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Adamson et al.

[11] **3,908,220**

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[54] **APPARATUS FOR SCRUBBING RUGS, FLOORS AND THE LIKE**

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Related U. S. Application Data

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[52] **U.S. Cl.** ..... **15/50 R**; 51/177

[51] **Int. Cl.**[2] **A47L 11/03**; A47L 11/162

[58] **Field of Search** ..... 15/28, 29, 49 R, 50 R, 15/98, 387; 64/1 R, 2 R; 51/170 T, 177

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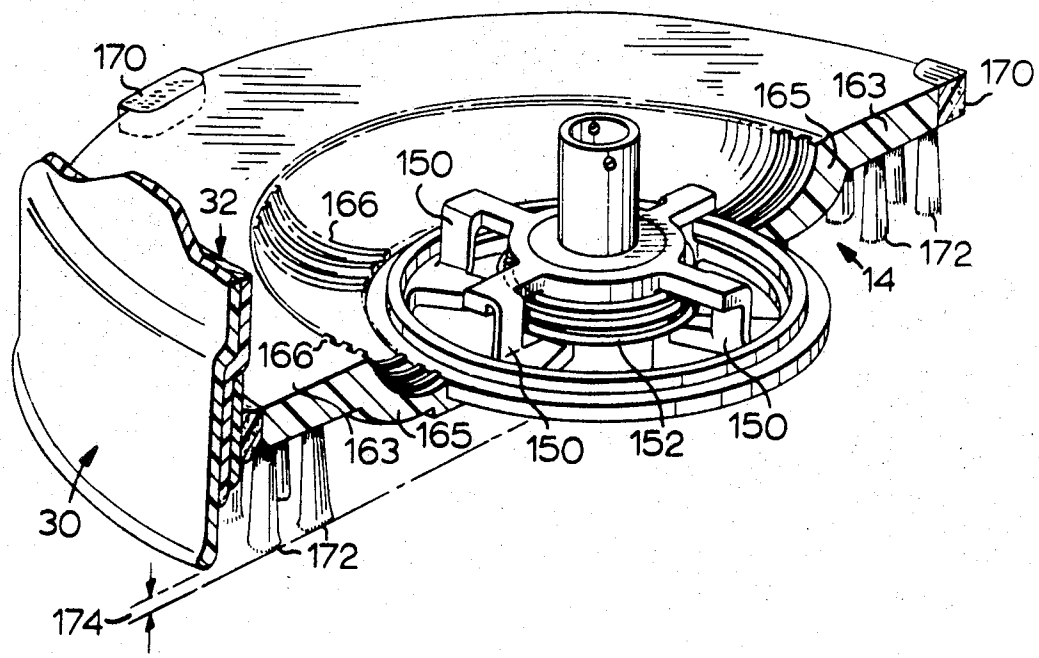
Primary Examiner—Edward L. Roberts

[57] **ABSTRACT**

The invention relates to a device for attachment to a domestic vacuum cleaner to clean floor coverings and the like. More particularly, the invention relates to a drive coupling for use in the device. The drive coupling consists essentially of an inner element connected to an outer element by straps and a spring positioned between the elements for biasing the elements apart and extending the straps. The drive coupling is positioned between an output from a turbine and a brush for transmitting torque from the turbine output to the brush. When the brush meets an increased resistance in cleaning the floor covering, the straps move from their normal axial position into an inclined position thereby elevating the brush and reducing the resistance to rotation for limiting the effects of the resistance on the turbine.

