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Kilstrom et al.

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[54] **SURFACE TREATING ATTACHMENT DEVICE**

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Related U.S. Patent Documents

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Filed: **Mar. 5, 1973**

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Mar. 7, 1972 Sweden 2834/72

[52] **U.S. Cl.** ..... **15/380;** 15/387; 51/170 MT; 285/7; 285/325

[51] **Int. Cl.²** **A47L 5/30;** A47L 9/24

[58] **Field of Search** ..... 15/380, 381, 387; 51/170 MT; 285/325, DIG. 4, DIG. 7, 7

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[57] **ABSTRACT**

A surface treating device such as a surface grinder in which power is transmitted to the operative elements of the assembly by a flowing gas, for example, air. The device is attached to a source of at least a partial vacuum, such as a vacuum cleaner. The motor fan unit of the vacuum cleaner together with a rotatable fan housed in the device form the power generating source which in turn operates the grinding member of the surface treating device in order to treat the work surface with an oscillating motion in a plane generally parallel thereto.

15 Claims, 7 Drawing Figures

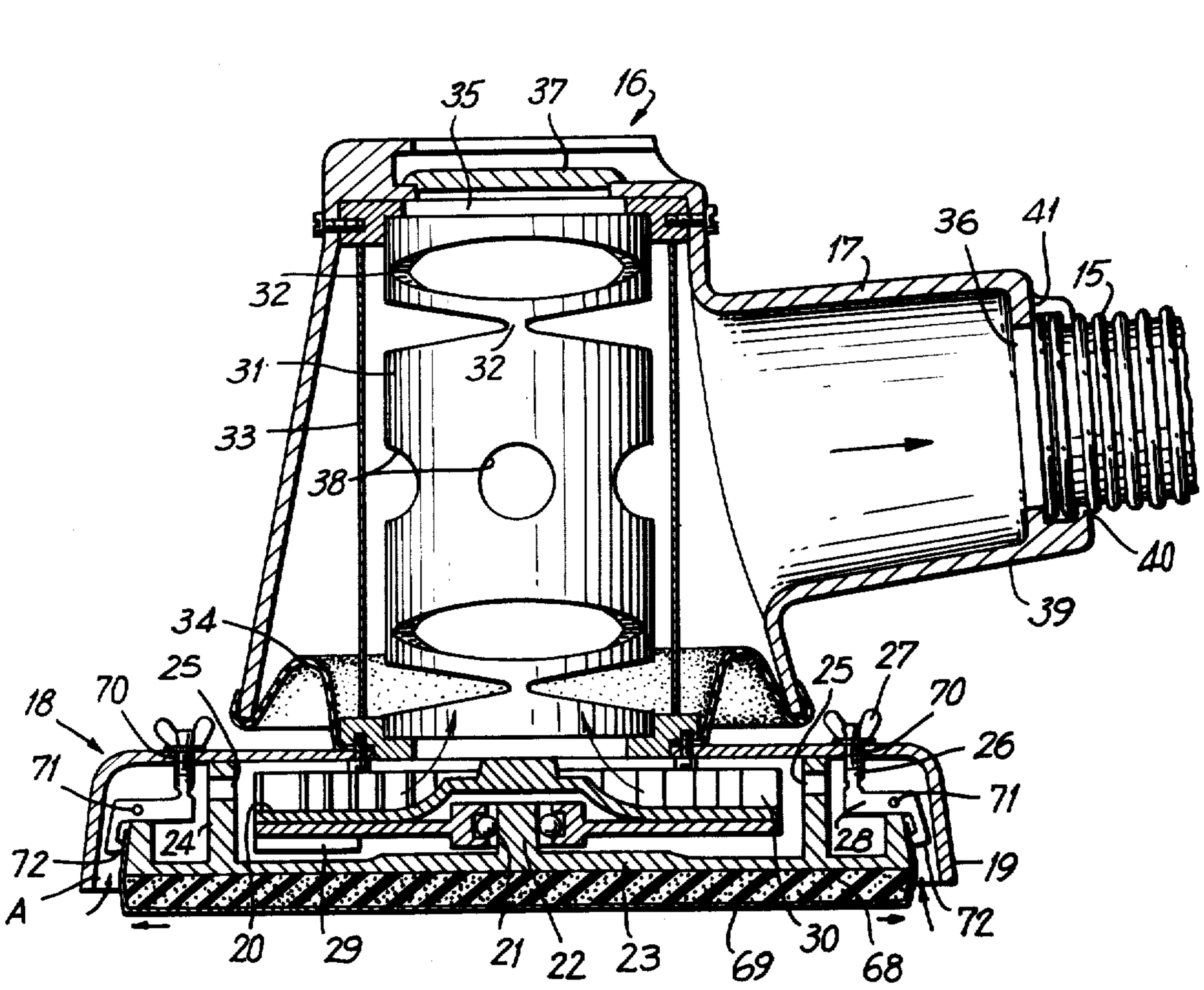

FIG. 1

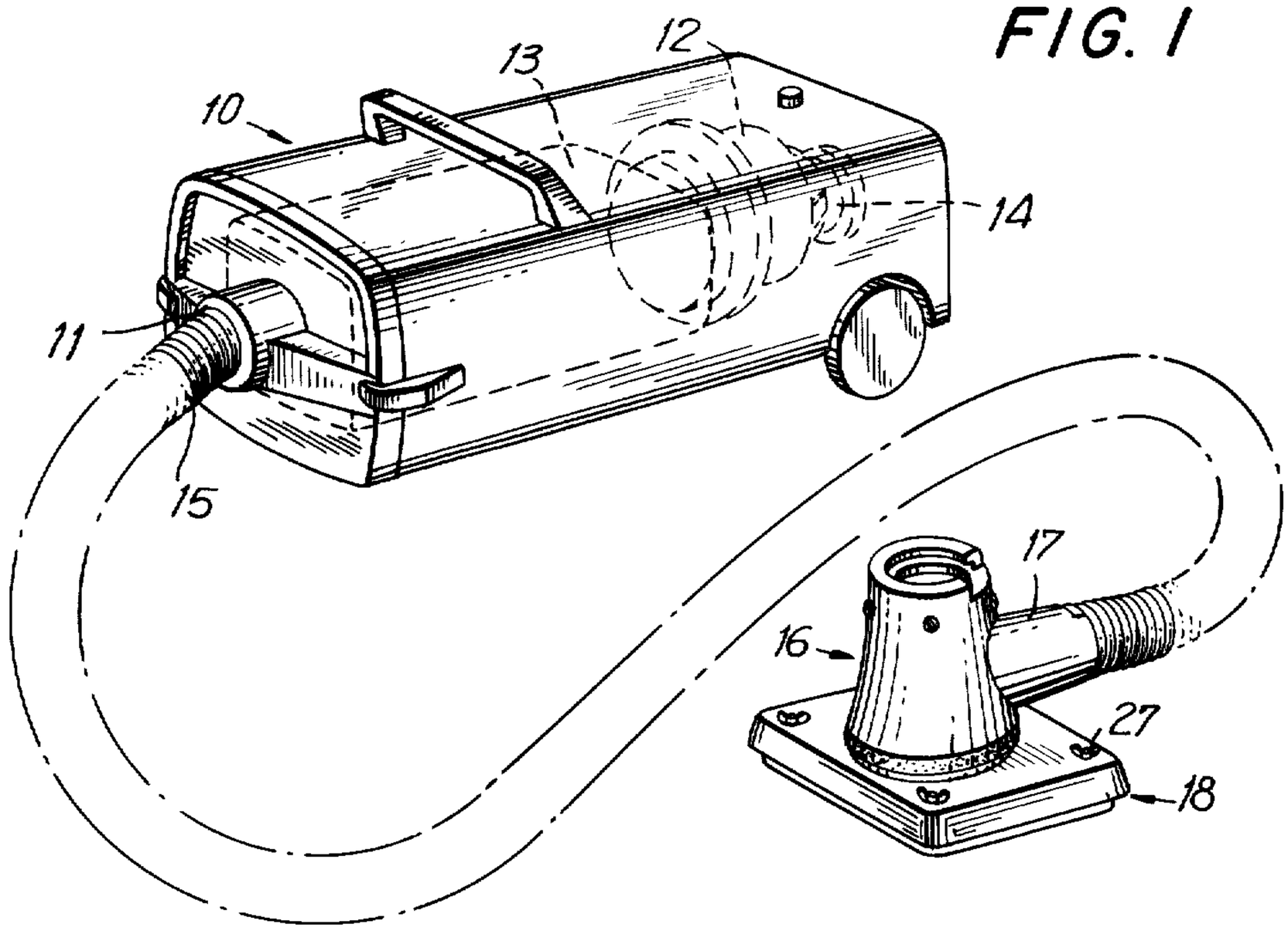
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FIG. 2

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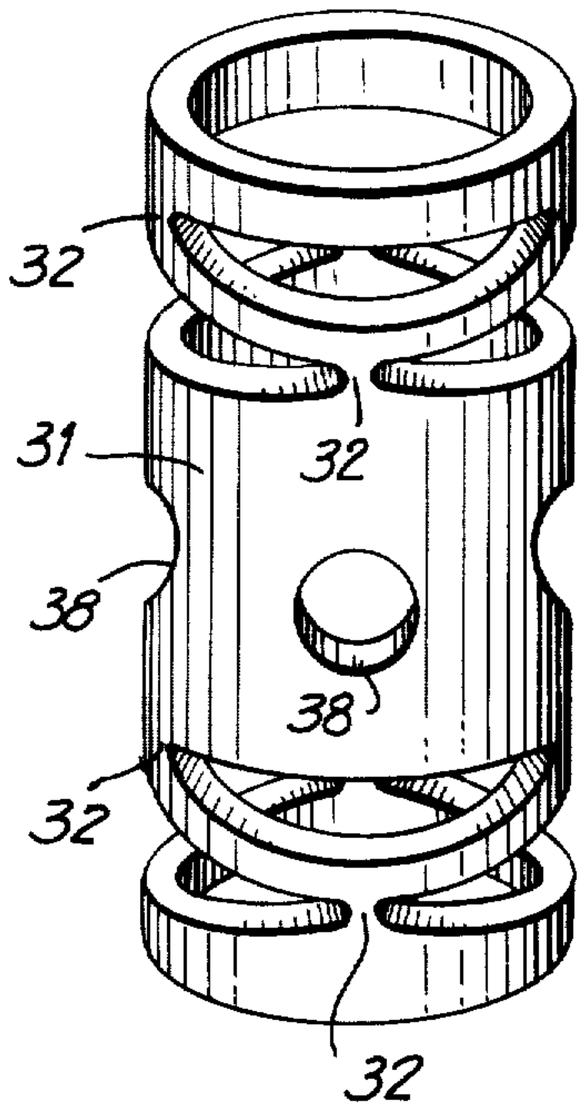


