Feb. 27, 1962 S. BONFANTI 3,022,529

ROTARY FLOOR POLISHER

Filed Sept. 2, 1959 2 Sheets-Sheet 1

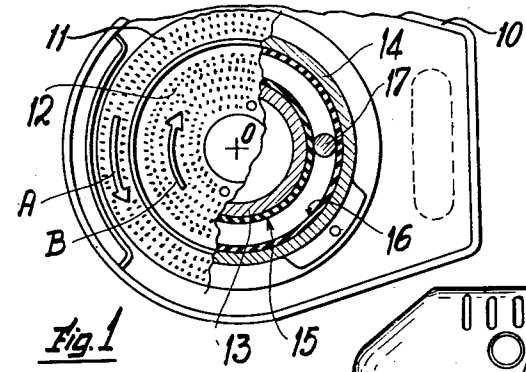

Fig. 1

Fig. 2

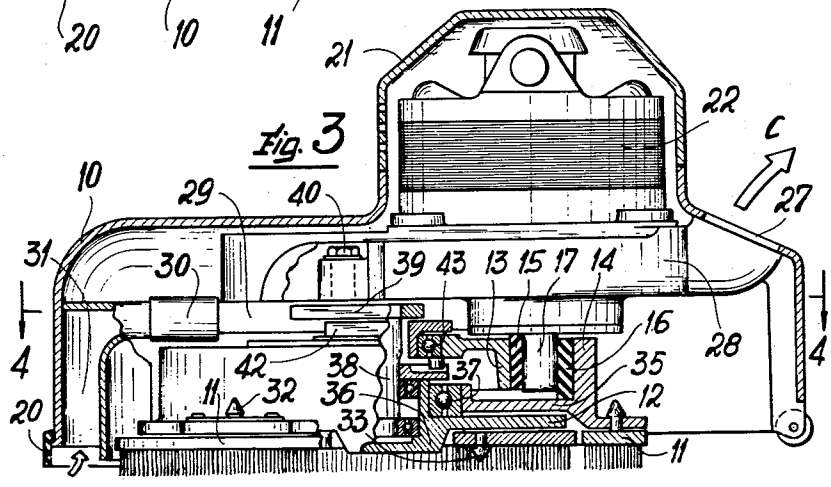

Fig. 3

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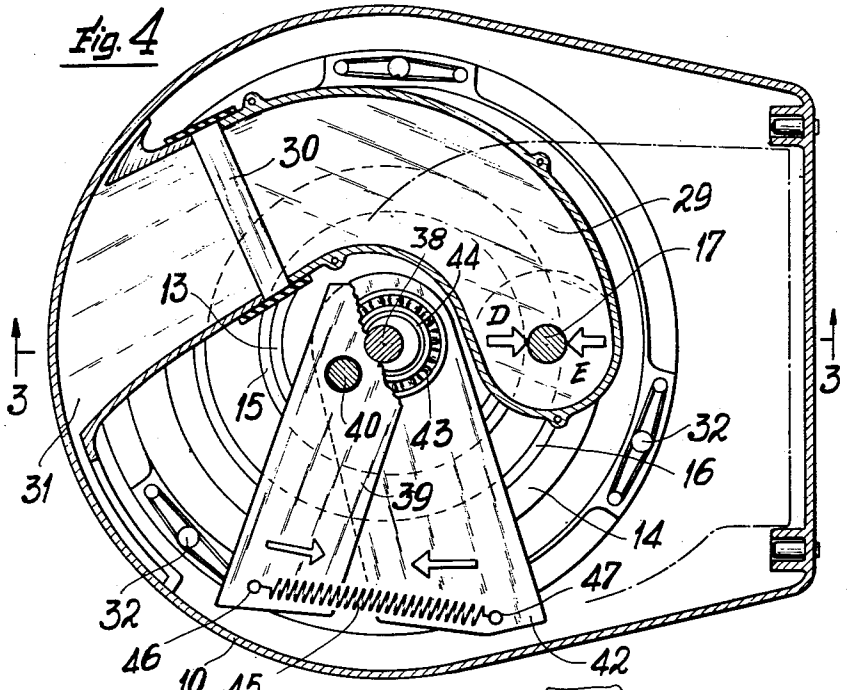
Fig. 4



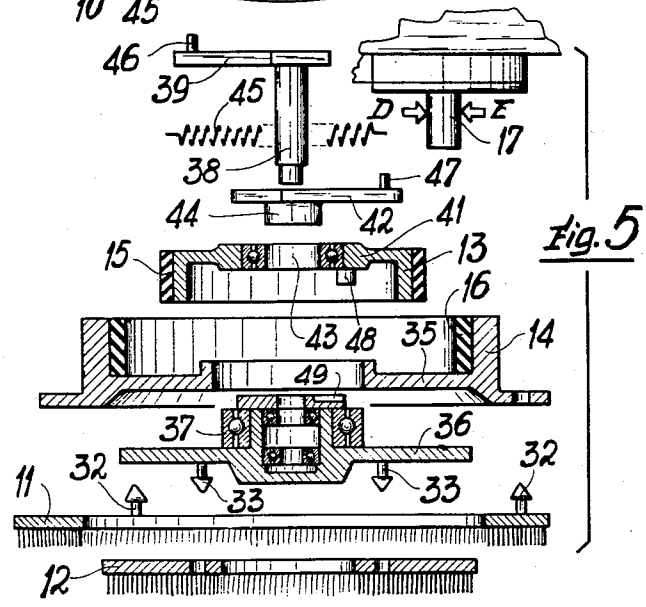


Fig. 5

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United States Patent Office 3,022,529 Patented Feb. 27, 1962

