Sept. 22, 1959 W. K. SKOLFIELD **2,904,816**

RUG TOOL HAVING A TURBINE-DRIVEN RUG BRUSH

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Fig. 5.

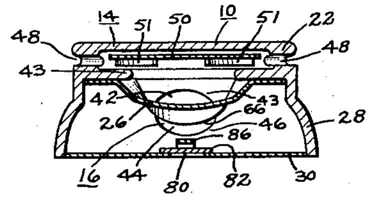


Fig. 1.

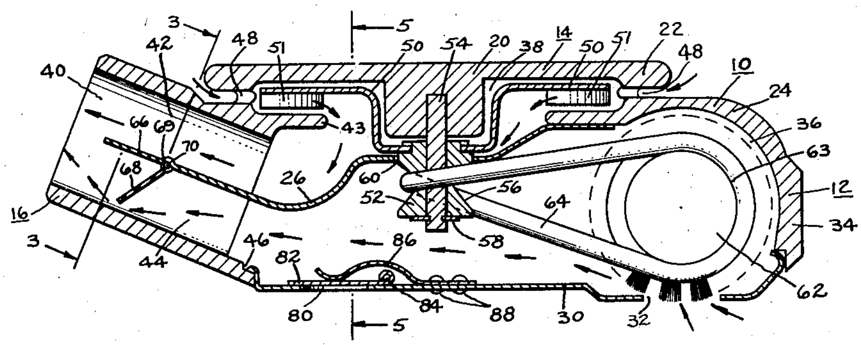


Fig. 2.

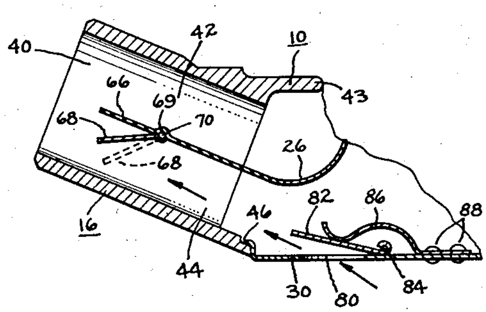


Fig. 3.

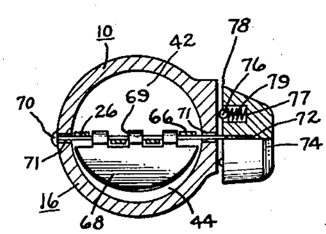


Fig. 6.

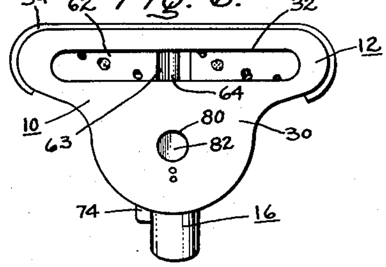
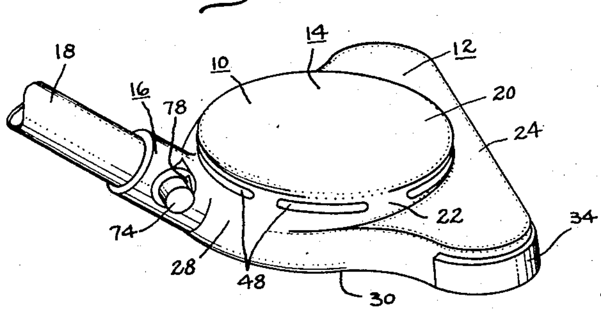


Fig. 4.



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RUG TOOL HAVING A TURBINE-DRIVEN RUG BRUSH

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Application February 24, 1956, Serial No. 567,685

9 Claims. (Cl. 15—375)

This invention relates to cleaning tools generally, and to air-operated cleaning tools particularly. My invention is well suited for use in a vacuum cleaner cleaning tool and, therefore, for the purpose of simplifying an explanation of it, will be disclosed in such a device.

