United States Patent [19]

Gilmore

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[45] **Nov. 20, 1973**

[54] **RUG DUSTER**

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[22] Filed: **June 16, 1971**

[21] Appl. No.: **153,698**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 848,619, Aug. 8, 1969, abandoned.

[52] **U.S. Cl.** ..... **15/309**, 15/5, 15/300 A

[51] **Int. Cl.** **A47l 5/38**

[58] **Field of Search** ..... 15/5, 300 A, 306 A, 15/308, 309, 386

[56] **References Cited**

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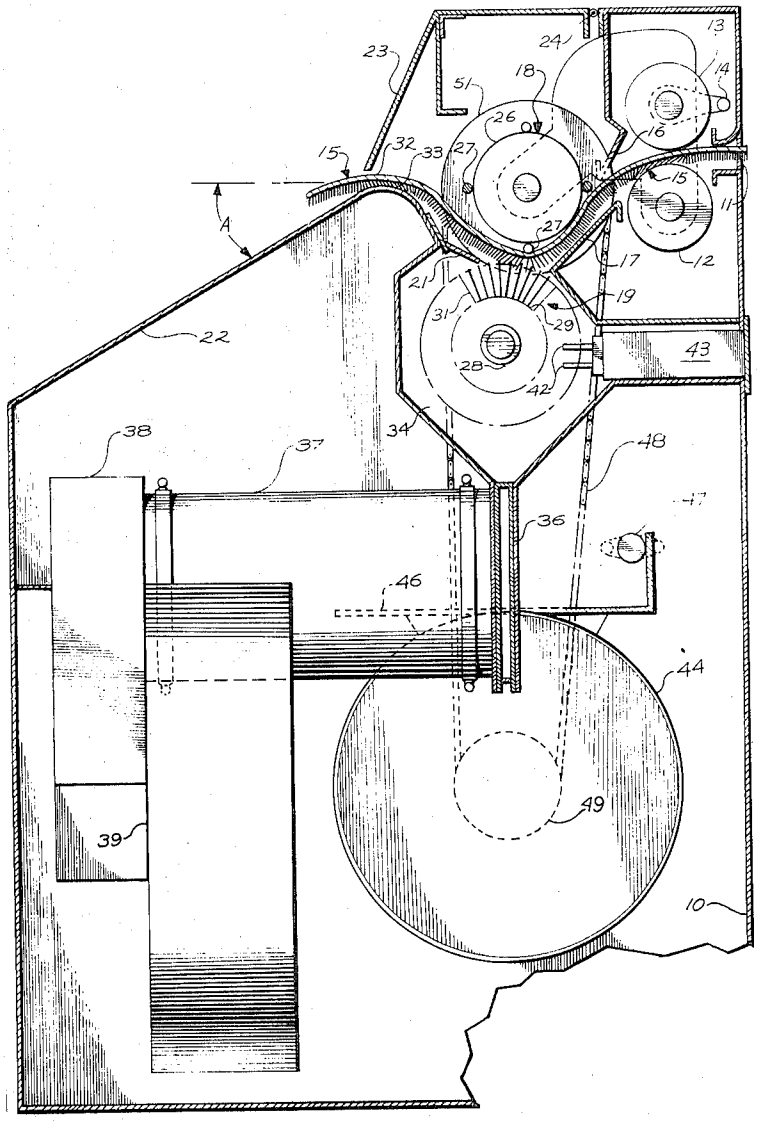
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Assistant Examiner—C. K. Moore
Attorney—Christie, Parker & Hale

[57] **ABSTRACT**

A rug duster removes dust and the like from rugs and mats by the action of brushes, beating bars, spreader bars and vacuum. Rugs are passed through feed rolls and over a beater roll with raised beater bars which flex the rugs' backings and open the rugs' naps. While the naps are open, a brush and vacuum remove dust and lint. The naps are further opened by flexure bars at the exit of a vacuum chamber which are spaced apart and have their axes in line with the path of the rug to flex the rug and develop a sinuous flex.