FIG. 3

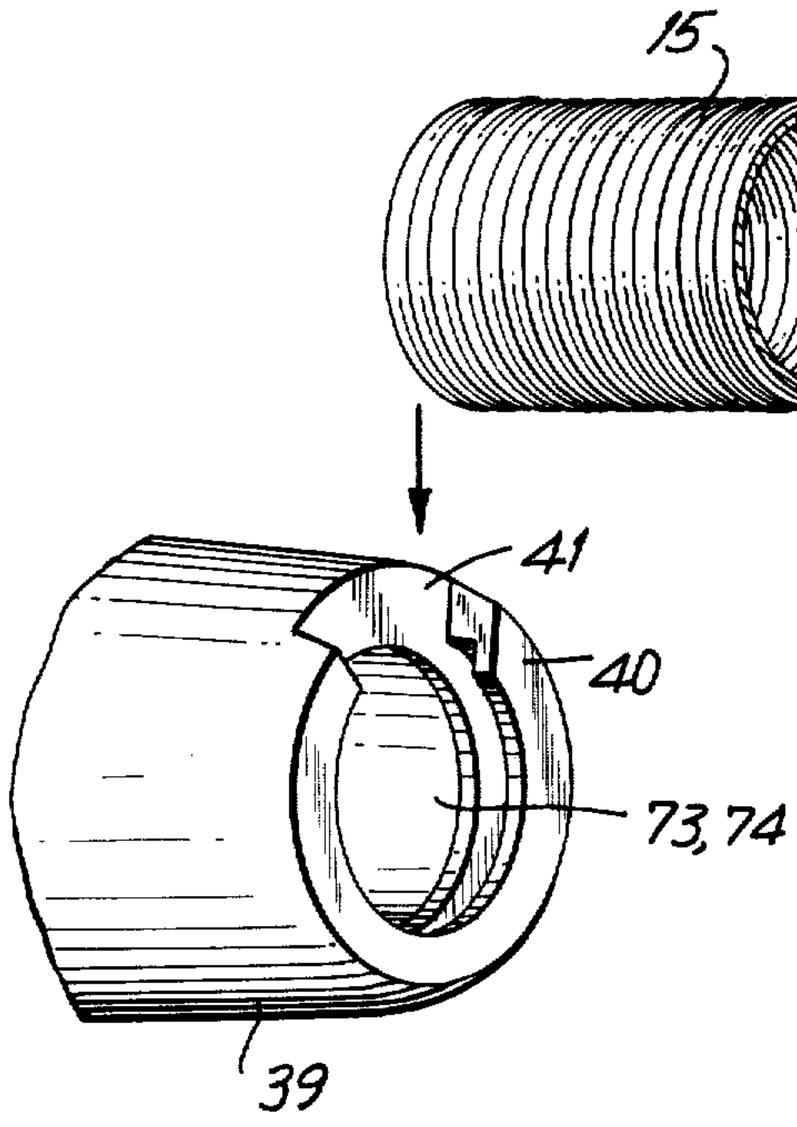


FIG. 4

FIG. 5

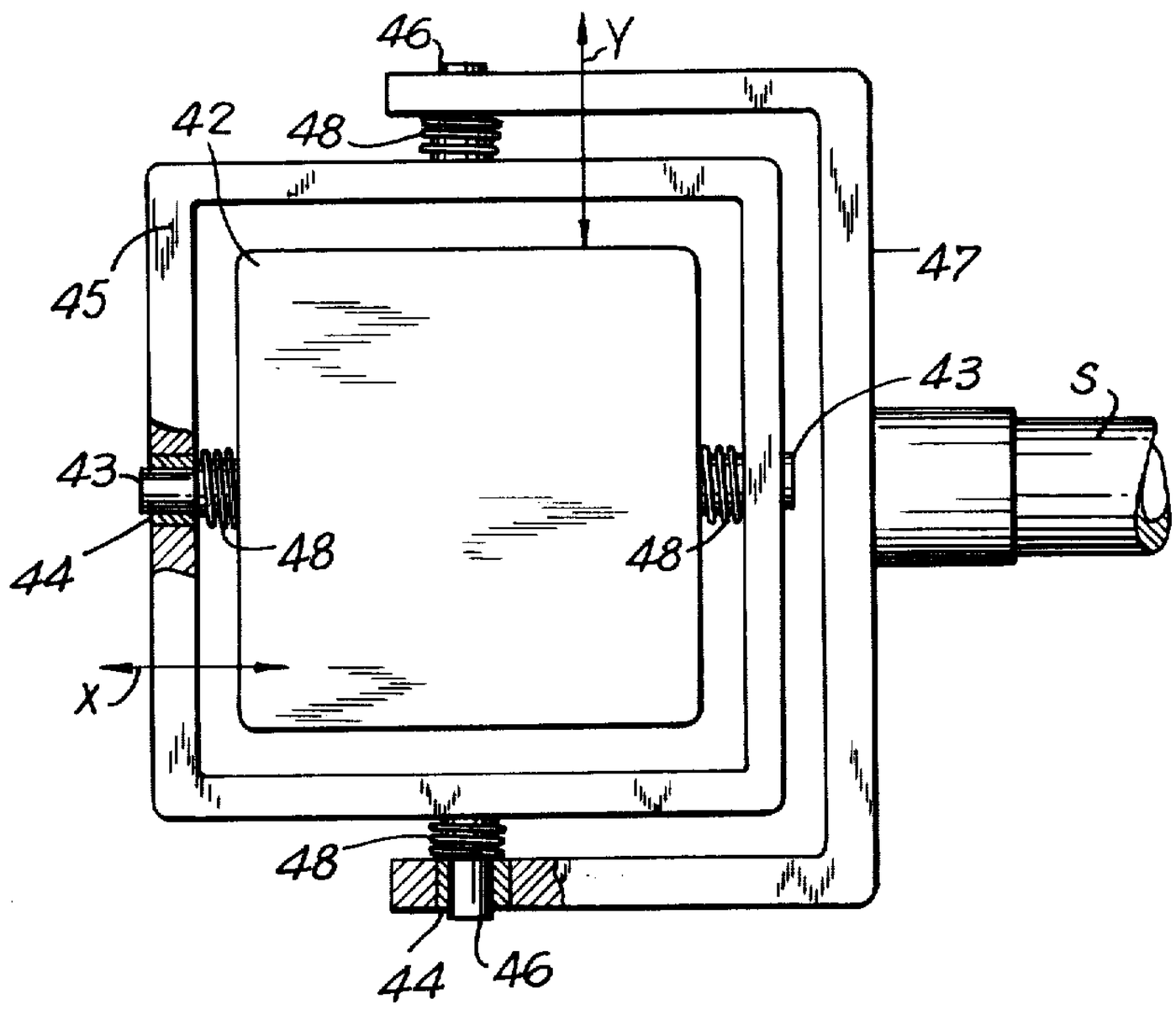


FIG. 6

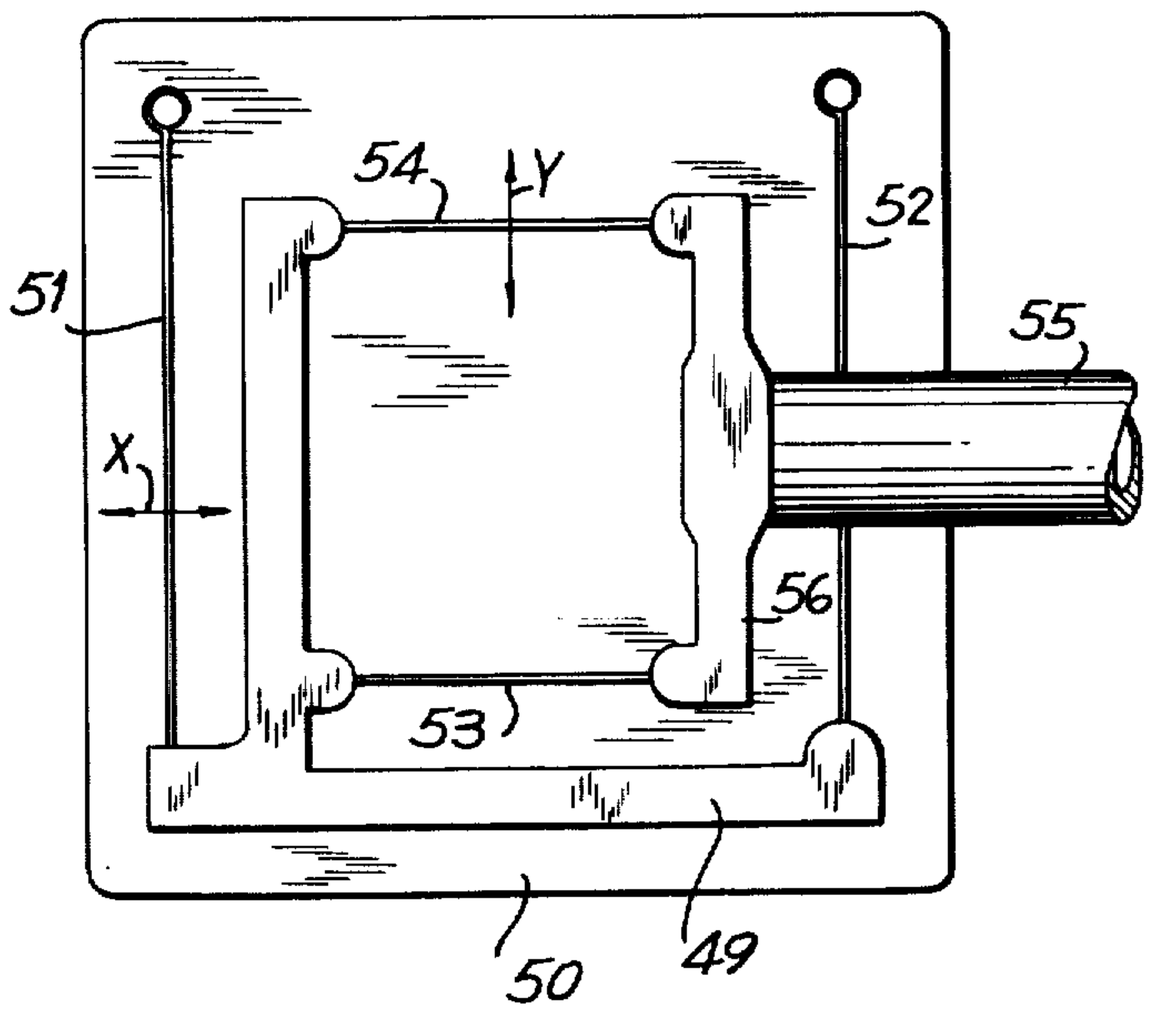
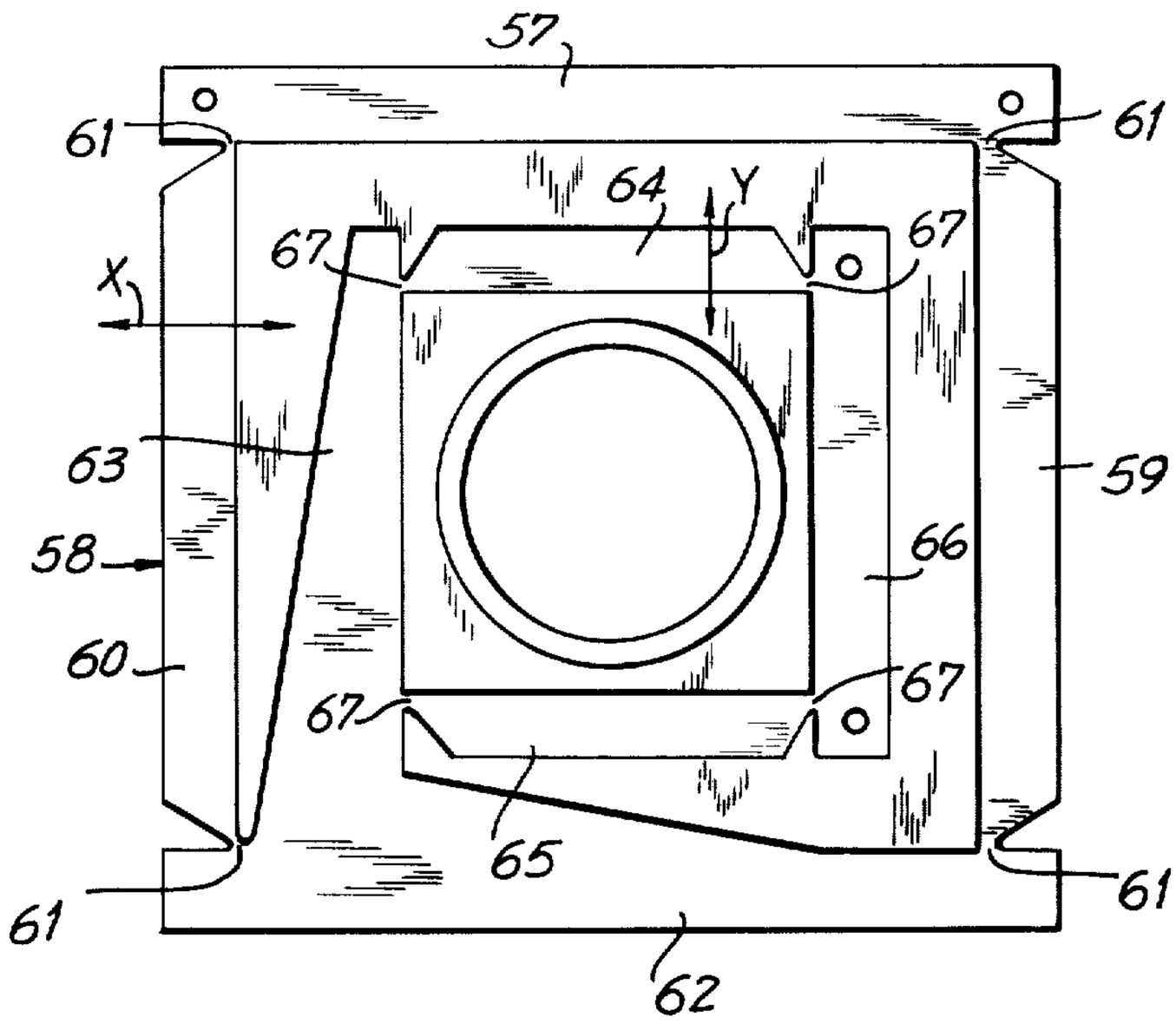


FIG. 7



SURFACE TREATING ATTACHMENT DEVICE

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

The present invention relates to a surface treating attachment device which is connected directly, or indirectly by a hose, to a source of at least a partial vacuum, such as a vacuum cleaner, and a fan wheel in the device which is directly in the path of air flow and is operable thereby.