Contemporary vacuum cleaners fall into two general types: first, those which clean partially by suction and include a motor-driven rug brush (this feature is normally found in so-called upright cleaners) and second, those which clean primarily by suction and do not include a motor-driven brush (commonly referred to as canister cleaners, and normally either of the horizontal or vertical variety). The vacuum cleaner cleaning tools to which the invention relates are primarily those which are used to clean rugs and floors. It is generally agreed that the best cleaning job on rugs is performed by cleaners having a power-driven rug brush which may or may not have other elements such as beaters associated with it. The strong features of the canister-type cleaners are that they are adapted for convenient above the floor cleaning, i.e., wall, furniture, drapery and ceiling cleaning. It is believed by many skilled in this art that a canister cleaner is superior to the upright cleaner, all other things being equal, in all respects other than its ability to clean rugs. Therefore, it is highly desirable that a cleaning tool attachment be devised that may be used with the canister-type cleaner and which is capable of closely approaching, if not duplicating, the excellent rug cleaning capabilities of the motor-driven rug brush of the upright-type cleaner. It is believed obvious that the reason motor-driven brushes are not provided in canister cleaner rug tools is because of the difficulty of furnishing power to the rug tool. In order to meet this problem, it has been suggested that the moving fluid (air) which passes through the canister cleaner rug tool when the cleaner is operated be utilized to drive a fluid-operated motor, which in turn drives a rug brush. In this application the term "turbine-driven rug tool" is used to signify this type of device.

One type of turbine-driven rug tool with which the inventor is familiar operates on a "split air flow" principle. In this arrangement, there is provided a rug tool body having a nozzle which is adapted to be associated with a rug, a rug brush mounted for rotation in the nozzle and contact with the rug, a turbine chamber which houses a turbine and communicates with the atmosphere through inlet openings, the turbine being connected to the rug brush in mechanical driving relationship, and an outlet passageway which communicates with the suction unit of the vacuum cleaner when the rug tool is connected to the canister cleaner wand. With this type of rug tool, when a flow of air is induced through the tool by energizing the suction unit, some air enters the nozzle through the opening in the nozzle, and some air enters the turbine chamber through the inlet openings. The air entering the nozzle opening is dust-laden and is carried off through the outlet passageway to the suction unit. The air entering the turbine chamber contacts the vanes on the turbine and rotates it, and thereby drives the rug brush.

It has been observed that this type of prior art rug tool suffers from a basic defect. Because the flow of air through the nozzle and the flow of air through the turbine chamber is constant, i.e., non-adjustable relative to each other, it is difficult to obtain reasonably good cleaning on various types of rugs. For example, on a deeply cut figured rug the nozzle may not seal well and, therefore, the larger portion of the air drawn into the tool enters through the nozzle opening. This results in a diminution of the amount of air passing through the turbine chamber, and results in weak or no rotation of the turbine and rug brush. Therefore, the cleaning action of the rug brush is insufficient to whisk off surface lint, thread, hairs, etc., although a moderately good job of sucking the dirt out of the rug is done. On the other hand, if the prior art rug tool is used on a finely woven smooth rug, the nozzle seals tightly to the rug, resulting in the dirt being drawn out of the rug very well and the turbine being operated properly and, therefore, the rug brush whisking the dirt off the rug adequately. However, the tight seal between the nozzle and the rug makes it difficult to push or pull the rug tool over the rug.

It is an object of this invention to provide an improved air-operated cleaning tool which is particularly adapted for use for canister-type vacuum cleaners, which operates on the split air flow principle and wherein the above mentioned basic defect in this type of device is obviated.

The object of this invention is achieved in one form by providing in a split air flow, turbine-driven, cleaning tool, means for regulating the relative flow of air through the nozzle and the turbine chamber, and preferably to achieve such regulation by controlling the flow of air through the nozzle. In this form, such control enables the user to decrease or increase at will the amount of air entering the nozzle, thereby automatically altering the amount of air entering the turbine chamber, and causing the turbine to rotate with more or less power, for the purpose of adapting the rug tool to the type of rug on which it is used and the type of dirt or lint to be picked up.