2 Claims, 6 Drawing Figures



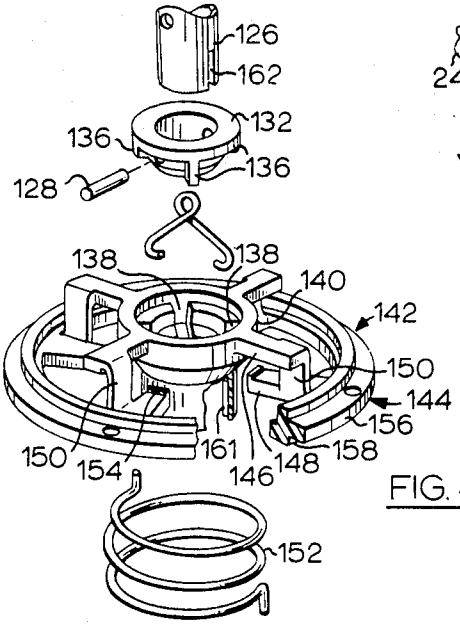


FIG. 4

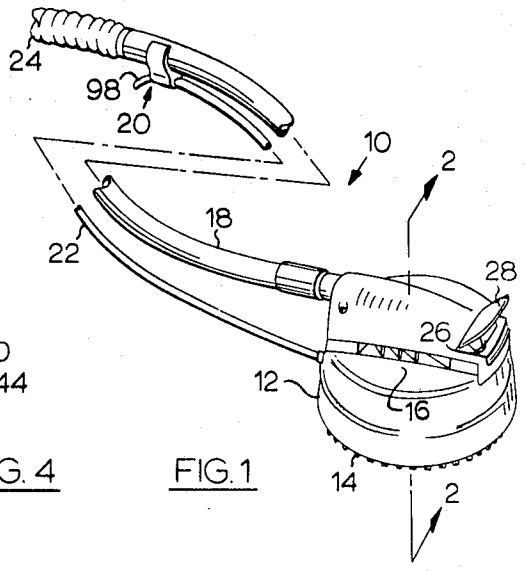


FIG. 1

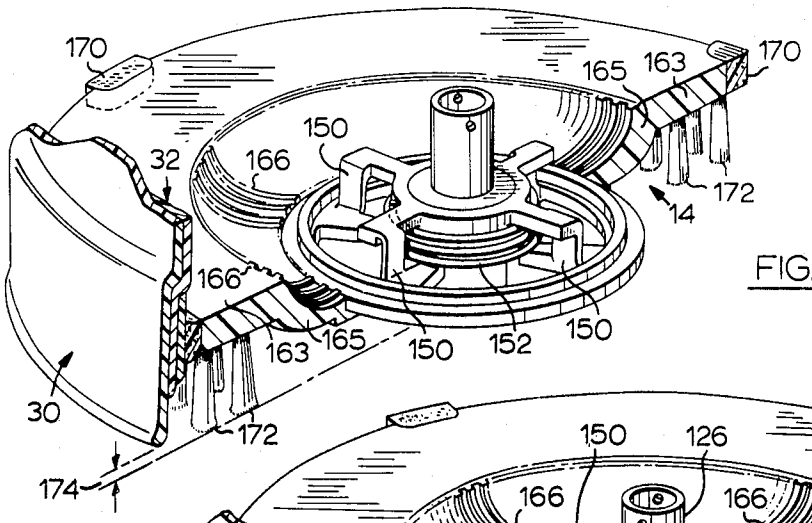


FIG. 5

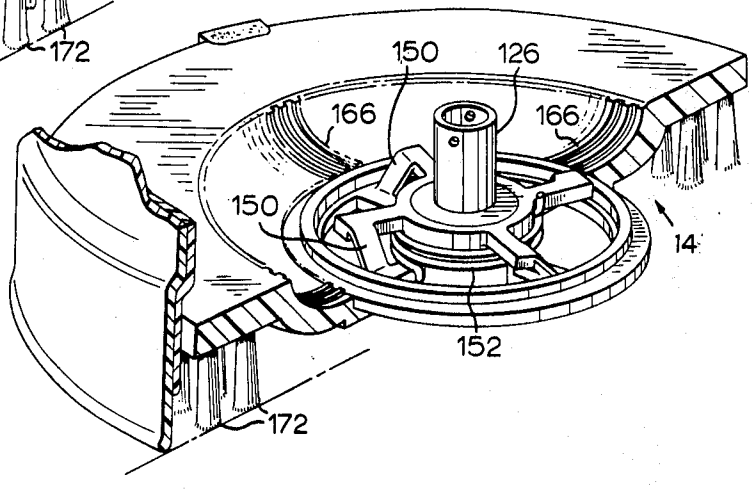


FIG. 6

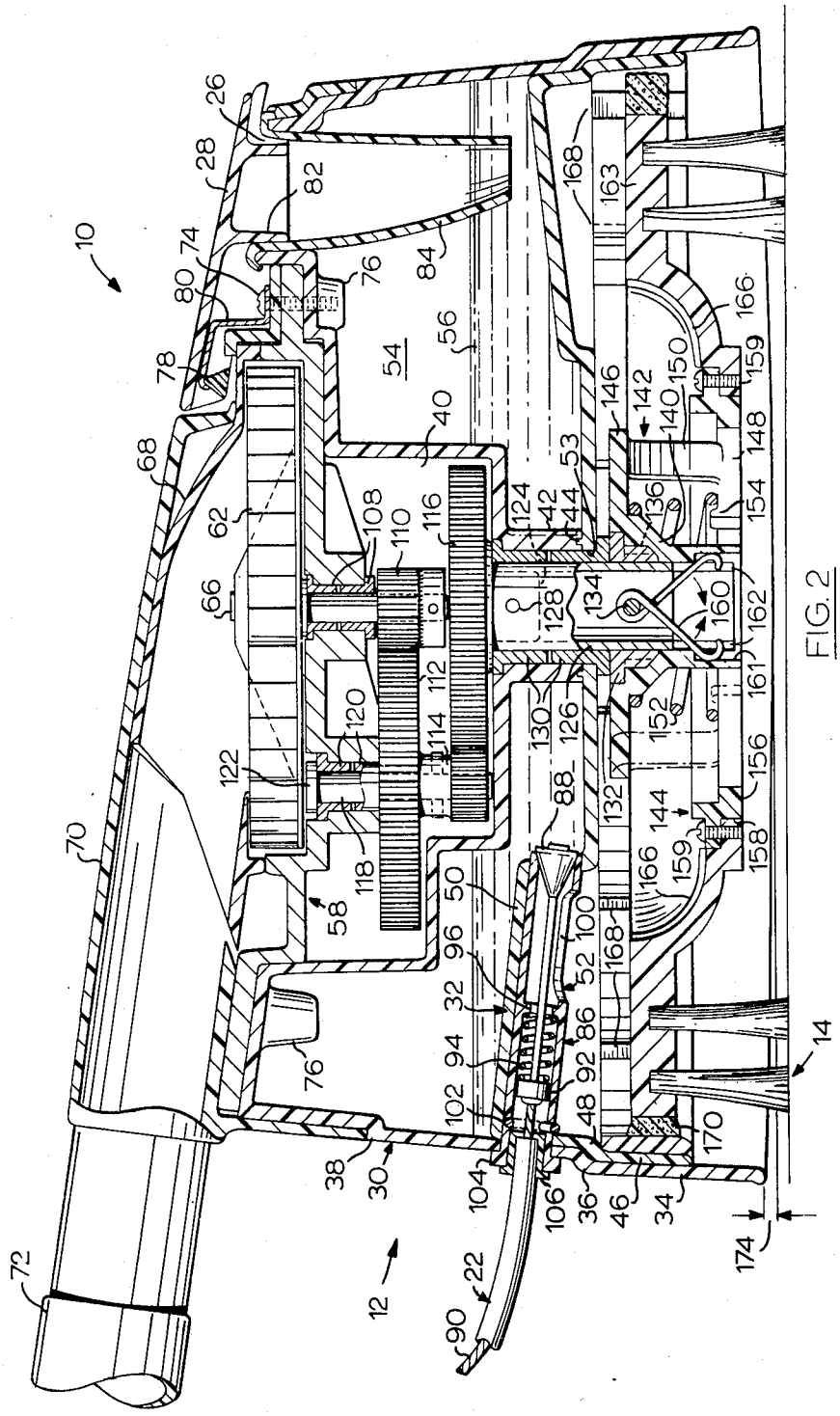

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FIG. 2

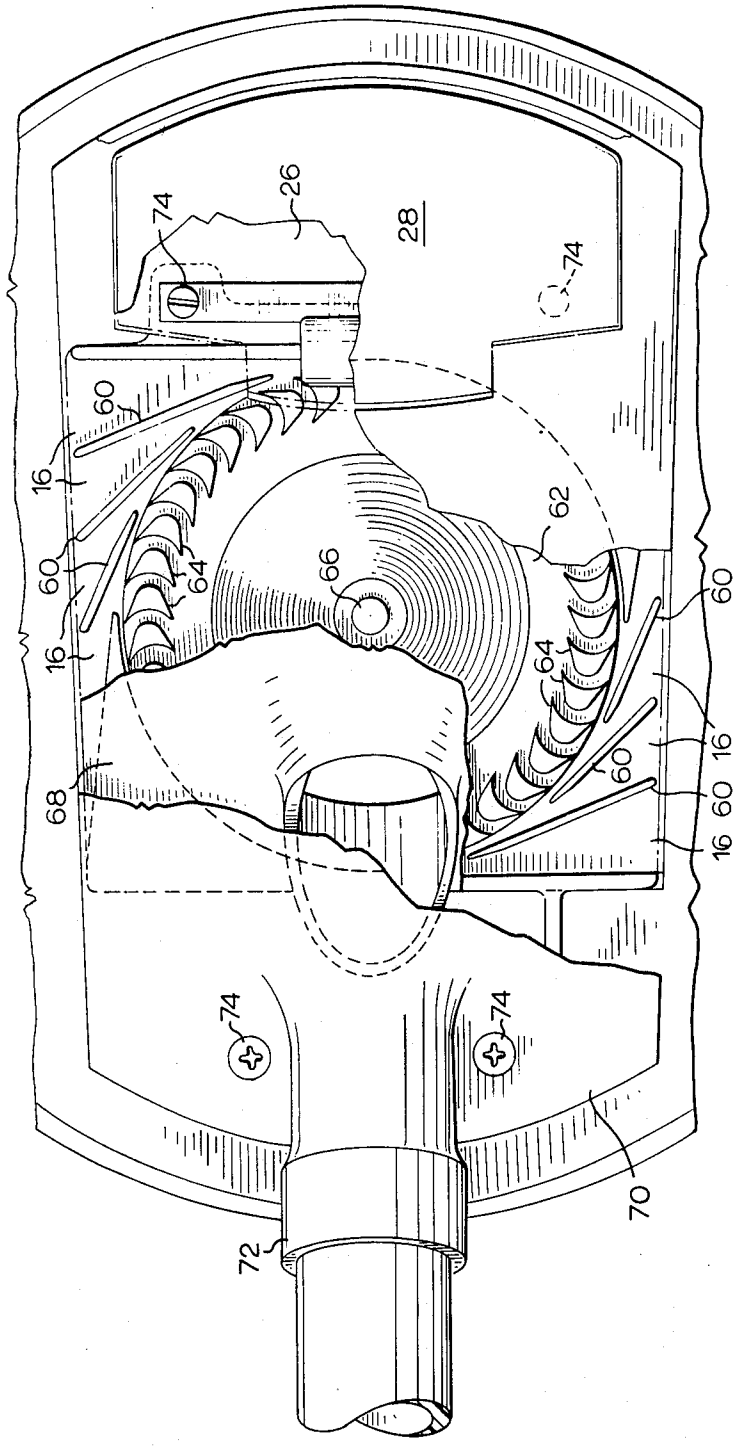

FIG. 3

APPARATUS FOR SCRUBBING RUGS, FLOORS AND THE LIKE

This application is a divisional of U.S. Patent Application No. 257,038, filed on May 25, 1972, Pat. No. 3,849,823.

This invention relates to a device for cleaning floor coverings and the like and more particularly to a drive coupling for use in the device, The device is preferably powered by air passing to a sub-atmospheric source such as a domestic vacuum cleaner.

In cleaning carpets it is essential that only sufficient cleaning fluid is used to clean the carpet so that the carpet is not subjected to excessive moisture. Applicators for applying the fluid are available and consist essentially of a reservoir containing the fluid and a pad through which the soap solution passes for spreading over the carpet. The user moves the applicator to and fro over the carpet at a substantially constant speed thereby gradually applying the solution to the whole carpet. Although such devices achieve a measure of success, they do not scrub the carpet and consequently are of limited use where the carpet has been marked or has localized dirty areas.

Attempts have been made to produce domestic devices which clean carpets by a scrubbing action and which are powered by a domestic vacuum cleaner. Each of these devices consists essentially of a turbine driven by air which is being sucked into a vacuum cleaner, and a brush driven about a vertical axis by the turbine. A drive coupling is positioned between the brush and the turbine and this coupling includes a means for permitting the brush to move axially. The brush is contained in a downwardly-opening skirt so that when the brush meets a high resistance to turning, the brush moves vertically into the skirt thereby bringing the skirt into contact with the carpet and reducing the resistance to avoid stalling of the turbine.