BACKGROUND OF THE INVENTION

It is known to use a flowing gas, such as air, as a power transmitting medium to a surface treating device. The device may be connected to the suction opening of a vacuum cleaner in order to produce a sufficient air flow to operate the surface treating device.

When air is used as a power transmitting medium, the device has a decided advantage over mechanical drive structures in its great flexibility. Moreover, the risk of the motor being damaged in the case of an overload is much smaller than in the case of a direct electric motor drive. Furthermore, it should be noted that a variety of tools can be selectively connected to the output shaft of the rotating fan unit, such as replaceable grinding, rubbing, brushing, scrubbing, or polishing tools. It will also become apparent that the same flowing air which operates the rotating fan unit can be used to carry away the particles of grinding dust materials.

A number of serious disadvantages have arisen in the use of air-operated grinding apparatus of the above-described type. One disadvantage is that the known grinding apparatus, after a short period of use, becomes clogged due to the accumulation of grinding particles in the air flow channels. This is especially true in the air paths to the rotating fan unit of the surface grinder. When the fan unit becomes clogged, a time consuming disassembly and cleaning operation becomes necessary. A further disadvantage of the known grinding apparatus construction is that the results of using a rotating grinding or polishing attachment are not satisfactory since very often circular marks are left on the work surface which cannot be eradicated.

It is an object of the present invention to overcome the aforesaid disadvantages by providing a surface treating attachment device in which the clogging of the rotating fan unit is effectively prevented, and at the same time, a much better surface treatment of the work area is achieved.

It is another object of the present invention to provide a means on the blades of a rotating fan unit for converting the rotating motion of this unit to an oscillating motion.

Another object of the present invention is to provide flow paths to the rotating fan unit of the proper dimensions in order to eliminate the possibility of the clogging of the fan unit assembly by dust particles generated by the grinding operation.

A further object of the present invention is to provide a unique handle construction in order to prevent or to substantially reduce or cushion the vibrations from being carried from the grinding mechanism to the handle.

An object of the present invention is to provide a quick connect and disconnect coupling for a vacuum cleaner hose which positively maintains the required vacuum in the device.

Another object of the present invention is to provide alternate embodiments of the present invention in which the surface treating device has a low overall structural height so that it can be easily operated under low furniture and the like.

The invention will now be more fully described with reference to the accompanying drawings in which:

FIG. **1** is a perspective view of the surface treating device attached to a household vacuum cleaner and constructed in accordance with the teachings of the present invention;

FIG. **2** is a vertical cross-section on a larger scale showing the surface treating device in detail;

FIG. **3** is a perspective view of the energy absorbing coupling member that is positioned between the handle and the oscillating working member of the surface treating device;

FIG. **4** is a perspective view of the outlet connection of the surface treating device, and a section of the vacuum cleaner hose which is removably attachable thereto; and

FIGS. **5, 6** and **7** are diagrammatic illustrations of alternate embodiments of the energy absorbing coupling member which are specifically constructed to reduce the overall constructional height of the device.

PREFERRED EMBODIMENTS OF THE INVENTION

A vacuum cleaner of a known type is shown in FIG. **1** and is referred to generally by the number **10.** The vacuum cleaner has a suction opening **11** from which atmospheric air is drawn by a motor fan unit **12** through a dust collector **13.** The clean air coming from the outlet of the dust collector exits to the ambient through the exhaust opening **14** of the vacuum cleaner **10.**

The surface treating attachment device referred to generally by the numeral **16** is shown connected to the suction opening **11** of the vacuum cleaner **10** by means of a flexible hose **15.** However, it is within the scope of the present invention to provide a direct attachment of the present device to the suction opening of the vacuum cleaner. The surface treating attachment device **16** is connected to one end of the hose **15** by a handle shaped part **17** which is the upper portion of the device while the working member referred to generally by the numeral **18** engages the floor or other surfaces to be treated.

Referring now particularly to FIG. **2,** the working member **18** comprises a skirt **19** that is open on the bottom and encloses a rotatable fan wheel **20.** The latter is rotatably mounted on ball bearings **21** about a stub shaft **22** that is connected to the horizontally disposed base plate **23.** The base plate **23** is provided with an annular wall **24** which extends upwardly and surrounds the fan wheel **20** at a given distance therefrom and is provided with a plurality of air inlet openings **25.** A substantial annular gap A exists between the circumferential periphery of the base plate **23** and the adjacent interior surface of the skirt **19** whereby air flows through the gap and through the openings **25** to the vanes of the fan wheel **20.** It will be noted that the undersurface of the base plate **23** is provided with a layer of resilient material **68,** such as foam rubber.