Other objects and further details of that which I believe to be novel and my invention will be clear from the foregoing description and claims taken with the accompanying drawings wherein:

Fig. 1 is a sectional view taken substantially on a central longitudinal line which passes through the improved cleaning tool;

Fig. 2 is a fragmentary sectional view similar to Fig. 1, but showing some of the parts in different positions;

Fig. 3 is a sectional view taken substantially on line 3—3 of Fig. 1, the control knob being shown fully in section;

Fig. 4 is a perspective view of the improved cleaning tool attached to a portion of a canister cleaner wand;

Fig. 5 is a sectional view taken substantially on line 5—5 of Fig. 1, and

Fig. 6 is a bottom view of the improved cleaning tool.

Referring to the drawings, the improved cleaning tool, which will herein be referred to as a rug tool, is designated generally by the reference numeral **10**. Rug tool **10** comprises a body having a nozzle portion **12**, the turbine portion **14**, the outlet portion **16**. As is illustrated in Fig. 4, the outlet portion **16** is tubular and adapted to be coupled in any conventional manner to the rigid wand **18**, which in turn communicates through appropriate conventional conduit mechanism with the suction unit, that is, an air flow producing source. The latter may be any one of the large number of available suction units and be stationary, built-in or portable. The improved rug tool is particularly useful when associated with a canister type vacuum cleaner, because it renders the latter substantially equal in rug cleaning ability to vacuum cleaners, such as the upright type, which have motor-driven rug brushes, hence, the wand 18 may communicate with a canister-type cleaner. However, it should be clearly understood that the improved rug tool is not restricted in utility to use with canister-type cleaners.

As can best be seen in Figs. 1, 4 and 5, the rug tool body has appropriate walls formed therein which compartment its interior in the desired manner. The rug tool body walls comprise essentially three generally horizontal walls, an upper, intermediate and lower wall, and appropriate side walls which render the body a unitary structure. Upper horizontal wall 20 is generally circular and merges at its periphery into a depending, slotted side wall 22 which is generally cylindrical. At its forward side (the side opposite to the outlet portion 16), the wall 22 merges into a generally horizontal wall 24 which forms the upper surface of the nozzle portion 12 and extends into the body. Within the body, wall 24 supports in any conventional manner a dividing wall 26 which is illustrated as a separate member, and which is spaced below the wall 20 and extends rearwardly partially into the outlet portion 16. The walls 24 and 26, together comprise the intermediate wall.

A portion 28 of the depending wall 22 at the latter's rear extends downwardly beyond the walls 24 and 26 and merges at its lowermost points with the generally horizontal lower wall 30 which is illustrated as being a separate piece. The central portion of the rearward side of portion 28 merges into the outlet portion 16. The lower wall 30 extends beneath the walls 24 and 26 and has an elongated opening 32 formed near its forward end. A generally vertical side wall 34 extends from the portion 28 of depending wall 22 completely around the nozzle portion 12 and is secured to the wall 24 at its upper edge and to the wall 30 at its lower edge. An inspection of Figs. 1 and 5, it is believed, will clearly indicate the wall formation and the manner in which the rug tool body is compartmented to provide the following: a nozzle chamber 36, which is located generally between the walls 24, 26, 30 and 34; a turbine chamber 38, which is located between the walls 20, 22, 24 and 26; and an outlet chamber 40, which is formed in the outlet portion 16. The terminal portion 66 of wall 26 extends into the outlet portion 16 and divides the latter into two passageways. The upper passageway 42 communicates through the opening 43 with the turbine chamber 38 and thereby places the latter into communication with the outlet chamber 40. The lower passageway 44 communicates through the opening 46 with the nozzle chamber 36 and thereby places the latter into communication with the outlet chamber 40. A plurality of slots 48 are formed in the depending wall 22 and thereby place the turbine chamber 38 into communication with the atmosphere.

