanding that I have chosen this design for purposes of explanation.

In the drawings accompanying and forming part of this application I have illustrated one embodiment of my invention, and in these drawings: Figure 1 represents a well known type of suction cleaner equipped with my present invention; Fig. 2 a bottom plan view showing the suction mouth of said cleaner with my improved agitating device in place therein; Fig. 3 is an enlarged detail view of the parts shown in Fig. 2, the bearings being shown in cross section and the central portion of the agitating device being omitted; Fig. 4 is a perspective view of the agitating device removed from the cleaner, the same being viewed upwardly from a position beneath the same; Fig. 5 is an enlarged detail view of the mouth part of the cleaner shown in Fig. 1 showing diagrammatically the operation of the said agitating device; and Fig 6 is a view drawn to reduced scale and showing the use of my improved agitating device with an extension nozzle or suction tool.

Describing the parts by reference characters 1 represents the fan chamber of a suction cleaner, the same being generally cylindrical in effect, and having therein a rotatable fan 2 driven by a motor 3 contained in a suitable casing 4 located beyond one of the flat faces 5 of this fan chamber. The other flat face 6 of the fan chamber is provided with a circular opening 7 opposite the center of this fan and communicating with the suction nozzle represented generally at 8, while the periphery of the fan chamber is formed at one side with the tangential outlet connection 9 to which is attached a suitable dust bag 10. Said collection nozzle comprises a front wall 12 merging at its upper end with the wall of the fan chamber as shown in Fig. 1, and

extending laterally for a considerable distance as shown in Figs. 2 and 3, terminating at its lower end in a substantially straight jaw 13. The opposite wall of this nozzle consists of a substantially, or nearly flat horizontal plate 14 merging at its forward end with a downwardly and forwardly inclined portion 15 which terminates in the rounded jaw 16, spaced from and parallel to the jaw 13. At their ends the plates 12 and 14 are connected together by webs or end walls 17 which converge rearwardly as shown in Fig. 2 so as to merge with the sides of the opening 7 while the rearward portion of the plate 14 merges with the upwardly curved approach 18 which leads to the rearward edge of said opening. The downwardly facing aperture defined by the jaws 13 and 16 I have herein termed the "inlet mouth" and same is supported above and adjacent to the floor by means of the carrying rollers 20 pivoted at 21 upon an axis parallel with said mouth, coöperating with the adjusting roller 22 attached to the rearward part of the machine. The axis 21 of the wheels 20 lies between the center of gravity of the machine and the inlet mouth, so that an up and down movement of the roller 22 by means of the adjusting devices 23 will serve to raise and lower this mouth.

Within this suction nozzle and above and parallel with the inlet mouth I secure an agitating device which in its preferred embodiment consists of a rotatable shaft 25 having movably joined thereto a plurality of driving vanes or blades equipped with the teeth heretofore mentioned. Preferably I secure adjacent to each end of this shaft a transverse flat plate 26 formed with a plurality of abrupt shoulders 27 equal to the number of the blades or vanes. In the present embodiment I have illustrated three such blades or vanes though it is clear that the number might be increased within limits if desired. Each of the blades or vanes consists of a narrow elongated strip 28 of thin sheet metal curved about an axis parallel to its length so as to be slightly trough shaped as shown in Fig. 5. One of the longitudinal margins of each blade or vane is folded over into such trough as shown at 29, and adjacent to this folded portion the blade is pivoted at each end to one of said plates 26 as illustrated at 30. Each of the pivots 30 is placed slightly in the rear of the adjacent shoulder 27 as shown in Fig. 5, and at each end the blade or vane is extended beyond the edge of the plate as illustrated at 31, which forms a stop for the blade, limiting the inward or rearward movement by contact with the periphery of the plate (see the upper side of Fig. 4) and limiting the outward or forward movement by contact with the abrupt

shoulder (see the nearest blade in Fig. 4.) The position of the device within the suction nozzle is such that the concave portion of the lower blade faces the jaw 13 of the inlet mouth, which jaw is formed with a plurality of spaced rounded teeth 33 defining narrow slots or channels 34 through which air is admitted to blow upon these vanes or blades as shown by the arrows in Fig. 1. The inner edge or base of each blade is spaced from the similar edge of opposite vanes so as to provide an air passageway through the center of the agitator, since it is found that closing this opening unduly obstructs the air stream and decreases the force of the rotation. The location of the shaft 25 is preferably such that the blades 28 lie entirely within the plane of the suction mouth, so that the cleaner can be run over floors and the like without the blades coming in contact with the surface of the same.