In prior art devices, the vertical brush movement has been achieved by the use of various mechanical parts which slide one over the other to permit the vertical movement. This mechanical sliding action creates frictional problems and in use, tends to become clogged with soap solution and dirt from the carpet or other floor coverings which have been cleaned. Consequently, the essential vertical movement is hampered and stalling of the turbine tends to result.

In one of its aspects, the present invention provides a drive coupling for use in a floor cleaning device of the type including a drive means, and a brush driven by the drive means and positioned within a skirt such that soap solution can be dispensed from within a reservoir above the skirt for use on the brush to clean a floor covering such as a carpet. The drive coupling comprises: an inner element including means for fixedly connecting the inner element to the drive means; an outer element adapted to be fixedly coupled to the brush with the inner and outer elements disposed about a vertical axis and spaced axially; straps extending generally axially and attached at respective first ends thereof to the inner element and at respective other ends thereof to the outer element; and spring means biasing the outer element axially away from the inner element to cause the brush bristles to project beyond the skirt such that in use when the brush encounters a relatively high resistance to rotation, the straps move towards the horizontal position and the spring is stressed resulting in an upward movement of the brush so that the skirt contacts the floor covering whereby the brush resistance is reduced and brush stalling is substantially obviated.

In another of its aspects the present invention provides a device for washing floor coverings such as carpet and the like. The device includes a housing defining a downwardly-opening skirt and a reservoir above the skirt for containing cleaning fluid such as soap solution. Below the reservoir a brush is mounted within the skirt for rotation about a vertical axis and a turbine is coupled by a drive coupling to the brush so that upon connection of the device to a sub-atmospheric source such as a domestic vacuum cleaner, the turbine rotates thereby driving the brush. The drive coupling includes generally upright straps operably coupled at respective first ends thereof to the turbine and at respective other ends thereof to the brush to provide upward movement of the brush within the skirt when the brush meets an increased resistance to rotation during use in cleaning the floor covering.

These and other aspects of the invention will be better understood with reference to the drawings, in which:

FIG. **1** is a perspective view of a device according to the invention;

FIG. **2** is a sectional side view on line **2—2** of FIG. **1**;

FIG. **3** is a top view of the device with parts broken away to show internal elements of the device;

FIG. **4** is an exploded perspective view of a coupling forming a part of the device;

FIG. **5** is a perspective view of a part of the device showing the coupling in position for driving a brush with the brush in a lowered position; and

FIG. **6** is a view similar to FIG. **5** showing the brush in a raised position.

Reference is first made to FIG. **1** which shows the device indicated generally by the numeral **10.** The device consists of a main housing **12** containing a brush **14** driven by a turbine which receives air inspired through directional inlets **16** by a sub-atmospheric source applied through a wand **18.** A hand control **20** is connected by a cable **22** to the housing **12** and attached to the wand for controlling the flow of soap solution to the brush **14** as will be explained. An end of the wand **18** is attached to a flexible connection **24** which preferably connects the wand pneumatically to a conventional vacuum cleaner. Access is provided through an opening **26** for pouring soap solution or the like into the device, and a spring-loaded lid **28** is operable to close the opening when the device is in use.

Reference is now made to FIG. **2** to describe the internal construction of the device **10** in more detail. The main housing **12** consists essentially of first and second moldings **30, 32** of a suitable plastic material. The molding **30** begins at its lower end in a generally cylindrical skirt **34,** defines an annular shoulder **36** and then continues upwardly to define a further shoulder **38.** The top of the molding **30** defines a gear cavity **40** and terminates in a downwardly-extending cylindrical portion **42** which is co-axial with skirt **34.** Portion **42** defines at its lower end a downwardly-opening annular recess for receiving an upstanding rib **44** formed on the second molding **32.**

Second molding **32** includes a generally cylindrical lower portion **46** adapted to engage snugly within skirt **34** and terminating in a shoulder **48** located against an inner side of the shoulder **36** in molding **30.** The molding **32** defines a valve housing **50** in which a valve as-

sembly **52** is contained as will be described, and a central opening **53** in alignment with the bore of cylindrical portion **42.**

The first and second moldings **30, 32** are bonded or welded together to define a water-tight reservoir **54** above the second molding **32** for containing soap solution **56** and the like.