13 Claims, 8 Drawing Figures

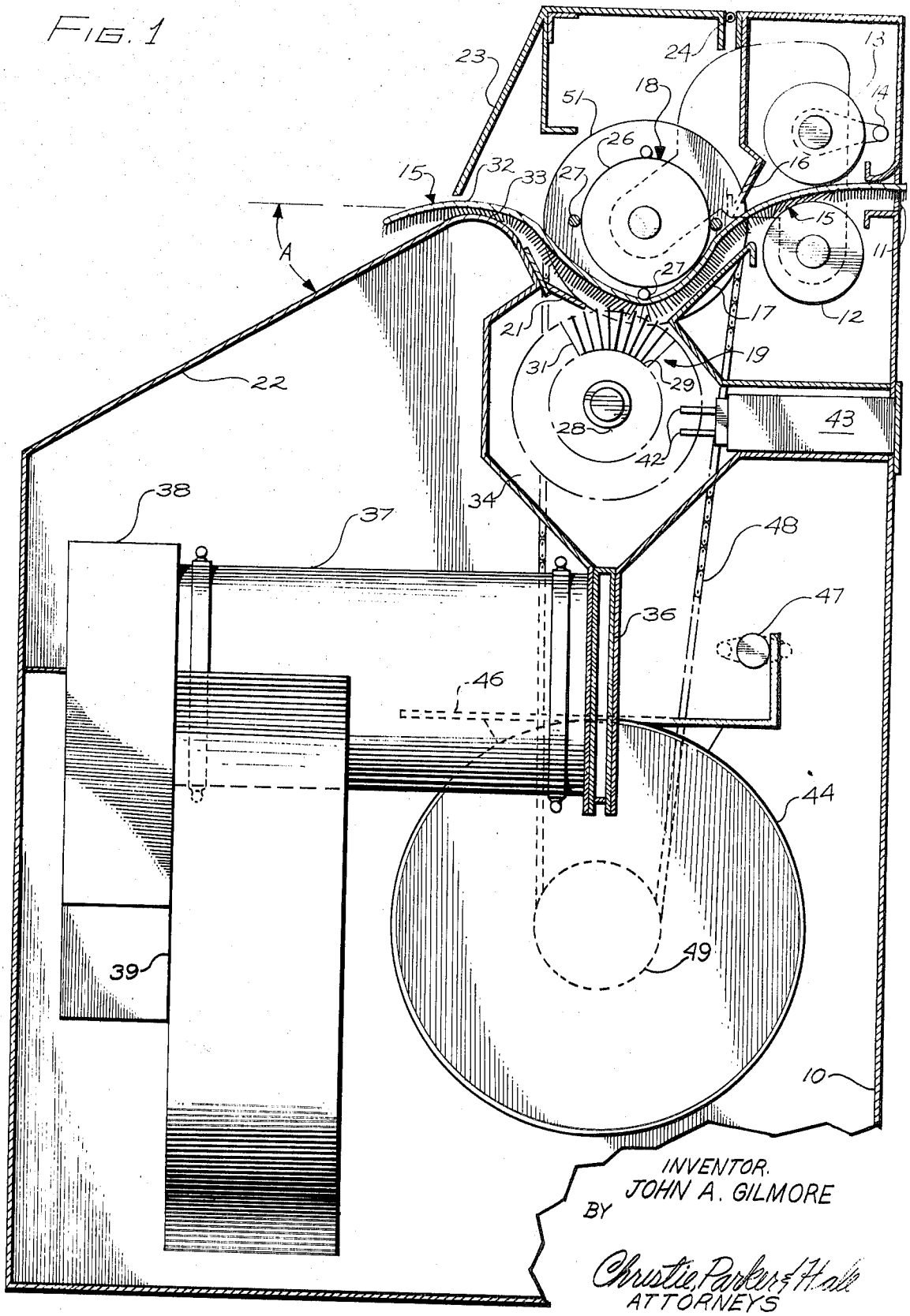


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FIG. 1



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FIG. 6

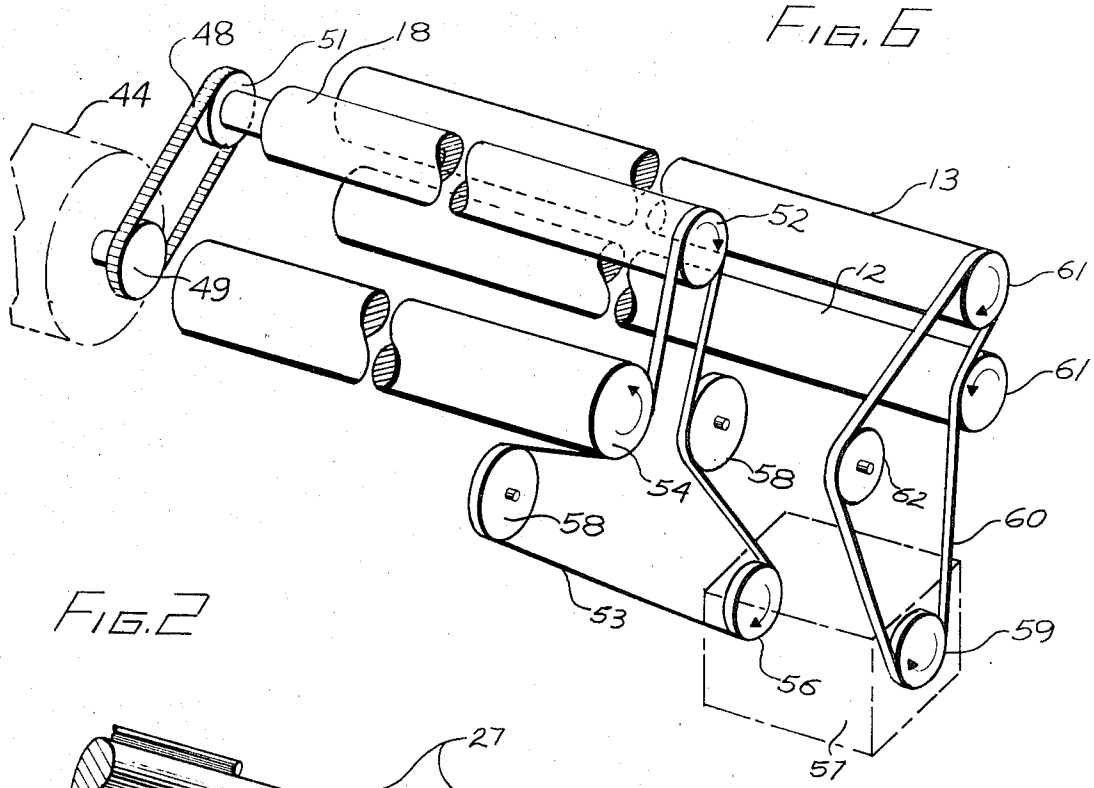


FIG. 2

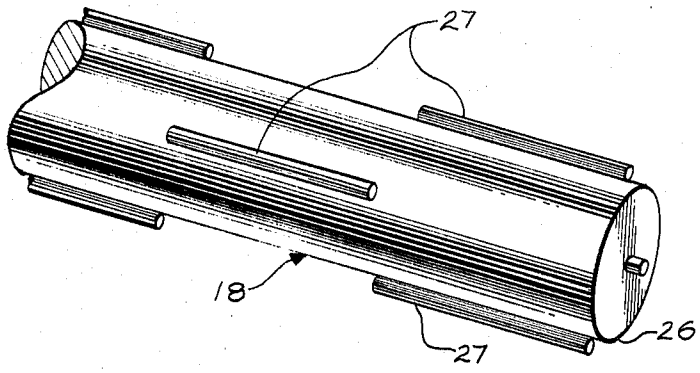


FIG. 3

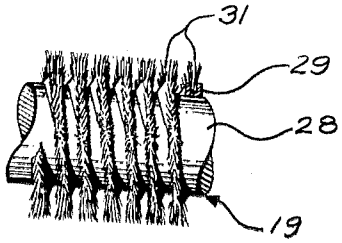


FIG. 4

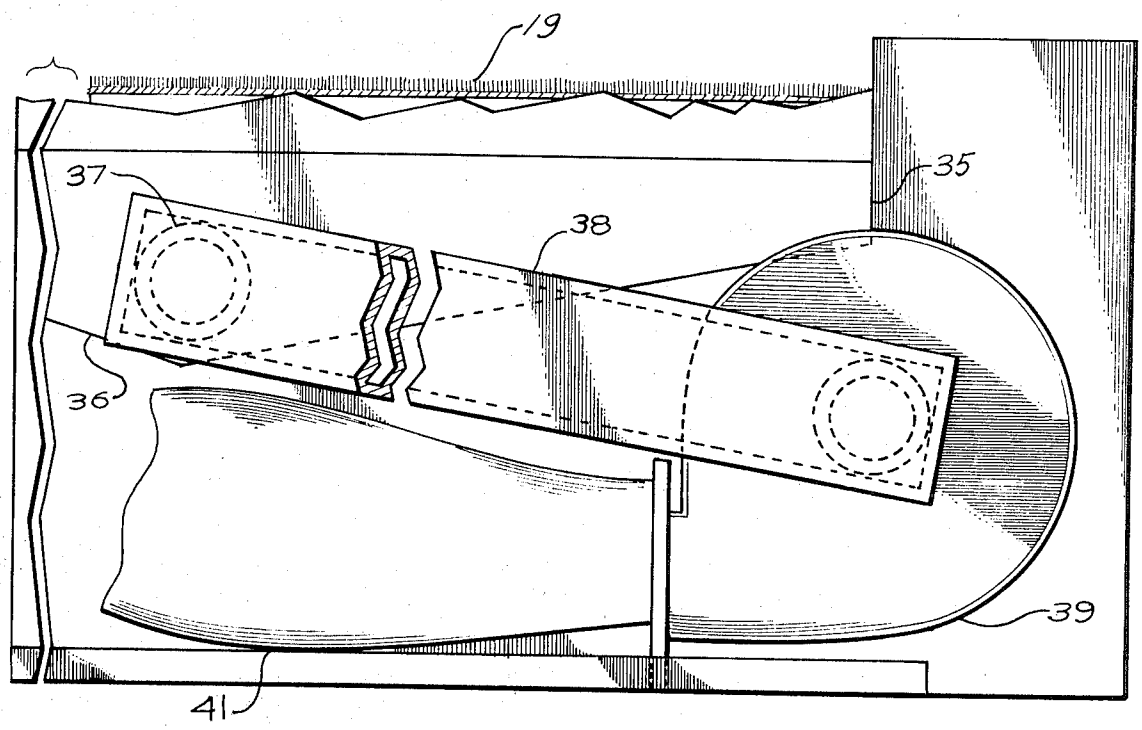


FIG. 5

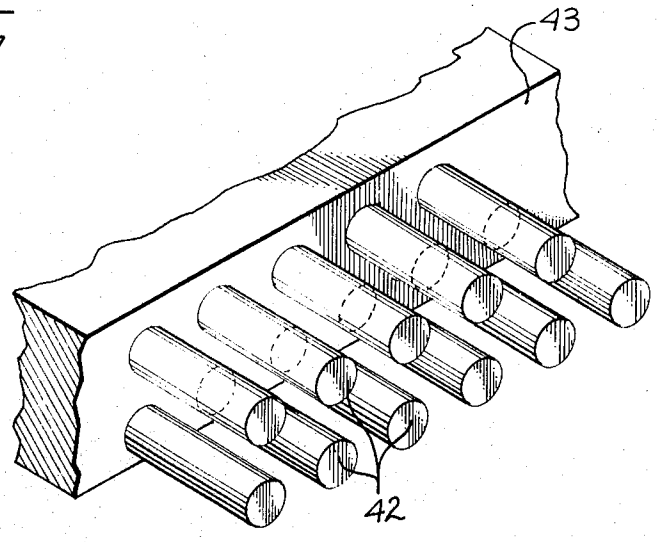


FIG. 7

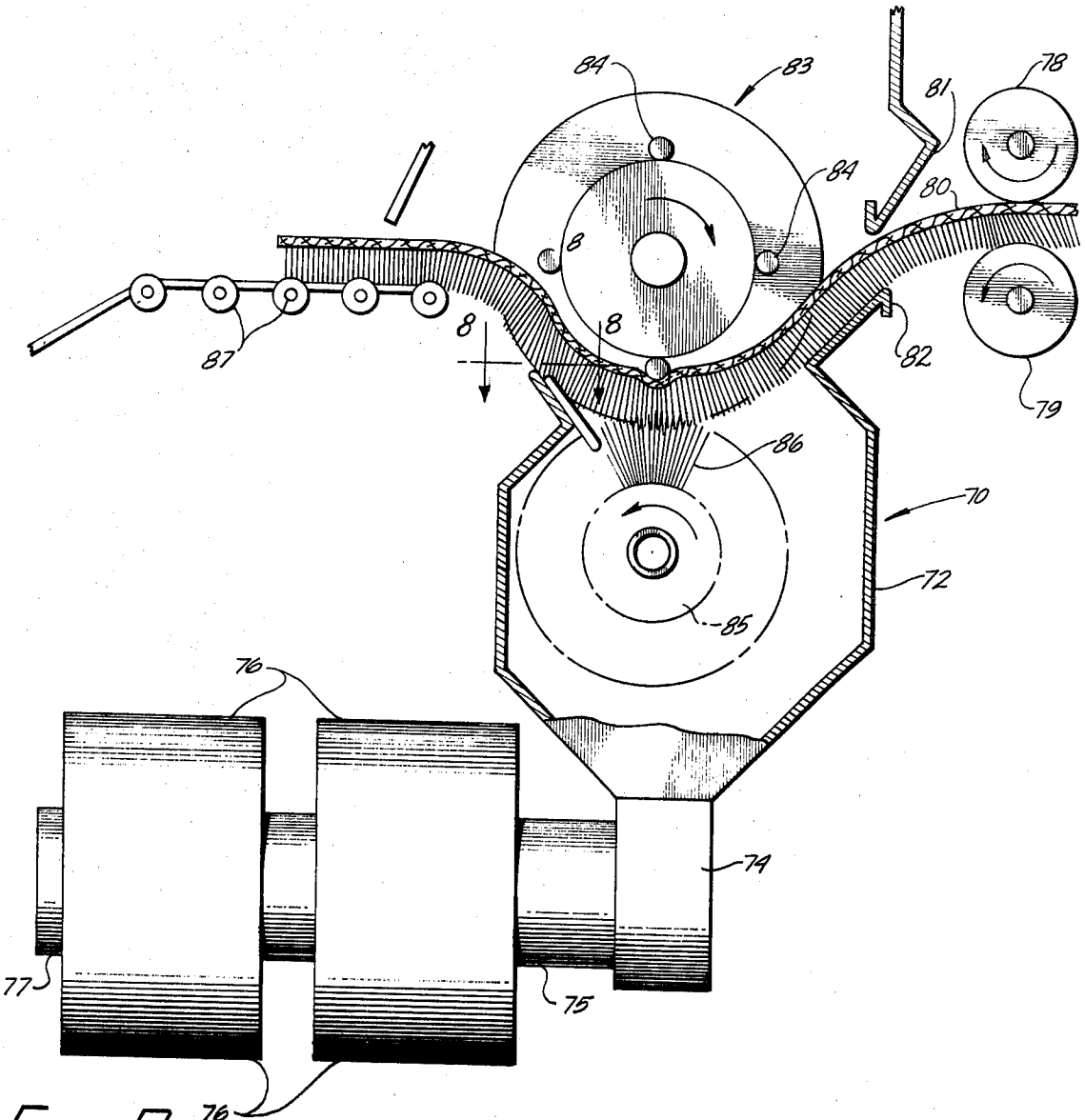