Over the concave face of each vane or blade I place a flat sheet 35 of rubber or the like yielding material, and secure the same in place by crimping down thereon the folded edge 29, as shown in Fig. 5. The rest of this flexible sheet is preferably entirely free from the vane or blade, although its free end is preferably formed with a plurality of comparatively deep narrow slots defining a large number of serrations or teeth 36, and also the free extremity of each flexible tooth is bent over the edge of its blade or vane so as to form a transversely projecting toe. In the case of rubber or a rubber-containing fabric this shape can easily be afforded to the material by heating and curing as will be well understood, the result being a permanent toe of the shape illustrated. I prefer to have this bend come intermediate of the length of these serrations or teeth as illustrated in Figs. 4 and 5, though this is not essential. Also the folded edges of the vanes or blades are spaced slightly from the shaft 25 so as to afford a narrow passageway therethrough which is found greatly to increase the efficiency of the device.

For mounting my improved agitating device in the suction nozzle I preferably secure in one end web 17 a hollow threaded stud 40 having mounted in the cavity thereof a slidable block 41 and a compression spring 42, this block being formed with a socket or recess adapted to receive the reduced end 43 of the shaft, and the end of the stud being peened inwardly as at 44 to prevent the escape of said block. To the other end web I attach a pointed stud 45 adapted to enter the pivot block 46 carried by the shaft. The blocks 41 and 46 are preferably made of phosphor bronze since this will run with steel without the necessity of oiling and notwithstanding the dust to which they are sub-

jected, oil being wholly impossible in a place where so much dust will collect. This arrangement of pivots and blocks is peculiarly desirable in this device since it renders it impossible to insert the agitator in wrong position, though I do not confine myself thereto.

A device of this character will be rotated rapidly by the air passing inwardly through the suction mouth, the shape of the blades and their flexible connection to the flanges 26, causing an unbalanced pressure to be exerted which rotates the members in the direction shown by the arrows. In addition, when the machine is in operative position on a floor or carpet the air rushing thereinto through the slot 34 impinges upon the blades in a direction to increase this rotative tendency. Although, as already explained, the metal vanes or blades are adjusted so as to rotate wholly within the plane of the suction mouth, the flexible toes 36 are preferably arranged so as to come substantially to this plane during the normal rotation of the device, added to which is the well known tendency when operating upon carpets or other fabric floor coverings for the fabric to be lifted into the suction mouth for a distance as clearly illustrated in Fig. 5. As a result of this action, the blades strike the fabric a light blow, at each revolution and are themselves driven backward a slight distance about their axes 30 while the flexible flap 35 is sprung away from the metal blade as illustrated at the lower side of the beater in Fig. 5, whereupon the continuous rotation of the agitator drags the toes 36 along the nap of the carpet or rug after the manner of a comb or rake, thus picking up and dislodging any material which may be lodged thereon. At the conclusion of this raking or combing movement, the centrifugal force of the rotation combined with the action of the air, throws this blade or vane to radial position again, which therefore gives a flip to the material thereon and deposits the same either on the slanting portion 15 or the flat plate 14 along which it is swept by the air stream. It will be noted that the upwardly curving portion of the plate 14 coincides with the lateral constriction of the nozzle in such a way that the accumulated force of the air is enabled to lift heavy refuse up the slope and deliver it into the fan. Coins as large as silver quarters, pins, hairpins, buttons, marbles, shot, and pebbles will be taken up as readily as matches, ashes, lint, ravelings, or thread, the inclined position of the fan casing assisting in this by reason of the shorter and straighter passage into the dust bag. The air slots 34 afford a directed blast upon the vanes or blades which not only serves to actuate the same, but also by acting directly upon the particles of dust, etc., aid in sweeping them through the fan cham-

ber. The rounded jaw 16 of the inlet mouth is ordinarily submerged to some extent in the nap of the carpet as shown in Fig. 5, thus to some extent preventing the entrance of air from that direction. Also the submer- sion of this jaw in the nap causes debris lying upon the carpet to pass substantially directly to the inclined portion 15 without being impeded by an abrupt shoulder. The association with the toothed combing devices of the metal plates which partly overlap those teeth prevents thread, and ravelings from becoming entangled in the same and affords a smooth non-resisting surface from which the air stream will remove such refuse.

As heretofore explained the use of the above described agitating mechanism is not confined solely to cleaners wherein the suction mechanism is mounted immediately adjacent the inlet nozzle; it may be employed with equal facility in connection with a cleaner of the type wherein a stationary pump is employed and a movable tool connected thereto by a flexible hose. Such an arrangement is indicated in Fig. 6 wherein 50 represents the head or mouth section of the tool, the same being formed with a downwardly opening laterally elongated inlet mouth 51 defined by jaws 52 and 53, and 54 indicates the hollow shank of the tool to which is connected the suction hose 55. 56 represents generally an agitating device substantially as herein described and claimed, although in the present embodiment I have illustrated the forward wall of the head as formed with apertures 57 to admit operating air thereto instead of the slots hereinbefore suggested. It will be understood that many additional modifications could be resorted to within the scope of my invention and within the terms of the claims hereto annexed.