Continuing with the description of the structural parts of the device, the top of the first molding **30** carries a turbine support **58** which covers the gear cavity **40** and, as better seen in FIG. **3,** defines the air inlets **16** previously mentioned with reference to FIG. **1.** The inlets **16** are separated by upright vanes **60** positioned to guide incoming air onto a turbine **62** having complementary blades **64** designed to convert the momentum of air entering inlets **16** into a torque applied at turbine shaft **66.**

As seen in FIGS. **2** and **3,** a vacuum chamber **68** is positioned over the turbine **62** for co-operating with the vanes of the turbine support **58** to guide air leaving the turbine blades **64** towards wand **18** (FIG. **1**). To this end, a shroud **70** contains the vacuum chamber **68** and guides air from the vacuum chamber to an integral coupling element **72** in which the wand **18** is received.

The turbine support **58,** is preferably of a suitable material in order to act as a heat sink. The vacuum chamber **68,** and shroud **70** are preferably of a suitable plastic material. Shroud **70,** and turbine support **58** are located positively by four screws **74** (better seen in FIG. **3**) which engage in corresponding bosses **76** (FIG. **2**) formed integrally in the underside of the top of the first molding **30.**

As previously mentioned with reference to FIG. **1,** access for soap solution is provided through an opening **26,** and a lid **28** is spring-loaded to cover the opening **26** when the device is in use. As seen in FIG. **2,** the lid **28** is connected to a pivot pin **78** which in turning rides on a spring **80** so that the lid is positively located either in a closed position as shown in FIG. **2** or in an open position as shown in FIG. **1.** The spring **80** is conveniently held in place by adjacent screws **74.**

Lid **28** has a downwardly-extending skirt **82** engaged in a spout **84** defining the opening **26.** The spout is preferably of a suitable plastic material and is sealed in place in a mating opening formed in the top of first molding **30.** The purpose of the spout is two-fold. Firstly, in the event that the device is turned over accidentally, there will be a minimum of spillage because the soap solution will move to the top of the reservoir and leave the lower end of the spout projecting out of the solution. Secondly, the spout limits the possibility that the soap solution will splash upwardly out of the reservoir when the device is in use.

Valve assembly **52** is sealed in the valve housing **50** for releasing the soap solution from the reservoir **54.** The valve assembly consists essentially of a generally cylindrical main portion **86** which is sealed in corresponding openings formed in the first and second moldings **30, 32** such that an inner end of the portion **86** projects into reservoir **54.** The inner end of the portion **86** is sealed by a conical valve head **88** attached to an inner end of the core **90** of cable **22.** A collar **92** is also attached to the core **90** and spaced from the valve **88** with a coil spring **94** positioned between the collar **92** and an inwardly projecting annular flange **96** formed on the main portion **86.** The spring is in compression so that the valve head **88** is biased into sealing engagement with the inner end of the main portion **86.**

Reference is next made to FIGS. **1** and **2.** The manual control **20** includes a trigger **98** operable to compress the spring **94** by moving the core **90** further into the reservoir **54** and thereby moving the valve head **88** off the main portion **86** to permit soap solution **56** to enter into the main portion **86.** A downwardly opening port **100** in the main portion **86** permits the soap solution to flow downwardly for co-operating with the brush **14** to wash a carpet or the like.

The valve assembly **52** is fused, or welded in place in the first and second moldings **30** and **32** when a collar **104** at the outward extremity of the main portion **86** is in engagement with the outer surface of the first molding **30** and the inner end of portion **86** is located in a hole in the valve housing **50** and projects into the reservoir **54.**

The valve assembly **52** is completed by a suitable ring **102** which serves to engage a collar **106** which is fastened to the cable sheath **22.** The ring **102** has a spring action which firmly holds the collar **106** and attached cable assembly in place and allows for the removal of the cable assembly.

Reference is now made to FIG. **2** to describe the drive between the turbine **62** and the brush **14.** Beginning at the turbine, the turbine shaft **66** passes through journal bearings **108** positioned in the turbine support **58** in alignment with a vertical axis of the brush **14.** Driving torque passes from the turbine shaft **66** by way of pairs of reduction gears **110, 112,** and **114, 116.** The gears **112** and **114** are formed from a common gear blank and attached to a spindle **118** rotatably mounted in journal bearings **120** set in the turbine support **58.** The spindle **118** includes a thrust collar **122** at its upper end to positively locate the gears **112, 114** vertically. Bearings **108, 120** are preferably of a sintered metal capable of absorbing oil. These bearings are commonly referred to as "self-lubricating" bearings.