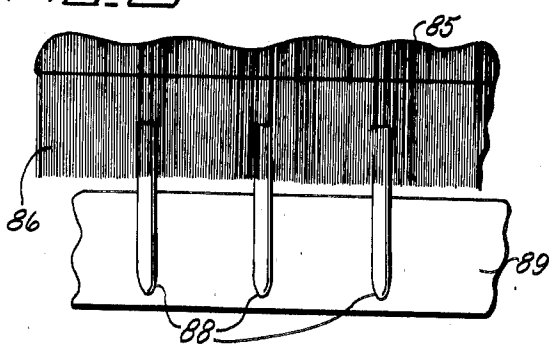


FIG. 8



RUG DUSTER

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is a continuation-in-part application of U.S. Pat. application Ser. No. 848,619 filed Aug. 8, 1969, and now abandoned and entitled Rug Duster.

BACKGROUND OF THE INVENTION

The present invention relates in general to the laundry machine art and, in particular, to a rug duster which effects its task through flexing, vacuum, brushing and beating.

In recent years a new style of runner has been employed for entrance rugs or mats for offices, hotels and the like. The runners are made with a relatively thick, say ⅛ inch, impermeable backing typically of vinyl plastic sheet. A fiberglass net or the like is bonded to the vinyl sheet and is employed to secure a tight pile of, typically, nylon, to the vinyl backing. In a typical rug of this type, a pile is approximately three-eighths inch long and the rugs are uniformly 4 feet wide, but have lengths varying from a few feet to many yards. The pile is very tight.