Turbine 50 is mounted for rotation in the turbine chamber 38 by being rigidly secured to the turbine hub 52, which in turn is mounted for rotation on the bearing pin 54 that is rigidly connected to the wall 20 and depends therefrom. Hub 52 has a V-shaped groove 56 formed therein to simulate a pulley surface, and is supported on the bearing plate 58, which is rigidly secured to the free end of the pin 54. Hub 52 is partially disposed in opening 60 formed in wall 26, but is not in bearing contact with the wall.

The foregoing arrangement provides a rotatable mounting for the turbine and its hub wherein most of the load is taken by the bearing plate 58. This particular mounting is merely exemplary of a rotary mounting for the turbine and is not a critical aspect of my invention, for other mountings can readily be devised which would be the equivalent of the one illustrated. It is important, however, that the turbine and its hub be mounted for rotary movement relative to the supporting portions of the rug tool body, and the illustrated arrangement accomplishes this objective.

Mounted in the forward end of the nozzle chamber 36 in juxtaposition to the nozzle opening 32 is the conventional rug brush 62, which has bristle tufting which extends through the nozzle opening for the purpose of contacting a surface to be cleaned and to whisk dirt through the nozzle opening into the nozzle chamber. The details of the rug brush construction form no specific part of my invention and, therefore, will not be described in detail, however, the rug brush does have a V-shaped groove 63 formed in it which simulates a pulley surface. The endless belt 64 is mounted in the V-shaped grooves 56 and 63, and thereby places the rug brush and turbine into mechanical driving relationship. By the latter it is meant that if either the turbine or the rug brush is rotated, the other will be rotated through the driving connection effected by the endless belt 64.

When a source of suction is attached to the outlet portion 16, a flow of air is induced through both the turbine portion and the nozzle portion of the rug tool in the manner illustrated by the schematic arrows in Fig. 1. When the parts are disposed as illustrated in Fig. 1, the air flow through the turbine portion is as follows: clean air from the atmosphere flows through the slots 48 into the turbine chamber 38, where it contacts the vanes 51 of the turbine 50 and rotates the latter and its hub 52, out of the turbine chamber through the opening 43 into and through upper passageway 42 to the outlet chamber 40, and then to the source of suction. In the nozzle portion of the rug tool a simultaneous flow of air is induced as follows: dust-laden air passes through the nozzle opening 32 into the nozzle chamber 36, through the opening 46 into the lower passageway 44, into the outlet chamber 40 and then to the source of suction.

The split air flow described is accompanied by rotation of the turbine which in turn rotates the rug brush 62 through the medium of the endless belt 64. This mode of operation is extremely desirable because it provides a power-driven rug brush in an air operated cleaning tool, and lends itself to convenient use with a canister type cleaner. However, as was mentioned in the introduction to the specification, a basic defect exists in cleaning tools of this type. This defect, applicant found, was due to the absence in prior art rug tools of this type of any means for controlling the flow of air through either the turbine chamber or nozzle chamber to permit the operator to regulate the relative air flow through said chambers to suit the operator's needs as dictated by the type of rug on which the rug tool is used and the type of dirt to be picked up. As was pointed out in the introduction of this specification, when prior art, turbine-driven, rug tools were used on certain types of rugs, the nozzle did not seal well and a large part of the air drawn into the rug tool entered through the nozzle opening, and this resulted in poor turbine operation and consequently poor rug brush operation; and when used on other types of rugs, the prior art, turbine-driven rug tools sealed tightly to the rug and had good general performance, but suffered from the necessity of requiring a great deal of effort in order to push or pull the rug tool over the rug.