Having thus described my invention what I claim is:—

1. In a vacuum cleaner, a nozzle having an elongated downwardly facing inlet mouth, an agitating device revolubly mounted inside said nozzle and parallel with said mouth, and comprising a plurality of beating members, pivoted upon axes parallel with said mouth, said device including vanes set in the air passageway whereby the device is rotated.

2. In a vacuum cleaner, a nozzle having an elongated downwardly facing inlet mouth, and an agitating device revolubly mounted inside said nozzle and parallel with said mouth, said device comprising a plurality of radiating blades having at their free edges a plurality of teeth bent in the direction toward which said blades revolve.

3. In a vacuum cleaner, a nozzle having an elongated downwardly facing inlet mouth, an agitating device revolubly mounted inside

said nozzle and parallel with said mouth, said device comprising a plurality of longitudinally extending radiating blades, and a flexible sheet covering the rear face of each blade and formed at its outer edge with teeth projecting beyond the edge of said blade.

4. In a vacuum cleaner, a nozzle having an elongated downwardly facing inlet mouth, an agitating device revolubly mounted inside said nozzle and parallel with said mouth, said device comprising a plurality of longitudinally extending radiating blades, and a flexible sheet covering the rear face of each blade, and formed at its outer edge with teeth projecting beyond the edge of said blade, said teeth projecting in the direction of rotation of said blades.

5. In a vacuum cleaner, a nozzle having an elongated downwardly facing inlet mouth, an agitating device revolubly mounted inside said nozzle and parallel with said mouth, said device comprising a plurality of longitudinally extending blades, and a flexible sheet covering the rear face of each blade, and formed at its outer edge with teeth projecting beyond the edge of said blade, said sheet being attached to said blade only at the edge opposite said toothed edge.

6. In a vacuum cleaner, a nozzle having an elongated downwardly facing inlet mouth, an agitating device revolubly mounted inside said nozzle and parallel with said mouth, said device comprising a plurality of longitudinally extending radiating blades, and a flexible sheet covering the rear face of each blade, and formed at its outer edge with teeth projecting beyond the edge of said blade, said teeth projecting in the direction of rotation of said blades, and said sheet being attached to said blade only at the edge opposite said toothed edge.

7. In a vacuum cleaner, a nozzle having an elongated downwardly facing inlet mouth, an agitating device revolubly mounted inside said nozzle and parallel with said mouth, and comprising a plurality of longitudinally extending vanes each of which is spaced from the axis of said device to provide a passageway, the cleaner nozzle being formed with apertures in line with the vanes at one side of said axis.

8. In a vacuum cleaner, a nozzle having an elongated downwardly facing inlet mouth, an agitating device revolubly mounted inside said nozzle and parallel with said mouth, and comprising a plurality of blades pivoted upon axes parallel to said mouth and having at their free edges a plurality of teeth bent in the direction toward which said blades revolve.

9. In a vacuum cleaner, a nozzle having an elongated downwardly facing inlet mouth, an agitating device revolubly mounted inside said nozzle and parallel with said mouth, said device comprising a plurality of longi-

tudinally extending pivoted members, and a flexible sheet secured to each of said members and having its outer edge formed with projecting teeth.

10. A vacuum cleaner having a nozzle formed with an elongated inlet mouth surrounded by work-engaging jaws, and an agitating device pivoted in said nozzle parallel with said mouth, said device comprising a plurality of flexible members having teeth projecting transversely of the pivot axis and arranged after being presented to the working surface to be raised and subjected to the air stream whereby adherent matter is removed.

11. In a vacuum cleaner, the combination with a suction producing device and a nozzle having an elongated inlet mouth surrounded by work-engaging jaws, of an agitating device comprising a plurality of teeth projecting in a direction transverse to the length of said mouth and adapted to be moved along the surface operated upon, and means for raising said teeth from said surface and presenting them to the air stream.

12. In a vacuum cleaner, a nozzle having an elongated inlet mouth surrounded by work-engaging jaws, an agitating device pivoted in said casing upon an axis parallel with said mouth, said device comprising a plurality of radial members having flexible teeth projecting substantially tangentially to the cylinder drawn about the pivot axis and arranged to engage and comb the surface operated upon, and means for rotating said device about its pivot so as to raise said teeth from such surface and present them to the air stream.