Since the rugs have a very tight pile and an impermeable backing, conventional rug cleaning techniques have not been entirely satisfactory. Mechanical or hand beating of the rugs and cleaning with petroleum solvents have been the only techniques even close to satisfactory. However, both of these techniques are expensive. Ordinary vacuuming of the rugs does little more than remove surface debris because of the very tight nap and impermeable backing. The rugs cannot be satisfactorily cleaned in an ordinary rug washing machine and the tight nap and impermeable backing make the rugs very difficult to dry.

BRIEF SUMMARY OF THE INVENTION

The present invention contemplates a rug duster having means for opening the nap of the rug and brushing, flexing, beating and vacuuming dust therefrom. Means are also provided for automatic passage of a rug at a controlled rate through the rug duster.

In a particular embodiment, a rapidly rotating cylinder has raised lugs that engage the impermeable backing of the rug and flex the rug in a direction to open the nap. This also applies a beating action to the rug. At the same time a brush engages the nap side of the rug so that the brush's bristles enter the opened nap to remove dirt. The brush and portion of the rug being flexed are simultaneously vacuumed. Flexure bars develop a sinuous pattern in the rug to further open the nap for vacuum cleaning. Feed rolls engage the rug before it enters the space between the beater cylinder and brush to control the feed rate through the machine. A common drive for the feed rolls, beater and brush synchronizes action and minimizes mechanisms needed.

These and other features, aspects and advantages of the present invention will become more apparent from the following description, appended claims and drawings.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 illustrates in end elevation a rug dusting machine constructed according to the principles of this invention;

FIG. 2 is a fragmentary view of a beater roller;

FIG. 3 comprises a detailed view of a portion of a cleaning brush;

FIG. 4 illustrates a portion of the vacuuming system of the rug duster;

FIG. 5 comprises a fragmentary view of cleaning fingers for the brush of FIG. 4;

FIG. 6 illustrates schematically the principal moving parts of the rug duster;

FIG. 7 illustrates in end elevation a modification of the rug dusting machine shown in the previous figures; and

FIG. 8 is a fragmentary view looking down in the direction of 8—8 in FIG. 7 with the rug removed and part of the bristles of the illustrated brush removed for clarity.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a preferred embodiment of rug duster constructed according to the principles of this invention. The view of FIG. 1 is an end elevation of the rug duster with end cover roller support bearings and the like deleted for purposes of illustration. As illustrated in this embodiment, there is provided a housing 10 which is a sheet metal structure constructed according to well known techniques. The housing 10 is preferably mounted on casters so that the entire self-contained rug duster can be readily transported to a site where cleaning is desired.

A narrow slot 11 is provided in the front side of the housing so that an operator can insert the leading edge of a rug into the interior of the machine. If desired, a foldable table or the like (not illustrated) may be provided outside slot 11 to assist the operator in inserting a rug 15 into the machine. It will be apparent that slot 11 is narrow and of approximately the same width as the thickness of the rug so that the rug may pass readily therethrough, but the operator's fingers are substantially prevented from entering the machine. It will also be understood that slot 11 is elongated along the length of the machine (that is, normal to the view of FIG. 1) to a total length at least sufficient to accommodate rugs of a standard width, for example, four feet. Clearly, other lengths of slot may be employed as desired to accommodate other rug widths.

A pair of feed or pinch rolls 12 and 13 are mounted in the housing just inside slot 11 to accept rug 15. If desired, the lower roller 12 may be fixed in position and the upper roller 13 mounted on pivot 14 so that its weight biases the two pinch rollers 12 and 13 together for a firm grip on a rug passing between them. It will, of course, be apparent that a spring may also be used to urge roller 13 toward roller 12 to provide a firm grip on a rug. The surfaces of rolls 12 and 13 may be smooth or suitably roughened to provide an adequate grip on the rug. The pinch rolls feed the rug into the cleaning structure described later in this description. The speed of the pinch rolls also controls the rate that the rug passes through the machine to effect thorough cleaning.

After passing between pinch rolls 12 and 13, which are driven at fairly low speed (for example, six revolutions per minute) the rug is then deflected downwardly by its weight and a deflector plate 16 so as to pass along a downward sloping entry apron 17. Rug 15 then passes between a beater roller 18 and rotary brush 19. At the

exit side of the passage between beater roller **18** and brush **19**, a plurality of deflector fingers **21** on, say, 1½ inch centers along the length of the brush, extend from housing **10** just into brush **19** to pick the rug off the brush and prevent the leading edge thereof from following along with the brush as it rotates. Deflecting fingers **21** instead cause rug **15** to rise along a short path and then slide down a sloping runout table **22** which slopes downwardly from the horizontal by an angle A. This angle A of runout table **22** from the horizontal should exceed about 15° and is preferably about 30° so that the weight of the rug, even for short mats, is sufficient to pull the last edge of the rug through the machine without assistance. This assures that a single operator may use the machine by feeding rugs therein and there is no requirement for a second operator to withdraw or catch rugs coming out of the machine.

An exit door **23** is mounted on the housing by a hinge **24** and is disposed at an angle so that the rug lifts the door and exits from the machine after leaving the space between beater roller **18** and brush **19.** Movable door **23** closes under its own weight and thereby prevents an operator from getting his hands in engagement with the rapidly rotating rollers.