Gear **116** includes a boss **124** engaged in a tubular output shaft **126** and is locked in place by a pin **128.** Output shaft **126** rotates in journal bearings **130** set in the cylindrical portion **42** of the first molding **30** and in the aligned opening **53** in the second molding **32.** The shaft **126** is located against a downward movement by the gear **116** and against upward movement by a thrust collar **132** attached by a pin **134** to the output shaft **126.**

The parts thus far described with reference to driving the brush are not normally removable from the device unless a major repair is to be made. However, it will be appreciated that the brush is preferably removable for replacement by a different type or by a new brush when an old brush is worn.

The arrangement of the brush and the drive from the drive shaft **126** to the brush will now be described with reference primarily to FIGS. **2** and **4.** Collar **132** includes four radial ribs **136** which engage in radial slots **138** formed in an inner element or central boss **140** of a drive coupling **142.** This coupling transmits torque from the drive shaft **126** to the brush **14** as will be described. The arrangement of ribs **136** on collar **132** and slots **138** in central boss **140** is such that drive is transmitted from shaft **126** by way of collar **132** to the drive coupling **142.**

As best seen in FIG. **4,** drive coupling **142** consists of the boss **140** and an outer element or ring **144** which

include four pairs of respective radial inner and outer fingers **146, 148,** and four integral straps **150** each of which interconnects a corresponding pair of inner and outer fingers. The drive coupling **142** is preferably molded from a suitable plastic material which is both flexible and sufficiently strong to transmit the required torque to the brush. A coil spring **152** is positioned under radial fingers **146** and above radial fingers **148** so that the spring biases the fingers apart and extends the straps **150** into generally upright positions. The fingers **148** project inwardly beyond straps **150** and terminate in upwardly extending lips **154** for locating a lower end of the spring **152.**

The outer ring **144** of the drive coupling **142** defines an outwardly-projecting radial flange **156** below which a generally cylindrical wall **158** projects. As seen in FIG. **2,** the wall **158** and flange **156** combine to locate a mating part of brush **14.** Screws **159** pass through the flange **156** and are threadably engaged in the brush to retain the brush in place on the outer ring **144.** As a result the brush moves with the ring.

Referring again to FIGS. **2** and **4,** the drive coupling **142** is adapted to slidably engage on the output shaft **126** and locate on the collar **132** for transmitting drive from the shaft **126** as previously described. On engaging the coupling over the shaft **126,** the boss **140** deflects rounded ends of a retaining spring **160** radially inwards until a major part of the boss has passed over the spring and the spring is then free to move outwardly into a suitable recess **161** formed in the boss for receiving the spring ends. The spring is held in place in the shaft **126** by the pin **134** and is located in the shaft in two axial slots **162** extending outwardly from a lower end of the shaft. The spring is sufficiently strong to retain the coupling and brush in place when the device is lifted from a supporting surface, but is sufficiently resilient to permit the coupling to be removed by pulling it off the shaft **126.** The operation of the drive coupling will be described after further description of the brush.

As seen in FIGS. **2** and **5,** the brush **14** includes a radial upper portion **163** and an upwardly curved portion **165** which terminates at the inner extremity of the portion **163.** The portion **165** includes generally radial raised ribs **166** for dispersing soap solution falling from valve assembly port **100** (FIG. **2**). The soap solution moves upwardly under the influence of centrifugal force and is frothed to some extent by its movement over the ribs **166.** The soap solution then moves outwardly over the upper portion **163** under the influence of centigugal force before landing on an inner surface of the second molding **32** at the lower portion **46.** This inner surface is formed with circumferentially extending tapers and steps as shown in FIG. **2.** The steps are indicated by numeral **168** and the tapers extend between these steps such that sponges **170** attached to the upper portion **163** are compressed gradually as they pass over the tapered portions and then allowed to expand once they pass each step. Consequently, in proceeding through one revolution, each of the sponges is alternately comprised and expanded in passing over the tapered portions and steps **168.**

Because the soap solution is thrown outwardly onto the tapered portions, the sponges contact the soap solution as it falls downwardly under gravitational influences, and because of the continuous compression and decompression of the sponges, there is a tendency for the sponges to alternately pick up soap solution and squeeze it out causing the soap solution to froth and foam. This is a desirable requirement in a device of this type in order to disperse the soap solution and also to create a foam which the user can see in applying soap solution to a floor covering such a carpet.