Secured to the underside of the foam rubber is a sheet of grinding paper **69** for grinding treatment of the work surface. The base plate **23** is fastened to the skirt **19** by means of threaded bolts **26** passing through holes **70** in the skirt **19.** The bolts **26** are integral with the lever **28** which is pivoted at **71** on the base plate **23.** The free end **72** of the lever **28** engages the edge of the grinding paper **69** and holds it in firm contact with the periphery of the base plate **23** when the nuts **27** on the threaded bolts **26** are tightened. Thus, the grinding paper **69** is maintained in place on the base plate **23.**

A weight **29** is shown secured to a part of the underside of the rotatable fan wheel **20** adjacent to the periphery thereof. Because the weight **29** is positioned eccentrically on the fan wheel **20,** the center of gravity of the rotating fan wheel will be outside of its center of rotation. Thus, the constant air flow through the device causes the fan wheel **20** to operate, but because of its unbalance, the wheel makes an oscillating motion.

The present surface treating attachment device operates as follows: The vacuum cleaner **10** is turned on and the motor fan unit **12** becomes operative thereby drawing atmospheric air through the gap A between the skirt **19** and the base plate **23,** and then through the openings **25** in the wall of the base plate **23** to the vanes **30** of the rotatable fan wheel **20.** The dust laden air continues to flow through the handle-shaped part **17** and the flexible hose **15** to the suction inlet **11** of the vacuum cleaner **10.** Since the weight **29** is mounted eccentrically on the fan wheel **20,** the movement of the wheel due to an unbalance is changed to an oscillating movement. This motion is transmitted to the base plate **23** having the grinding paper **69** securely mounted thereon and consequently the base plate will oscillate over the work surface in a movement which is generally parallel thereto. The dust created by the grinding operation is drawn by the air under at least a partial vacuum through the rotating wheel **20** and air channels to the dust collector **13** of the vacuum cleaner **10.** Because of the vigorous vibration exerted on the entire working member **18** there is no risk of clogging of the air paths by dust particles. Consequently, the rotating fan wheel **20** is virtually self-cleaning.

Because of the rather considerable vibration created by the present construction, it is important to prevent the vibrations in the working member **18** from being carried to the handle of the device. The handle part **17** is therefore provided with a coupling member, as particularly seen in FIGS. **2** and **3,** which effectively absorbs the vibrations of the operative device yet permits excellent guidance of the working member. The coupling member, shown in detail in FIG. **3,** comprises a cylindrical tube **31,** the lower end of which is attached to the upper surface of the skirt **19** and the upper end is clamped under the upper part of the handle shaped part **17.** As seen in FIG. **3,** the tube **31** has four joints **32** disposed at opposite ends of the tube and arranged substantially at right angles to each other in pairs. It will be noted that each joint is formed by two diametrically opposed wall portions of the tube. Those parts of the wall which are between two wall portions of the tube form one and the same joint and are removed. The tube **31** is constituted of a resilient material, such as polypropylene, so that the joints will effectively absorb all radial forces caused by the vibrating working member which acts on the tube **31.** The tube construction maintains a satisfactory stiffness for the rotational movement around the longitudinal axis of the tube whereby

the precise guiding of the operative working member is ensured.

As seen in FIG. **2,** three rods **33** are shown within the handle part **17.** The rods **33** tend to maintain a constant distance between the undersurface of the handle part **17** and the upper surface of the skirt **19.** The space formed between the side walls of the handle part **17** and the mounting place of the tube **31** on the skirt **19** is connected and sealed by a diaphragm **34,** which also allows some relative movement between the working member **18** and the handle part **17.**

Referring to FIG. **2,** the handle part **17** has two openings **35** and **36** into either one of which the vacuum cleaner hose **15** can be connected. However, the opening which is not used is closed by a sealing plate **37.** In order to ensure the satisfactory flow of air in the hose connection adjacent to the opening **36,** the median part of the tube **31** is provided with a plurality of spaced holes **38.**

As seen in FIG. **4,** a tubular outlet connecting piece **39** is illustrated at one end of the handle part **17.** One end of hose **15** having annular segments is adapted for insertion in the openings **73** and **74** of the tubular piece **39.** The extreme end of the tubular piece **39** is in the form of an inwardly turned collar **40.** It will be noted that both the tubular piece **39** and the collar **40** are partly split open in order to permit the side insertion of one end of the hose **15,** as shown by the arrow in FIG. **4.** The hose **15** is slightly compressed upon insertion through the slot **41** and into the openings **73** and **74** of tubular piece **39.** When the hose is properly in place in the circular opening, the hose springs back to its natural circular form and the inwardly turned collar **40** engages the annular end segment of the hose **15** and securely locks the hose relative to the opening.

There are some occasions, when using the floor treating apparatus, that it is desirable to have a structure with a low overall height thereby making it possible to surface treat a floor under low furniture and the like. FIGS. **5, 6,** and **7** show diagrammatically various coupling arrangements which reduce all components to the same generally horizontal plane.

