

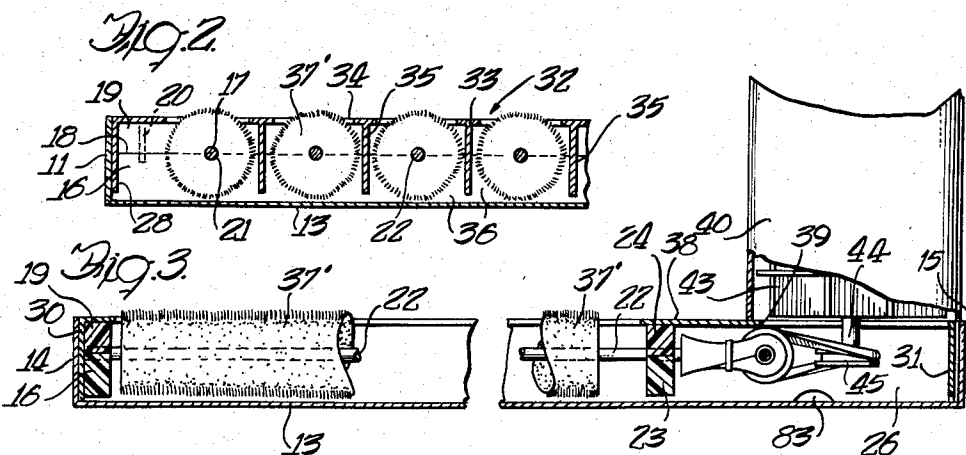
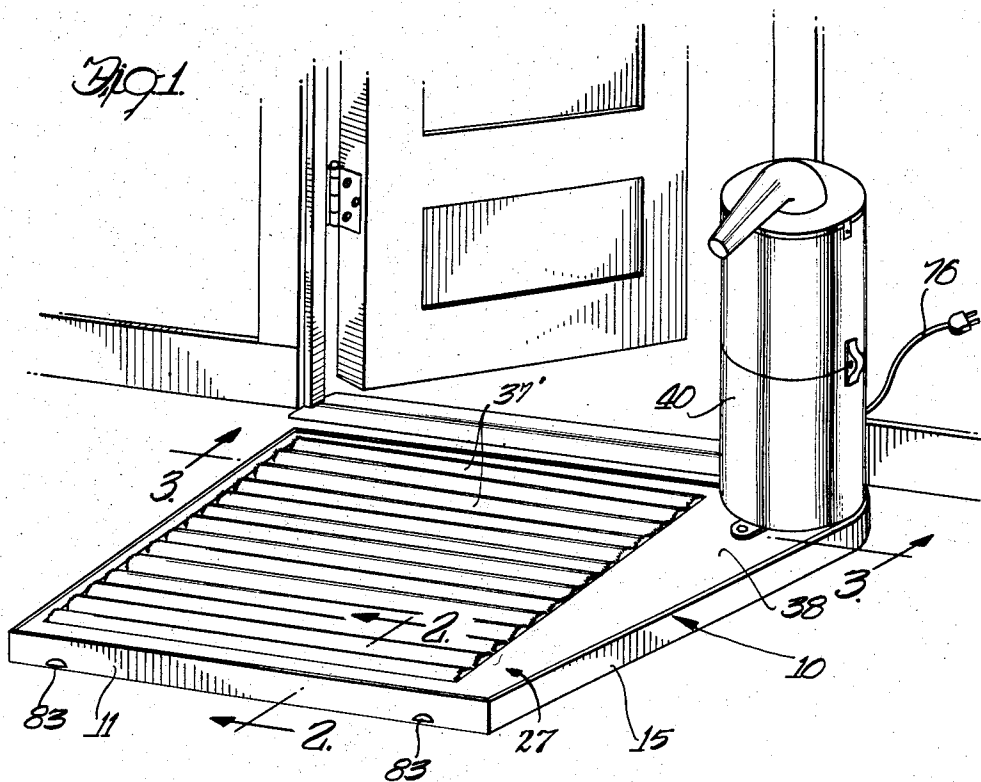
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H. J. OSTROW
ELECTRIC DOOR MAT