In the first situation, applicant found that decreasing the amount of air flowing into the nozzle opening resulted in more air entering the turbine chamber and, hence, improved the turbine's operation. In the second situation, applicant found that decreasing the amount of air flowing into the nozzle opening lessens the seal and permits easier movement of the rug tool on the rug. Therefore, it will be seen that applicant has discovered that controlling the amount of air entering through the nozzle opening effects and regulates the relative amounts of air entering into both the nozzle chamber and turbine chamber, and affords the operator an adjustable control for adapting the air flow characteristics of the rug tool to the type of rug which is being cleaned and the type of dirt to be cleaned. It will be understood that there are various types of rugs and conditions that may be met when operating a vacuum cleaner, and that in many cases no adjustment of the air flow is needed, whereas in others such adjustment assists a person using the cleaner to do a better cleaning operation.

The improved rug tool includes the referred-to means for controlling the amount of air entering through the nozzle opening. While numerous equivalent arrangements could be effected, the illustrated valve plate arrangement is a simple and effective manner of controlling this flow of air. By reference to Figs. 1, 2 and 3, it will be observed that the terminal portion **66** of the wall **26** supports a valve plate **68** which extends into the lower passageway **44**. The outline of valve plate **68** conforms to the cross-section of passageway **44**, which is substantially semicircular, and is pivotally mounted at its straight edge to the wall portion **66** so as to be movable between a position wherein it lies closely adjacent to said portion and thereby does not constrict the passageway **44** at all, and another position wherein it is disposed at approximately 90 degrees from said portion and, therefore, substantially closes the passageway **44**. There are numerous positions between these two extreme positions which the valve plate may assume to constrict the passageway **44** to different extents. In Fig. 2, two representative positions of the flap valve are illustrated, one being shown in dotted lines.

The manner of pivoting the valve plate to the terminal portion **66** is not critical. As illustrated, the hinge pin **70** is rigidly connected to the straight edge of the valve plate **68** and passes through a transverse opening **69** formed in the terminal portion **66** by displaced portions of the latter, and openings **71** in the sides of the tubular outlet portion **16** (see Fig. 3). The ends of hinge pin **70** are mounted for rotary bearing motion in openings **71**, and one end **72** of the hinge pin extends to the exterior of the tubular outlet portion and is rigidly connected to the knob **74** at its free end on one side of the tubular outlet portion. Rotation of the knob **74** rotates the hinge pin **70** in the transverse opening **69**, and pivots the valve plate **68**.

In order to maintain the valve plate in adjusted position, a plurality of balls **76** are mounted in sockets **77** in the knob **74**, and are frictionally pressed into engagement with one side of the tubular outlet portion **16** by appropriate resilient means **79** to thereby maintain the knob in any position to which it is adjusted. The braking effect of the spring pressed balls **76** is supplemented by the generally tight fit of the hinge pin **70** in the displaced portions of the terminal portion **66** in which it is supported, to retain the hinge pin and, hence, the valve plate in any position to which it has been adjusted. The knob **74** may have a pointer **78**, and appropriate indicia (not shown) may be formed on the rug tool for indicating the various positions of adjustment of the valve plate.

It will be apparent that the valve plate enables an operator of the rug tool to control the amount of air which enters through the nozzle opening **32** and consequently the amount of air that enters through the slots **48**. Starting with a condition in which the valve plate lies contiguous to the terminal portion **66** and, therefore, wherein the passageway **44** is not constricted at all, it will be observed that a certain amount of air will enter through the slots **48** and a certain amount will enter through the nozzle opening **32**. If the type of rug on which the rug tool is operated seals too tightly to the rug tool or if it does not seal enough and too much air is entering into the nozzle opening, either condition may be alleviated by adjusting the valve plate **68** in such a manner that it constricts the passageway **44**. This reduces the amount of air which may pass through the passageway **44** and consequently the amount of air that may enter through the nozzle opening **32**. This has the consequential effect of increasing the amount of air that enters through the slots **48**. Therefore, if the rug tool has been sealing too tightly, the reduction in the amount of air entering through the nozzle opening will lessen the seal, and if the rug tool has not been sealing sufficiently, and too much air has been entering through the nozzle opening and not enough entering through the slots **48**, this adjustment will force more air to enter through slots **48**. It will be observed that the provision of the valve plate **68** renders the rug tool susceptible to regulation of a wide range of variations in the relative flow of air through the nozzle chamber and the turbine chamber.