As the soap solution leaves the sponges and falls downwardly, it is picked up by bristles **172** set conventionally in the underside of the upper portion **163** of the brush.

In use, it will be evident that the brush should be in contact with the surface being cleaned. However, in the event that the friction between the brush and the surface reaches a point at which the turbine would stall, it is necessary that the brush move upwardly out of engagement with surface sufficient to free the brush and ensure continuous rotation of the brush. This is achieved by the drive coupling **142** in combination with the lower extremity of skirt **34.** The bottom of skirt **34** is shaped as shown in FIG. **2** so that with the axis of drive shaft **126** vertical, and the device on a horizontal surface, the skirt is in contact with the surface only at two points diametrically opposite and at the centre of FIG. **2.** The bottom of the skirt tapers away from these points to define a small angle indicated at **174** to both sides of the skirt. Accordingly, the device can be rocked on the supporting surface through an angle of twice the angle indicated at **174.** This rocking action combined with the action of the drive coupling (to be described) limits the possibility of the device becoming lodged against projections on floor coverings and the like and also aids in preventing stalling of the turbine.

The action of the drive turbine **142** is illustrated in FIGS. **5** and b. In FIG. **5** the brush is at its lowest extremity in which position the straps **150** are fully extended in a generally axial or upright position. As previously described, spring **152** causes this downward displacement and upward alignment of the straps. Upon standing the device on a supporting surface, the weight of the device is transmitted to the spring **152** by the bristles **170** and associated parts of the brush **14.** Consequently, the spring is compressed to some extent and the straps move towards an inclined position shown in FIG. **6.** As the straps become inclined, there is a relative rotational movement between the brush and the output shaft **126.**

Once the device is started, the bristles **172** will pass over the surface being cleaned driven by the straps **150.** In the event that the bristles engage an obstacle which tends to stop rotation of the brush, there is an increased tension in the straps **150** resulting in the straps tending to become horizontal. As a result, the brush is moved upwardly sufficient to either disengage itself from the projection or to bring the skirt **30** into solid engagement with the supporting surface. The brush is then no longer supporting the device so that friction between the brush and the projection is reduced and the brush then frees itself of the projection and continues to rotate. Once the device has passed over the projection, the spring **152** will force the brush downwardly so that the brush is again substantially supporting the device on the surface.

It has been found that the following materials are suitable for making the major components. The turbine and gears are of DELRIN a trade mark for a polyoxymethylene and the parts forming the main housing **12** are of acrylonitrite butadiene stynene although, as previously described, the turbine support is of a suitable

metal. The brush and drive coupling of polypropylene and the bristles are of **0.009** inches diameter nylon.

What we claim is:

1. A drive coupling for use in a floor cleaning device of the type having a drive means and a brush driven by the drive means within a skirt such that soap solutions can be dispensed from a reservoir above the skirt to be used on the brush for cleaning a floor covering, the drive coupling comprising:

an inner element adapted to be operably coupled to the drive means;

an outer element adapted to be coupled to the brush with the inner and outer elements disposed about an axis and spaced axially;

straps extending generally axially and attached at respective first ends thereof to the inner element and at respective other ends thereof to the second element; and

spring means biasing the outer element axially away from the inner element so that in use the brush bristles project beyond the skirt such that when the brush encounters a relatively high resistance to rotation, the straps move towards a horizontal position, the spring means is further stressed, and the brush moves upwardly so that the skirt contacts the floor covering and the brush resistance is reduced whereby brush stalling is substantially obviated.

2. A drive coupling as claimed in claim **1** in which the drive coupling inner and outer elements include respective inner and outer fingers, the inner fingers extending radially outwards and the outer fingers extending radially inwards and in which each of the straps is integrally connected at respective said upper and lower ends to corresponding inner and outer fingers, and in which the spring means comprises a coil spring in compression and located between the inner and outer fingers.

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