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2 Sheets-Sheet 1

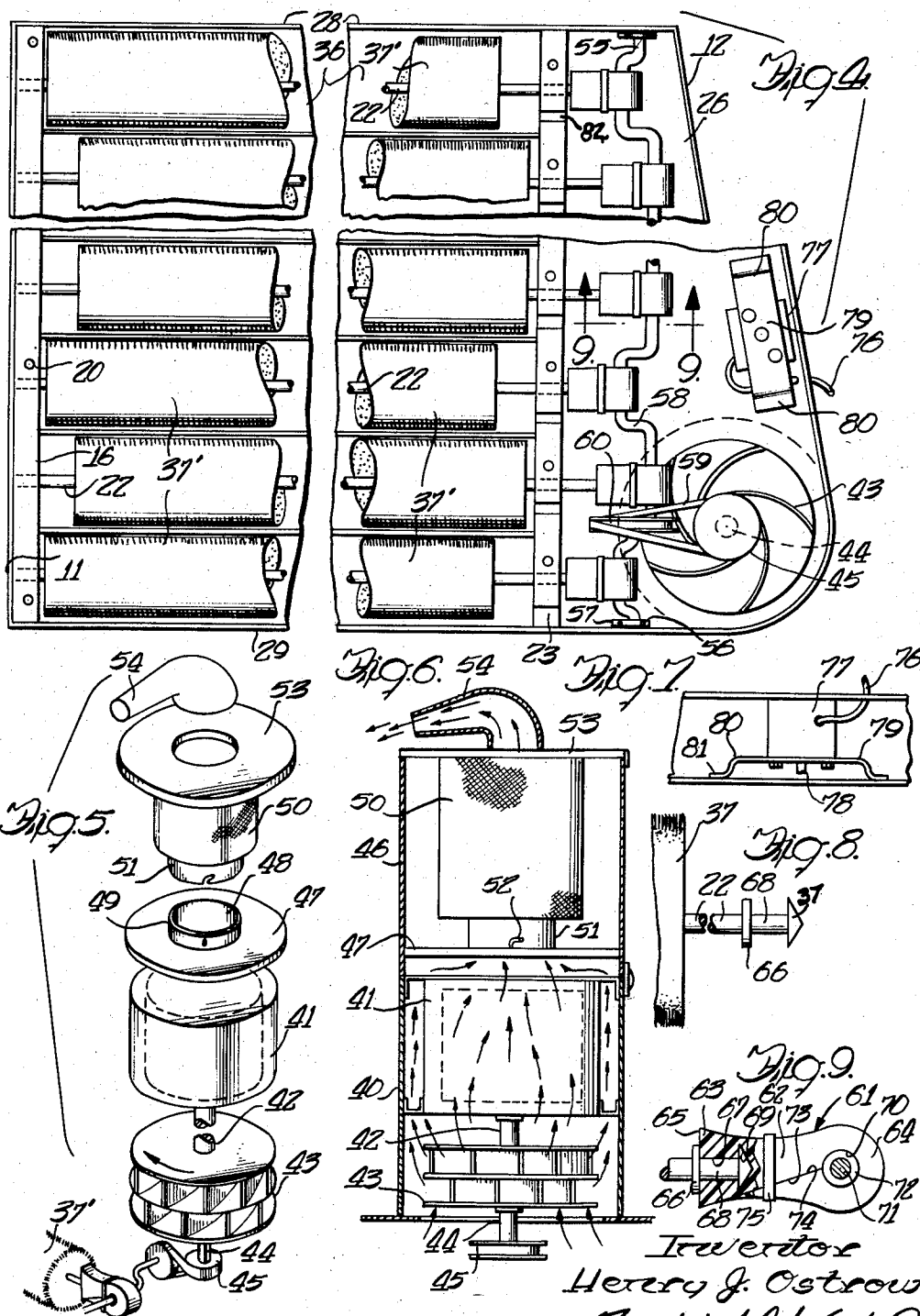


Inventor
Henry J. Ostrow
Frederick J. Kugel
Attorney

Filed June 12, 1957

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2 Sheets-Sheet 2



Inventor
Henry J. Ostrow
Frederick J. Krabel
Attorney

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ELECTRIC DOOR MAT

Henry J. Ostrow, Palatine, Ill.

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This invention relates to electric door mats for porches, entrance halls, or the like, and more particularly to a new and improved device provided with a plurality of brushes which are automatically actuated when a person steps on the device to remove dirt and other foreign matter from the shoes of the person.

An important object of the present invention is a power actuated door mat having means for conveying the dirt and other foreign material removed from the soles of the shoes of a person standing on the mat and means for collecting such dirt and other debris so conveyed and which collecting means may be readily emptied periodically when necessary.