Referring to FIG. **5,** the working member which is similar to member **18** is designated by the reference numeral **42** and has on opposite sides two pins **43** supporting the member in holes **44** in a rectangular frame structure **45.** The frame **45** is in turn supported by pins **46** in a bracket **47** to which is connected an operating shaft S, not shown in detail. The through connecting line between the pins **46** is generally at right angles to the through connecting line between the pins **43.** Between the outer edge of the working member **42** and the inside of the frame **45** as well as between the outer edge of the frame **45** and the inside of the bracket **47,** resilient elements **48** are arranged, the first of which absorb the movement of the working member **42** in the direction designated by the arrow X and the other two absorb the remaining movement in the direction designated by the arrow Y. The desirable result of this construction is that the bracket **47** and hence also the operating shaft S will be cushioned from the vibrations of the working member **42.**

Another embodiment of the coupling arrangement is shown in FIG. **6,** in which a generally L-shaped bracket **49** is attached to the oscillating working member **50** by two elongated springs **51** and **52,** which absorb the movement in the direction designated by the arrow X. The remaining movement in the direction designated

by the arrow Y is absorbed by two elongated springs **53** and **54** each attached at one end to the bracket **49** so that the operating shaft **55,** which is connected to the other ends of the springs **53** and **54** by a bracket **56,** will be substantially without vibrations.

A further embodiment of the invention is shown in a top view of FIG. **7.** In this construction, the working member is assumed to be connected to a wall **57** of a frame structure **58** of elastic material, such as polypropylene. Walls **59** and **60** of the frame **58** which are adjacent to the wall **57** have thinned portions **61.** The walls **59** and **60** are joined by a wall **62** which by means of part **63** passes inwardly to form an inner frame structure with walls **64** and **65** as well as a wall **66,** which joins the walls **64** and **65** and is generally parallel to the part **63.** In addition, the walls **64** and **65** have thinned portions **67** at their connections to the part **63** and the wall **66,** respectively, which thinned portions together with the thinned portions **61** act as the resilient elements shown in FIGS. **5** and **6,** i.e., the portions **61** absorb the movement in the direction X and the portions **67** absorb the movement in the direction Y such that the wall **66** and an operating shaft connected to it, but not shown, will be free from vibrations in the same way as shown and described in the embodiments illustrated in FIGS. **5** and **6.** Also, in this embodiment the requirement for a low structural height is satisfied because all frame parts are situated generally in the same horizontal plane.

What is claimed is:

1. A surface treating attachment device adapted to be connected to a source of at least a partial vacuum comprising: an air flow channel extending from a location adjacent to the surface to be treated to said vacuum source, a rotatable fan wheel in said air flow channel, a handle-shaped part, said fan wheel having a weight placed outside the axis of rotation thereof whereby movement of the fan wheel by the air striking the vanes of the fan wheel generates an oscillating motion, a surface engaging working member operatively connected to said fan wheel whereby the oscillating motion generated by the fan wheel is transmitted to the working member which in turn oscillates in a plane that is generally parallel to the work surface, and energy absorbing means for operatively connecting said handle-shaped part to said working member which absorbs the movement of the working member in two directions that are generally perpendicular to each other.

2. A surface treating attachment device as claimed in claim **1** further comprising a skirt housing said fan wheel, a base plate for said working member and a dust collector in said vacuum source, said working member being secured to the underside of said base plate, and a plurality of passageways being provided in the base plate for conveying dust-laden air via the fan wheel to said dust collector.

3. A surface treating attachment device as claimed in claim **1** wherein said energy absorbing means are members which absorb in pairs the movement of the working member, said members being arranged substantially in the same horizontal plane.

4. A surface treating attachment device as claimed in claim **3** wherein said members are resilient elements positioned in two supporting locations between said working member and said handle-shaped part, the imaginary lines through the two supporting locations are substantially perpendicular to each other.

5. A surface treating attachment device as claimed in claim **4** wherein said resilient elements are metal springs.

6. A surface treating attachment device as claimed in claim **4** wherein said resilient elements are constituted of an elastic material.

7. A surface treating attachment device as claimed in claim **4** wherein said resilient elements are constituted of a plastic material.

8. A surface treating attachment device as claimed in claim **7** wherein said resilient plastic elements are constituted of polypropylene.

9. A surface treating attachment device as claimed in claim **1** further comprising a skirt housing said fan wheel, said skirt supporting said handle-shaped part, and said energy absorbing means including four joints arranged in pairs in different planes but substantially parallel to the work surface and operatively connecting said working member to said handle-shaped part, one joint of a pair being located at right angles to the other joint thereof, said joints co-acting to absorb radial forces caused by the oscillating working member but are of sufficient rigidity to precisely guide said working member.

10. A surface treating attachment device as claimed in claim **9** wherein said joints are formed by wall portions in a cylindrical tube, said wall portions being in pairs located diametrically opposite to each other.

11. A surface treating attachment device as claimed in claim **10** wherein said tube is constituted of an elastic material.

12. A surface treating attachment device as claimed in claim **11** wherein said tube is polypropylene.

13. A surface treating attachment device as claimed in claim **10** further comprising a spacing element positioned between the handle-shaped part and said skirt which maintains a constant distance therebetween.

14. A surface treating attachment device as claimed in claim **13** wherein said spacing element comprises at least three rods arranged about said tube.

15. A surface treating attachment device as claimed in claim **1** wherein said handle-shaped part is provided with a tubular piece having at its outer end a radially split inwardly turned collar, and a hose having one end adapted for insertion laterally through the slot formed by said radial split in the outer end of the tubular piece and engaged by the inwardly turned collar of the tubular piece.

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