13. The combination with a vacuum cleaner nozzle having an elongated, downwardly facing inlet mouth, said nozzle having at one side of said mouth a substantially horizontal, smooth bottom wall forming a receiving ledge, of an agitating device pivoted inside said nozzle parallel to said mouth, said device comprising a plurality of radial members having teeth at their outer edges adapted to engage the surface operated upon, and means for rotating said device in the direction to move said teeth over the working surface toward said ledge.

14. In a cleaner, a suction nozzle having an elongated inlet mouth surrounded by work engaging jaws, and an agitating device rotatably supported within said casing with its axis parallel to said mouth said device having a plurality of radiating vanes and also having a plurality of flexible teeth, one of said jaws being formed with air passageways debouching upon said vanes, there being air passageways formed between the base of each vane and the neighboring vanes.

15. In a cleaner, a suction nozzle having an elongated inlet mouth surrounded by work engaging jaws, and an agitating device

rotatably supported within said casing with its axis parallel to said mouth, said device having a plurality of radiating vanes, one of said jaws being formed with air passage-
 5 ways debouching upon said vanes, and tangential teeth carried by said agitating device and facing in the direction toward which the same revolves.

16. In a cleaner, a suction nozzle having
 10 an elongated inlet mouth surrounded by work-engaging jaws, a shaft rotatably mounted in said nozzle parallel to said mouth, a plate secured to said shaft near each of its ends, and a plurality of elongated blades or vanes rotatable with said
 15 shaft and having their ends pivoted to said plates upon axes parallel to said shaft, said nozzle having air passageways formed in one of its walls arranged to admit air from a region of higher pressure to blow upon the
 20 vanes at one side of said shaft.

17. In a cleaner, a suction nozzle having an elongated inlet mouth surrounded by work-engaging jaws, a shaft rotatably
 25 mounted in said nozzle parallel to said mouth, a plate secured to said shaft near each of its ends a plurality of elongated blades or vanes rotatable with said shaft and having their ends pivoted to said plates
 30 upon axes parallel to said shaft, and shoulders carried by said plates and arranged to limit both the inward and the outward movement of said vanes, the wall of said nozzle having air passageways formed in one of
 35 its walls arranged to admit air from a region of higher pressure to blow upon the vanes at one side of said shaft.

18. In a cleaner, a suction nozzle having an elongated inlet mouth surrounded by
 40 work-engaging jaws, a shaft rotatably mounted in said nozzle parallel to said mouth and having a rigid bearing member secured thereto at each end, blades pivoted to said bearing members parallel to said
 45 jaws each of said bearing members having abutments whereby the movement of said blades is limited and the inner edge of each blade being spaced from the edge of the adjacent blades to define a passageway, the position of said shaft being such that said
 50 blades revolve wholly within the plane of said mouth, and passageways formed in the walls of the nozzle and admitting air beneath said shaft.

55 19. In a cleaner, a suction nozzle having an elongated inlet mouth surrounded by work-engaging jaws, one wall of said nozzle

being formed adjacent and substantially parallel to the work-surface so as to form a ledge, and the other jaw having air passageways therein directed toward said ledge, agitating mechanism movably mounted in
 60 said mouth between said jaws, and vanes carried by said mechanism adapted to be moved by the air entering said passageways. 65

20. In a cleaner, a suction nozzle having an elongated inlet mouth surrounded by work-engaging jaws, a shaft rotatably mounted in said nozzle parallel to said
 70 mouth and having a rigid bearing member secured thereto at each end, blades pivoted to said bearing member, each of said bearing members having abutments whereby the movement of said blades is limited and the inner edge of each blade being spaced from
 75 the edge of the adjacent blades to define a passageway, the position of said shaft being such that said blades revolve wholly within the plane of said mouth and the wall of said nozzle being formed with air admission
 80 apertures opening beneath said shaft, and flexible, toothed devices rotatable with said blades and adapted to catch adherent refuse and elevate it into the air stream.

21. In a cleaner, in combination, a suction
 85 nozzle having an elongated inlet mouth surrounded by work-engaging jaws, one of which is formed to admit air between the same and the work-surface, a rotatable agitating device journaled within said casing
 90 upon an axis substantially parallel with said mouth and having vanes exposed to the air entering past said jaw, and means for raising and lowering said nozzle so as to adjust the other jaw with reference to the work-
 95 surface.

22. In a collecting nozzle for vacuum cleaners a rotatable shaft journaled inside the inlet mouth, rigid supporting members carried by said shaft, and a plurality of longitudinal beating members pivoted to said
 100 supporting members upon axes parallel to but spaced radially from said shaft, said beating members being curved longitudinally and the distance of said shaft inside the
 105 plane of the inlet mouth being such that said beating members will strike and beat a carpet to which the nozzle is applied.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses. 110
 JAMES B. KIRBY.

Witnesses:

HAROLD E. SMITH,
 BRENNAN B. WEST.