A further object is the provision of means for producing air under pressure and directing the air flow toward the shoes of a person standing on the door mat to free dirt and other foreign matter from the shoes of the person.

A still further object is the provision of a door mat having power driven brushes which are readily replaceable when necessary.

Still another object is the provision of a power driven door mat which is simple and durable in construction, economical to manufacture, easy to install, and neat and attractive in appearance.

The foregoing and other important objects and desirable features inherent in and encompassed by the invention, together with many of the purposes and uses thereof will become readily apparent from a reading of the ensuing description in conjunction with the annexed drawings, in which,

Figure 1 is a perspective view of a door mat embodying the invention;

Figure 2 is a sectional view taken substantially along line 2-2 of Figure 1;

Figure 3 is a sectional view taken substantially along line 3-3 of Figure 1;

Figure 4 is a bottom view of the grid frame;

Figure 5 is an exploded view of the components incorporated in the drive means for the brushes and the dirt collecting means;

Figure 6 is an enlarged, detailed view of certain of the components illustrated in Figure 6 in their assembled relationship;

Figure 7 is a fragmentary view of the push button for controlling the operation of the electric motor;

Figure 8 is an enlarged fragmentary view of one end of a brush; and

Figure 9 is a sectional view taken substantially along line 9-9 of Figure 4.

Referring to the drawings in detail, wherein like reference characters represent like elements throughout the various views, there is shown open top metal support frame 10 having spaced apart and substantially parallel vertical side walls 11, 12 and a flat bottom wall 13. The frame 10 may be suitably fixed to the top surface of entry way flooring as illustrated in Figure 1, or, optionally, recessed in an opening in the flooring. One end wall 14

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of the frame 10 is disposed substantially at right angles to the side walls 11, 12 while the other wall 15 extends from one end of the side wall 12 at an interior angle greater than 90°.

Telescoped within the frame 10 is a grid frame 27 having vertically arranged side walls 28, 29 adjacent the side walls 11 and 12 respectively, and vertically arranged end walls 30, 31 adjacent the end walls 14 and 15 respectively, of the frame 10. That portion 32 of the top wall 33 of the grid frame 27 overlying the compartment 25 is provided with a plurality of elongated slots 34 which are arranged parallel to the side walls 28, 29 and are spaced with respect to each other. A metal plate 35 depends from and is rigidly fastened to the underside of the top wall 33 between each pair of adjacent slots 34, as best illustrated in Figure 2. The plates 35 divide the compartment into a plurality of chambers 36.

Suitably fixed to the top wall 33 is bar 19 of synthetic material such as "nylon" or the like. The bar 19 abuts the end wall 30. The bar 19 is provided with a plurality of spaced, semi-cylindrical grooves 17 in the lowermost surface 18 thereof. A bar 16 of similar material underlies the surface 18 and is fastened to the bar 19 by means of a plurality of bolts 20 extending through the upper bar 19 into threaded recesses formed in the lower bar 16. The lower bar 16 is provided with spaced semi-cylindrical grooves 21 which are respectively concentric with the grooves 17 of bar 19. Each pair of concentric grooves 17, 21 define a bearing for slidably and rotatably supporting one end of a brush shaft 22. The opposite ends of the shafts 22 are similarly supported by a lower bar 23 and an upper bar 24 which are spaced from and substantially parallel to the bars 16, 19. The upper bar 24 and the lower bar 23 attached thereto serve as a common wall for a pair of adjacent compartments 25, 26, as illustrated in Figures 3 and 4.

The shafts 22 carry cylindrical brushes 37' and the brush on each shaft is located in a separate chamber 36 as shown. One end portion of each shaft 22 extends into the compartment 26 and the terminal end 37 thereof is in the form of a cone, as shown in Figures 8 and 9.