Beater roller **18** is seen in greater detail in FIG. **2** and comprises an elongated cylinder **26** having a plurality of staggered beaters bars **27** arrayed along the length thereof. Each of beater bars **27** may be small diameter cylinders or rods welded to the cylinder **18** so as to extend a short distance along the length thereof. In the illustrated embodiment, four rows of beater bars are provided around the circumference of the beater cylinder **26,** with each beater bar extending 6 or 7 inches along the length of the cylinder. About 6 inches is provided between the ends of successive beater bars in each row, and the bars in successive rows are staggered so that all positions along the width of the rug are contacted by at least two beater bars for every revolution of the beater roller.

In one embodiment, the beater roller **18** comprises a cylinder **26** of approximately 2⅞ inches in diameter rotating at a speed of about 600 revolutions per minute. The beater bar bars **27** comprise, for example, 5/16 inch diameter cylinders welded on the main cylinder **26.** These dimensions give the beater bars a peripheral speed of about 6,100 inches per minute.

The brush **19** in one embodiment is also slightly over four feet in length to accommodate the standard rug width and has a diameter of about 5 inches to the ends of the bristles. As seen in greater detail in FIG. **3,** the brush is formed of a central cylinder **28** having a helical brush strip **29** with a pitch of about **13** turns per foot secured therearound. Stiff nylon bristles **31** extend radially from the brush strip **29** for engaging the nap of the rug. In a typical embodiment, the bristles are about 0.014 inch diameter, of stiff nylon fibers about 1½ inches long. By providing the bristles in the brush strip in a helical path, it is assured that all areas of the rug are adequately brushed or subjected to a dry scrubbing action by the bristles. It will also be apparent that with the aforementioned relative dimensions and a rotational speed of about 500 revolutions per minute in the brush that the bristles have a peripheral speed of about 7,800 inches per minute, that is, about 25 percent faster than the peripheral speed of the beater bars.

Referring again to FIG. **1,** the path of the rug **15** between beater roller **18** and brush **19** and the deflection of the rug as it is cleaned can be clearly seen. As hereinabove mentioned, the rug duster is particularly suitable for a rug or mat having an impermeable backing **32** such as a sheet of vinyl plastic with a tight nylon nap **33** secured thereto. As is clearly seen in FIG. **1,** as the rug passes under beater roller **18** it is bent with the impermeable backing **32** on the concave side and the nap **33** on the convex side. Such a bending of the rug clearly opens up or spreads the nap to increase the spacing between individual fibers of the nap. It will also be seen that, as individual ones of the beater bars **27** repeatedly contact the reverse side of the rug, it is further flexed and deflected locally to further spread the nap and mechanically vibrate the rug to beat the dust loose. The rug travels through the machine at about 3 feet per minute and the beater bars have a speed of about 500 feet per minute so that considerable vibration and flexing of all areas of the rug are obtained.

In addition to the beating of the rug and opening of the nap by the beater bars, there is simultaneous engagement of the opened nap by bristles **31** of the brush. The rapidly traveling stiff bristles (about 650 feet per minute) effectively remove dust, lint, chewing gum and other debris from deep within the nap of the rug.

In order to further enhance the cleaning of the rug, a vacuum is applied thereto during the beating and brushing operation. The brush **19** is mounted within a vacuum chamber **34** in fluid communication with a vacuum plenum **36.** Since backing **32** of the rug is impermeable, substantially all of the air entering vacuum chamber **34** must pass along the nap of the rug, thereby sweeping out any loose dirt. By mounting the brush in the vacuum chamber **34,** it is also subjected to high volume air flow so that dust, lint and other debris brushed from the nap of the rug are cleaned from the brush.

The vacuum system employed for cleaning the dust from the nap and from the brush is further illustrated in the semischematic view of FIG. **4.** As illustrated in this view, plenum **36,** which again is connected to vacuum chamber **34,** is relatively narrow at its ends **35** and wide in its middle so that the volume of air passing through any section of the plenum is substantially uniform along its length. This assures that the volume of air passing over any individual segment of the width of the rug or length of the brush is substantially uniform and good cleaning is obtained over the entire rug width. Air leaving plenum **36** then passes through a transverse duct **37** and diagonally downward through a rectangular conduit **38** to the inlet port of a conventional centrifugal blower **39.** The outlet of the blower is connected to a conventional large volume vacuum bag **41** for collecting the dust, lint and other debris from the rug.

Referring again to FIG. **1** and to detail in FIG. **5,** the bristles **31** on the brush are further cleaned by means of a plurality of fingers **42** extending into the rows of bristles after they have passed through the portion of the vacuum chamber where maximum cleaning due to air flow has occurred. The cleaning fingers are typically ⅛ inch diameter steel spring pins about 1½ inches long and they serve to remove threads, hair, lint and chewing gum from the bristles. The cleaning pins or fingers **42** are provided in two or more staggered rows so that all of the bristles are adequately cleaned upon each revolution of the brush. The cleaning fingers **42** are mounted on a removable drawer **43,** readily extractable

from the front side of the rug duster so that the fingers can be cleaned of any accumulated dirt.

In order to drive the several rollers of the rug duster, it is preferred to employ a single drive motor to maintain a selected relative speed and minimize the mechanisms needed. A 1½ H.P. electric motor 44 is mounted on a base 46 pivotally attached to the housing by a pivot 47 so that the weight of the motor maintains the drive linkage in the proper constant tension.