Whereas the provision of the valve plate **68** constitutes a significant improvement in turbine-driven rug tools, under one condition a situation may arise which creates a subsidiary problem. In some cases it may be necessary to so severely restrict the flow of air through the nozzle opening in order to provide easy pushing of the rug tool that the effective amount of opening in passageway **44** is so small that it will not readily allow coarse dirt to pass through to the outlet chamber and ultimately to the source of suction.

To eliminate this problem, a bleeder valve is provided, which is illustrated as being mounted in the lower wall **30**, but which may be mounted at some other location, such as in the side wall **34**, if it is desired. The bleeder valve comprises the opening **80** which is formed in the bottom wall **30**, and the valve disk **82** which is larger than the opening **80** and overlies the latter. The valve disk **82** is pivotally connected by a conventional hinge construction **84** to the inner side of the bottom wall **30** and is movable to either cover or uncover opening **80**. Valve disk **82** is normally pressed against the inner surface of the bottom wall to cover the opening **80** by the leaf spring **86** which is rigidly secured at one of its ends to the inner side of the bottom **30** by the securing means **88**.

In Fig. 1 the bleeder valve is illustrated as closed, i.e., the opening **80** is covered by valve disk **82**. In Fig. 2 the bleeder valve is illustrated as being open. It will be observed that when the bleeder valve is open, air enters directly through the opening **80** into the passageway **44**, thereby bypassing the nozzle opening **32**. This becomes useful, as was mentioned, when it is necessary to severely restrict the amount of air entering through the nozzle opening **32** in order to reduce the seal created between the rug and the nozzle, and when it is desired not to unduly constrict the passageway **44**. The latter undesirable condition is avoided by allowing the bleeder valve to open when the vacuum in the nozzle chamber reaches a predetermined level. By permitting additional air to flow directly into the passageway **44** and to bypass the nozzle opening, the vacuum at the nozzle which is causing the tight seal may be reduced, and yet the passageway **44** does not have to be unduly restricted.

In view of the foregoing, it is believed that it will be apparent that the improved rug tool satisfies the object of this invention in that it provides in a split air flow, turbine-driven rug tool, means which permits an operator to regulate the relative amounts of air flowing into the turbine portion and the nozzle portion of the rug tool, and thereby adapt the rug tool to whatever cleaning conditions obtain, i.e., type of rug and dirt being cleaned.

As will be evident, certain aspects of my invention are not limited to the particular details of the construction of the example illustrated, and I contemplate that various and other modifications and applications will occur to those skilled in the art. It is, therefore, my intention that the appended claims will cover such modifications and applications as do not depart from the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an air operated rug tool attachment for cooperation with the air conducting wand of a canister type vacuum cleaner comprising a body having a turbine chamber disposed near the top of said body which communicates with the atmosphere and has a turbine rotatably mounted therein, a nozzle chamber disposed near the bottom of said body which communicates with the

atmosphere and has a rug brush rotatably mounted therein, and an outlet chamber which communicates with the turbine chamber, nozzle chamber and a source of suction, said outlet chamber communicating with said source of suction through said air conducting wand, said turbine being disposed to rotate on a vertical axis and being adapted to rotate said rug brush when it is rotated, whereby on actuation of said source a flow of dust-laden air is induced through said nozzle chamber and out said outlet chamber, and a flow of clean air is induced through said turbine chamber where it contacts said turbine and rotates it, and out said outlet chamber, that improvement comprising means for regulating the relative amounts of air that flow through said nozzle chamber and said turbine chamber, said regulating means comprising air flow restricting means which is located wholly within said body, and a manually operable means which is accessible from the exterior of said body for operating said air flow restricting means, said air flow restricting means being adjustable by said manually operable means to any one of a plurality of different positions to thereby provide a plurality of different settings wherein the air flow is restricted to different extents.