The compartment 26 has its top completely covered by a portion 38 of the top wall 33 of the grid frame 27 and is imperforate except for a circular opening 39 adjacent the intersection of the walls 29 and 31. Positioned over the opening 39 is an open-ended, upright cylindrical casing section 40 which is securely fastened to the wall portion 38. An electric motor 41 is mounted in the upper portion of the casing section 40. The driven shaft 42 of the motor 41 is vertically disposed and has an exhaust blower 43 attached to the lowermost end thereof. Keyed to the blower 43 and depending therefrom into the compartment 26 is a short shaft 44 to which a belt pulley 45 is fixed. An upper cylindrical section 46 has one end detachably connected to uppermost end of the cylindrical section 40 by any suitable means. A plate 47 is secured to the interior of the section 46 by any suitable means. Plate 47 is secured to the interior of the section 46 adjacent the lower end thereof which is provided with a central opening 48 encircled by an annular upwardly projecting collar 49. A dirt and dust collector bag 50 has its open end provided with a metal band 51 which is adapted to telescope over the collar 49. A bayonet-type of connection, indicated generally by numeral 52, is employed to detachably connect the bag 50 to the plate 47. The uppermost end of the cylindrical section 46 has a detachable cover 53 fastened thereto. The cover 53 has an air-directing nozzle 54 mounted on the top thereof which is in air communication with the interior of the upper cylindrical casing section 46. The purpose of the nozzle 54 will be pointed out hereinafter.

Disposed within the compartment 26 and having its

rotational axis substantially parallel to the bars 23, 24 is a crankshaft 55 which has its opposite ends journaled in bearing blocks in a conventional manner. The bearing blocks are removably secured, as by bolts 56, to L-shaped brackets 57 secured to the side walls, 28, 29, of the grid frame 27. The crank shaft 55 is formed with a plurality of offset cranked portions 58; there being a cranked portion 58 provided for each brush shaft 22. Each cranked portion 58 extends radially in a direction substantially opposite the adjacent cranked portion. The crankshaft 55 is rotated by means of an endless belt 59 which is trained around the pulley 45 and a belt pulley 60 keyed to the crankshaft 55. It will be noted that pulley 45 is of a much smaller diameter than the crankshaft pulley 60, and, consequently, the crankshaft 55 rotates at a much lower speed than the shaft 44, which, is rotated at the speed of the armature shaft 42 of the motor 41.

A novel coupling, designated generally by numeral 61 and shown in detail in Figure 9, is employed by drivingly interconnecting each shaft 22 and the crankshaft 55 whereby rotation of the crankshaft effects reciprocation of the brush shafts. The couplings 61 are made of rubber, plastic, synthetic resin or other material having like physical properties. The couplings 61 are somewhat elongated in form and each coupling comprises an intermediate shank section 62 integrally formed with and interconnected to enlarged opposite end portions 63, 64, respectively. The enlarged end portion 63 contiguous to the bearing bars 23, 24 of each coupling 61 is provided with a flat face 65 which is adapted to abut a thrust washer 66 fixed to the shaft 22 and axially spaced from the base of the cone-shaped terminal end 37 of the shaft 22. The enlarged end portion 63 has a central bore 67 extending axially from the flat face 65 which has an internal diameter slightly smaller than the diameter of the shaft 22 and a length slightly greater than the shaft section 68 extending between the thrust washer 66 and the base of the cone-shaped terminal end 37 when the coupling 61 is disconnected from the shaft 22. A cone shaped cavity 69, formed within the enlarged end portion 63, is in communication with one end of the bore 67 and has a volume substantially equal to the volume of the terminal end 37. From the foregoing it will be appreciated that in order to connect each shaft 22 to respective coupling 61 it is merely necessary to advance the terminal end 37 thereof axially in the bore 67 until the terminal end 37 is disposed and seated within the cavity 69. When in this position, the flat end face 64 abuts the thrust washer 66 and the base of the cone-shaped terminal end 37 engages the interior wall surface defining the base of the cavity 69. The end 64 opposite the end 63 is somewhat cylindrical in shape and has a central bore 70 extending therethrough which has an axis disposed substantially perpendicular to the axis of the bore 67. The axially extending section 71 of each cranked portion 58 of the crank shaft 55 is provided with a bearing sleeve 72 of plastic or similar material which is journaled thereon. Each bearing sleeve 72 is adapted to extend through the bore 70 of a respective coupling 61 and be frictionally gripped by the wall surface defining the bore 70. In order to detachably connect the couplings 61 to the crank shaft 55, a diagonal slit is provided which extends from the bore 70 through the cylindrical end 64 and part of the shank section 62 and is defined by abutting surfaces 73, 74. Thus, in order to attach a coupling 61 to the crank shaft 55 it is merely necessary to separate the surfaces 73, 74 sufficiently to permit a section 71 and bearing sleeve 72 to pass therebetween and be seated in a bore 70. Thereafter, the surfaces 73, 74 are brought into abutting engagement and an encircling, contraction band 75 is placed on the shank section 62 adjacent the cylindrical end 64 to maintain the surfaces 73, 74 in engagement and the bearing sleeve firmly gripped by the surface defining the bore 70. From the foregoing, it will be appreciated that by