As is seen in greater detail in FIG. 6, the output of motor 44 is connected so as to directly drive beater roller 18 by a conventional gear or toothed timing belt 48. Sprockets 49 and 51 on the motor and beater roller, respectively, provide a suitable speed reduction so that the beater roller is driven at about 600 revolutions per minute. In addition to supporting the beater bars, the beater roller 18 also serves the double function of a jackshaft for conveying rotary motion to other portions of the rug duster. A 14-tooth sprocket 52 on the opposite end of the beater roller 18 from sprocket 51 drives a conventional roller chain 53 which, in turn, drives a 17-tooth sprocket 54 on the end of brush 19 to provide an appropriate speed reduction. In addition, roller chain 53 drives an input pulley 56 of a conventional 100-to-1 gear reducer 57. A pair of idler sprockets 58 resiliently biased against roller chain 53 maintain constant tension in the chain. An output sprocket 59 on gear reducer 57 drives a roller chain 60 which, in turn, drives a pair of sprockets 61 on the pinch rollers 12 and 13, respectively, so that the pinch rollers are driven in opposite directions for controlling the feed speed of the rug. An idler pulley 62 resiliently biased againt chain 60 maintains constant tension in the chain. The common drive so provided is economical and reliable and keeps all parts moving at suitable relative speeds. The double function of the beater cylinder as the main drive shaft also minimizes parts needed.

Referring again to FIG. 1, in order to operate the rug dusting machine, an operator inserts the leading edge of a rug into slot 11 in housing 10 with rug backing 32 facing upwardly and rug nap 33 facing downwardly. When the leading edge of the rug is engaged by the upper and lower rolls 12 qnd 13, respectively, the rug is thereafter drawn into the machine by the feed rolls and at a speed controlled by the rotational speed of the feed or pinch rolls. The rug then passes along a path on entry apron 17 and between beater roller 18 and brush 19 where the beating or rapid intermittent flexing, brushing, and vacuuming of the rug are carried out as previously described. Since the rug beater and brush are traveling at higher speed and in the same direction as the feed rolls, the rug feeds readily between them and travels at a speed determined by the speed of the pinch rolls. After passing between beater 18 and brush 19, the rug slides down runout table 22 to exit from the machine under its own weight.

FIGS. 7 and 8 illustrate the presently preferred embodiment of the present invention. The drive and housing are essentially the same as shown in previous Figures. Because of this, FIGS. 7 and 8 are presented schematically.

The preferred rug duster is shown in general by reference numeral 70 in FIG. 7. The rug duster includes a vacuum chamber 72 which through a plenum 74 and across duct 75 is in air communication with a pair of serially connected blowers 76 of standard design. It has been found that serially connected blowers increase the capacity of air drawn through the vacuum chamber over that which would be drawn by a single blower having the same capacity.

Plenum 74 is made deeper than corresponding plenum 36 to reduce restriction in the air path between the vacuum chamber and the exit of the blowers, the latter being shown at 77. In this embodiment the air bag is dispensed with.

If desired, hatches or the like can be provided in the vacuum system for cleaning access.

As before, a pair of pinch rollers, shown here at 78 and 79, are provided to feed a rug 80 through the rug duster. In this embodiment the feed rollers feed a rug at about ten feet per minute. The rug enters the active portion of the rug duster between a deflector 81 and an entrance apron 82 in the same manner as described with reference to the previous embodiment. A beater roll 83 with a plurality of beater bars 84 corresponds structurally to beater roll 18 and its beater bars 27. As will be recalled, the beater bars beat the backing of a rug to force dust from the rug and create a condition where the rug is constantly being flexed and the nap opened for more effective action by the brush and vacuum.

brush 85 has bristles 86 which engage the nap of A brush rug to dislodge dust and solid matter. The bristle arrangement of brush 85 differs from brush 19. As will be recalled, brush 19 had bristles arranged helically. Bristles 86 of brush 85, on the other hand, are arranged in rows paralleling the rotational axis of the brush. It has been found that this type of brush provides more effective cleaning. The cleaning fingers and drawer of the previously described embodiment are dispensed with in this embodiment for reasons which will become apparent.

As stated previously, the drive of the embodiment of the invention illustrated in FIGS. 7 and 8 is essentially identical to the previous embodiment. The drive rates, however, are different. The tip of bristles 86 rotate between about 350 to 400 feet per minute. Beater bars 84 rotate at about 900 feet per minute.

On the exit side of vacuum chamber 72, sloping roll-off table 22 shown in FIG. 1 has been replaced by a plurality of rollers 87. These rollers are mounted in standard manner to the housing of rug duster 70.

In addition, a plurality of bars 88 extending parallel to the path of rug travel extend from a mount 89 of the cabinet into the path of bristles 86 of brush 85. Bars 88 cooperate to force the rug between the spaces of bars 88 to develop a sinuous flexing of the rug as it passes over bars 88. This sinuous flexing, at right angles to the flexing effected by the action of the beater bars and brush 85, further opens the nap of the rug for cleaning by the vacuum within vacuum chamber 72.

Bars 88 also act on rug 80 to seal the exit from vacuum chamber 72 and prevent dirt from being thrown out the exit by brush 85 or roll 83.

It will be apparent to one skilled in the art that many modifications and variations can be made in the described structure without departing from the principles of this invention. Thus, for example, other raised portions such as hemispherical lumps can be provided on the beater roller in lieu of the described beater bars so long as transverse stretching of the rug backing is not excessive. Other minor modifications and variations will be apparent.