2. In an air operated rug tool attachment for cooperation with the air conducting wand of a canister type vacuum cleaner comprising a body having a turbine chamber which communicates with the atmosphere and has a turbine rotatably mounted therein, a nozzle chamber which communicates with the atmosphere and has a rug brush rotatably mounted therein, and an outlet chamber which communicates with the turbine chamber, nozzle chamber and a source of suction, said outlet chamber communicating with said source of suction through said air conducting wand, said turbine adapted to rotate said rug brush when it is rotated, whereby on actuation of said source, a flow of dust-laden air is induced through said nozzle and said outlet chamber, and the flow of clean air is induced through said turbine chamber, where it contacts said turbine and rotates it, and said outlet chamber, that improvement comprising means for regulating the relative amounts of air that flow through said nozzle chamber and said turbine chamber, said regulating means comprising air flow restricting means which is located wholly within said body in the path of the air that flows through said nozzle chamber, and a manually operable means which is accessible from the exterior of said body for operating said air flow restricting means, said air flow restricting means being adjustable by said manually operable means to any one of a plurality of different positions to thereby provide a plurality of different settings wherein the air flow is restricted to different extents.

3. A device as defined in claim 2 wherein said body includes a nozzle opening and air enters said nozzle chamber through said nozzle opening, and additional means is provided for allowing air to enter said nozzle chamber under certain predetermined conditions without passing through said nozzle opening.

4. An air operated rug tool comprising a body having a turbine chamber, a nozzle chamber and an outlet chamber, openings in said body placing said turbine chamber into communication with the atmosphere, a turbine rotatably mounted in said turbine chamber, a nozzle opening placing said nozzle chamber into communication with the atmosphere, a rug brush rotatably mounted in said nozzle chamber adjacent said nozzle opening, said turbine and said rug brush being in mechanical driving relationship, a passageway connecting said nozzle chamber and said outlet chamber, and valve means in said passageway for selectively directly controlling the flow of air through said passageway to thereby control the amount of air that enters through said nozzle opening, said valve means being selectively positionable between a fully opened position and a fully closed position in any one of a plurality of different intermediate positions wherein a different amount of air is allowed to flow through said passageway.

5. A device as defined in claim 4 wherein said valve means comprises a pivotal valve plate.

6. A device as defined in claim 5 wherein said valve plate is controlled by means which is accessible from the exterior of the rug tool.

7. An air operated rug tool comprising a body having walls which define a turbine chamber, a nozzle chamber and a tubular outlet chamber, openings in said walls for placing said turbine chamber into communication with the atmosphere, a turbine rotatably mounted in said turbine chamber, a nozzle opening placing said nozzle chamber into communication with the atmosphere, a rug brush rotatably mounted in said nozzle chamber adjacent said nozzle opening, said turbine and said rug brush being in mechanical driving relationship, one of said walls separating said turbine and nozzle chambers and extending into said tubular chamber, a plate in said tubular chamber hinged to said one of said walls on the nozzle chamber side thereof, said plate being selectively movable to a plurality of positions to vary the amount of clearance between itself and the portions of the tubular chamber forming walls on said side, whereby the amount of air flowing through the nozzle chamber may be selectively controlled.

8. A device as defined in claim 7 wherein means is provided in the walls which form the nozzle chamber on the upstream side of said plate for admitting air into said nozzle chamber under certain predetermined conditions without passing through said nozzle opening.

9. A device as defined in claim 8 wherein said means comprises a bypass opening and a spring pressed closure which normally covers said bypass opening, but which uncovers said bypass opening when the vacuum within the nozzle chamber reaches a predetermined point.

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