providing the unique coupling 61 described above the need for a pivot connection between the coupling and a respective shaft end 37 is eliminated since the movement of the coupling with respect to the shaft, when the crank shaft 55 is rotated, is accommodated by flexing of the shank section 62. It is also obvious that the pivotal connections between the couplings 61 and the crank shaft 55 require no lubrication to remain in good working order.

Electrical current for energizing the motor 41 is supplied through a conductor 76 which may be plugged into a convenience outlet located adjacent the doorway. The conductor 76 leads to switch 77 fastened to the underside of portion 38 of the grid frame top wall 33 adjacent the vertical wall 31 and substantially midway between the side walls 28, 29. The switch 77 is provided with a spring-pressed push button 78 which is biased to its circuit-opened position. Electric current is supplied to the motor 41 only when the push button 78 is depressed. The central section of a bar 79, made of spring material, is secured to the underside of the switch 77, as shown in Figures 4 and 8. The end portions 80 of the bar 79 depend from the bottom of the switch 77 and are each provided with a terminal, flat foot 81 which is adapted to bear against the bottom wall 13 of the support frame 10. The feet 81 are vertically spaced from the underside of the switch 77, a distance greater than the length of the push button 78 projecting from the switch 77 when in its circuit-opened position, as shown in Figure 4. As best shown in Figure 3, the bottom edge of the end wall 30 of the grid frame 27 bears against the bottom wall 13 while the bottom edge of the opposite end wall 31 is vertically spaced above the bottom wall 13 which vertical spacing is maintained by the spring bar 79 when in its uncompressed state. The bottom edges of the side walls 28 and 29 are inclined upwardly from the bottom edge of the end wall 30 to the bottom edge of the end wall 31. It is also to be understood that the bottom edges of the divider plates 35 lie substantially in the plane containing the bottom edges of the side walls 28, 29. From the foregoing, it will be appreciated that the entire grid frame 27 and all the components and parts described above mounted thereon are supported by the frame 10 through the intermediary of the bottom edge of the end wall 30 and the spring bar 79 and the resilient force exerted by the spring bar 79 is sufficient to maintain the top wall 33 of the grid frame 27 substantially parallel to the bottom wall 13 of the support frame 10 when the door mat is not being used. It will be noted in Figure 3 that a slight clearance is provided between the facing surfaces of the end wall 31 of the grid frame 27 and the end wall 15 of the support frame 10. The clearance is provided to accommodate pivotal movement of the grid frame 27 with respect to the support frame 10 about an axis coinciding with the bottom edge of the end wall 50 and the bottom wall 13 when weight is added to the grid frame 27 as when a person steps on the door mat. The biasing action of the spring bar 79 is chosen such that very little additional weight is required to effect pivoting of the grid frame 27 by compressing the spring bar 79.

In use, when a person steps on the top wall 33 of the grid frame 27, the grid frame 27 pivots in the manner as pointed out hereinbefore and the push button 78 of the switch is depressed to its circuit-closed position. Once the electric circuit is completed by depression of the push button 78, the motor 41 is energized and the brush shafts 22 are reciprocated. Simultaneously, with the reciprocation of the brush shafts 22, the exhaust blower 43 commences to operate causing a vacuum to be created in each of the chambers 36. Air communication is established between each chamber 36 and compartment 26 by means of grooves 82 formed in the bottom edge of the lower bearing bar 23. Any dust, dirt, etc., dislodged from the soles of the shoes of the person

standing on the door mat by the reciprocating brushes will be drawn into the chambers 36 and the dust and dirt-laden air will then pass from the compartment 26 to the collector bar 50 where the dust and dirt particles are retained while permitting the passage of air therethrough. The air flowing through the bag 50 is discharged through the nozzle 54 which is directed to the feet of the person using the door mat. It will be appreciated that the current of air discharged from the nozzle facilitates removal of dirt and debris from the shoes of the person using the device. The collector bag 50 may be conveniently cleaned out periodically when required as pointed out hereinbefore. Any large particles of dirt or other debris too heavy to be drawn upwardly to the collector bag 50 by the exhaust blower 43 collect on the bottom wall 13 of the support frame 10. The bottom wall 13 may be cleaned by merely lifting the grid frame 27 from the support frame 10 and displacing it to one side of the support frame temporarily. It is obvious there are no bolts or other fastening means to remove or unfasten in order to remove the grid frame 27 from the support frame 10. The brush shafts 22 may be readily replaced in the same manner. From the foregoing, it will be appreciated that the door mat is easily serviced or repaired because access to any portion of the operating mechanism is readily had simply by lifting the grid frame 27 and laying it over on its side.