What is claimed is:

1. A rug duster comprising:
a. a housing;
b. a pair of parallel pinch rolls in the housing for gripping a rug therebetween and to control the speed of passage of a rug through the machine;
c. means for rotating the pinch rolls at a predetermined peripheral speed;
d. a rug beater rotatably mounted in the housing adjacent the exit side of the pinch rolls comprising a cylinder extending parallel to the pinch rolls and a plurality of raised rigid portions on the surface of the cylinder for contacting the backing of a rug;
e. means for rotating the cylinder of the rug beater at a predetermined peripheral speed higher than the peripheral speed of the pinch rolls;
f. a cylindrical brush adjacent the rug beater and disposed relative to the rug beater for passage of a rug between them, the bristles of the brush being arranged to engage the nap of a rug in the same region of a rug contacted by the raised portions;
g. means for rotating the cylindrical brush at a predetermined peripheral speed higher than the peripheral speed of the pinch rolls;
h. the pinch rolls, rug beater, and brush at least partly defining a rug path through the rug dusting machine;
i. a vacuuming chamber surrounding the brush and adjacent at least a portion of the rug path;
j. means for creating a vacuum in the vacuuming chamber; and
k. a plurality of side-by-side and spaced-apart bars in the rug path on the exit side of the vacuuming chamber with the axes of the bars oriented along the path of movement of a rug and the bars extending into the path of the bristles of the brush, the bars being positioned to develop a sinuous flexing in a rug passing over them with the sinuous flexure being transverse to the direction of rug travel, the bars also being in position such that the sinuously flexed rug experiences vacuum from the vacuuming chamber.

2. The rug duster claimed in claim 1 wherein:
the means for rotating the rug beater comprises a motor operatively connected to a first end of the cylinder for rotation thereof;
the means for rotating the brush comprises drive means operatively interconnecting the second end of the cylinder with an end of the brush for rotation thereof simultaneously with rotation of the rug beater; and
the means for rotating the pinch rolls comprises speed reduction means operatively driven by the second end of the cylinder and drive-connected to the pinch rolls.

3. The rug duster claimed in claim 1 wherein:
a plurality of rows of rollers, each row having a plurality of rollers in it, the rows of rollers being oriented in the horizontal on the exit side of the rug duster immediately adjacent the bars, with the bars being between the vacuuming chamber and the rollers.

4. An improved rug duster comprising:
a. a housing;
b. means defining a vacuum chamber in the housing;
c. means for creating a vacuum in the vacuum chamber;
d. means to feed a rug towards the vacuum chamber;
e. a beater roller having a plurality of rigid protrusions for engaging and flexing the backing of a rug, the beater roller being rotatably mounted in the housing in position for the protrusions to engage the rug backing;
f. a bristled brush rotatably mounted in the vacuum chamber in position for the rug to pass between the brush and the beater roller with the bristles of the brush engaging the nap of the rug while the beater roller engages the backing of the rug opposite the nap being engaged by the bristles so that the nap is opened by the beater bars for brushing by the bristles;
g. means for driving the beater roller and the brush in rotation in a directional sense to advance the rug through the rug duster; and
h. a plurality of parallel and spaced-apart bars at the exit from the vacuum chamber oriented with their axes along the direction of travel of the rug over them, the bars being in position to cause flexing of the rug passing over them in a generally sinuous pattern transverse to the direction of rug travel and for the nap of the rug over the bars to be in communication with the vacuum chamber.

5. The improved rug duster claimed in claim 4 including means for convexly curving the nap side of the rug for engagement of the convexly curved nap by the bristles of the brush.

6. The improved rug duster claimed in claim 4 wherein the bars extend into the path of the bristles of the brush.

7. The improved rug duster claimed in claim 5 wherein the bars extend into the path of the bristles of the brush.

8. The rug duster claimed in claim 7 wherein the beater roller and the brush rotate at different peripheral speeds.

9. The rug duster claimed in claim 8 wherein the rug feed means includes a pair of pinch rollers oriented for the rug to pass between them and to apply a force on the rug, the pinch rollers rotating at a slower peripheral speed than the beater roller and the brush to control the rate at which the rug advances through the rug duster.

10. The rug duster claimed in claim 9 wherein the means for creating a vacuum in the vacuum chamber includes at least two serially connected blowers.

11. The rug duster claimed in claim 9 wherein a plurality of rollers for supporting an exiting rug are disposed adjacent the bars with the bars being between the vacuum chamber and the rollers.

12. An improved rug duster comprising:
a. a housing;
b. means defining a vacuum chamber in the housing;
c. means for creating a vacuum in the vacuum chamber;
d. means to feed a rug towards the vacuum chamber;
e. a beater roller having a plurality of rigid protrusions for engaging and flexing the backing of a rug, the beater roller being rotatably mounted in the housing in position for the protrusions to engage the rug backing;
f. a bristle brush rotatably mounted in the vacuum chamber in position for the rug to pass between the brush and the beater roller with the bristles of the brush engaging the nap of the rug on the opposite

side of and simultaneously with the engagement of the backing of the rug by the beater roller;

g. means for driving the beater roller and the brush in rotation in a directional sense to advance the rug to the rug duster; and

h. means for drawing air into the vacuum chamber through the nap of the rug.

13. The improved rug duster claimed in claim 12 including means for convexly curving the nap side of the rug for engagement of the convexly curved nap by the bristles of the brush.

* * * * *