When the weight of the person is removed from the grid frame 27, the spring bar 79 pivots the grid frame 27 and the switch 77 is then opened to discontinue operation of the motor 41.

It will be noted that a plurality (two being shown in Figure 1) of small apertures 83 are provided in the side wall 11 adjacent the bottom wall 13. The apertures 83 permit water which may accumulate in the support frame 10 to drain therefrom.

By virtue of the novel connection between the brush shafts 22 and the couplings 61 the brush shafts 22 and the brushes 37' carried thereby may be manually rotated with respect to the grid frame 27, while being reciprocated, by user as he rubs the bottom of his shoes perpendicular to the axes of the shafts 22. Rotation of the brush shafts 22 insures even wear of the bristles of the brushes 37' and prevents the peripheral sections of the brushes 37' actually contacting the shoe soles from being overloaded and clogged with dirt by affording different sections of the brushes to extend above the grid frame 27 at will.

The embodiment of the invention chosen for the purposes of description and illustration herein is that preferred for achieving the objects of the invention and developing the utility thereof in the most desirable manner, due regard being had of existing factors of economy, simplicity of design and construction, and the improvements sought to be effected. It will be appreciated, therefore, that the particular structural and functional aspects emphasized herein are not intended to exclude, but rather to suggest, such other adaptations and modifications of the invention as fall within the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A mechanical door mat comprising an open-topped, cup-shaped support frame having a flat bottom wall, transversely spaced and parallel vertical side walls, and longitudinally spaced, vertical end walls; an inverted cup-shaped grid frame telescoped within said support frame having a substantially flat top wall closing the open top of said support frame having a plurality of elongated slots formed therethrough arranged in parallel spaced re-

lation with respect to each other, and longitudinally spaced, vertical end walls of unequal vertical depth, the bottom edge of said end wall having the greatest vertical depth resting upon said flat bottom wall adjacent one of said end walls of said support frame; spring means depending from the opposite end of said top wall and engaging said bottom wall to maintain said top and bottom walls substantially parallel, said spring means being effective to permit pivoting of said top wall whereby said top wall is inclined with respect to said bottom wall; bearing means detachably connected to the underside of said top wall; a plurality of brush shafts arranged in horizontal parallel spaced relation with respect to each other supported by said bearing means for axial and rotational movements separately and severally with respect to said grid frame, each of said shafts being disposed below a respective slot in said top wall; a brush having radially extending bristles carried by each shaft, a section of each brush projecting through a respective slot and disposed above said top wall; a motor supported by said grid frame; a drive shaft rotatably supported by said grid frame and drivingly connected to said motor, said drive shaft having a plurality of axially spaced, radially offset cranked portions; quick detachable, flexible coupling means connecting each cranked portion to a respective brush shaft and imparting reciprocating movement to the brush shaft when said motor is energized, said coupling means permitting said brush shafts to be manually rotated; an electric circuit for energizing said motor; switch means carried by said top wall adjacent said spring means, said switch means being in said electric circuit and being open when said top and bottom walls are substantially parallel, said switch means being actuated to close when said top wall is inclined with respect to said bottom wall to complete said electric circuit and energize said motor; air conducting means having one end in air communication with the space between said top and bottom walls and its opposite end opening to the atmosphere; and exhaust blower means drivingly connected to said motor and supported by said grid frame for causing air to be drawn through said slots to said space between said top and bottom walls and flow through said air conducting means and be discharged to the atmosphere.

2. A mechanical door mat as set forth in claim 1, including nozzle means on the end of said air conducting means opening to the atmosphere for directing air discharged therefrom downwardly toward the upwardly facing surface of said top wall.

3. A mechanical door mat as set forth in claim 2, including a detachable dirt and dust bag secured in said air conducting means for intercepting and collecting dirt and dust contained in the air flowing through said air conducting means.

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