3,022,529

ROTARY FLOOR POLISHER

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Filed Sept. 2, 1959, Ser. No. 837,702
Claims priority, application Italy Sept. 11, 1958
6 Claims. (Cl. 15—49)

This invention generally relates to floor polishers and, more particularly it is related to floor polishers of the type including a casing connected to handle means and adapted to be moved on the floor surface, a plurality of down-facing rotary brushes in the lower portion of said casing, each rotatably supported for rotation about a vertical axis, an electric motor and drive means drivingly connecting said motor to each one of said brushes for rotating same at a properly selected rotational speed for having the floor surface polished as the assembly is caused to travel thereon.

According to the most advanced techniques such floor polishing means are preferably but not necessarily combined with vacuum cleaner means and, therefore, the present invention will be described below as embodied in structure including both said rotary floor polishing means and said vacuum cleaner means. It is evident however that the invention is not limited to said combination but that it includes all such floor care mechanisms comprising the features of the invention and set forth in the appended claims.

According to current knowledge, the various floor cleaners heretofore proposed and widely manufactured include two or three rotary brushed co-planarly arranged within the outline of the casing, in general in side-by-side relationship. Each one of such brushes, therefore, moves along in its own path as the device is moved on the floor surface and, owing to the unavoidable minor disparity of working conditions of any single rotary brush, say by the lack of dirt and/or of sliding of the device on the various locations of the floor surface, the polishing action of the brushes may differ, thus impairing the desirable even glossy appearance of the polished floor.

In addition, the relatively small diameter of each rotary brush, resulting from the necessary relatively small plan size of the casing, leads to the provision of very rapidly rotating brushes, to provide a proper linear speed of brushes' bristles on the floor. Such relatively high rotational speed is obviously a source of vibration and of noisy operation of the floor caring device.

Still further, notwithstanding the provision of counter-rotating brushes in the currently produced floor polishers to compensate the torque thereof, some rotational effect unavoidably results in the operating of such devices, due to the above said unavoidable disparity of friction respective to the various rotary brushes.

Having the above and other objections in mind, it is therefore an object of this invention to provide a new and advantageous floor polishing mechanism which is not subject to the above objections and which is capable of vibrationless, noiseless and even operation on the floor surface for imparting thereto the most desirable uniform brightness.

More particularly, it is an object of this invention to provide a new and improved floor polisher of the character described including at least one rotary annular brush having a central opening and at least another rotary brush, co-planar and substantially co-axial to said one brush, located in the said central opening, an electric motor and drive means for drivingly connecting said motor to each one of said brushes for counter-rotationally driving same.

A further object of this invention is the provision of a new and useful floor polishing device as above, wherein the said drive means includes an improved friction type driving mechanism employing a motor driven roller, say

made integral with the shaft of the electric motor, interposed between the inner surface of an annular member connected to the said annular brush and the outer surface of a disk member connected to the said another brush, the difference of diameters of said inner and outer surfaces causing a difference of the rotational speed of said brushes, so that a substantially advantageous equality of linear speed of brushes' bristles and of the resulting torques may be attained.

Another object of this invention is to provide a new floor polisher as above with drive means of the character described including horizontally floating mount means for carrying the said annular and disk drive members and spring means for constantly biasing said members' inner and outer surfaces towards said motor driven roller for resiliently maintaining the required frictional engagement.

A still further object of this invention is to provide a new and improved floor caring device of the character referred to above and which will achieve the desired purpose in a simple, reliable, expeditious and effective manner.

These and other objects and advantages of the invention are in part obvious and in part will be made apparent as this description proceeds and the features which are believed to be new and characteristic of the invention will be in particular set forth in the appended claims. The invention itself, however, both as to its construction and to its mode of operation will become best apparent from the following detailed description of a preferred form of embodiment thereof, when taken in conjunction with the accompanying drawings, forming an essential component of this disclosure.

In the drawings:

FIGURE 1 is a diagrammatical showing of the typical combination and relative arrangement of the brushes and of the drive means in an improved floor polisher produced according to the invention, such showing illustrating the assembly in horizontal sectional view taken in planes cutting said brushes and said drive means;

FIGURE 2 is a side elevation of a preferred form of embodiment of this invention as embodied into a combined floor polishing and vacuum cleaning floor caring assembly;

FIGURE 3 is a vertical longitudinal sectional view of same, taken on the line 3—3 of FIG. 4, and wherein some of the interior parts are shown in side view;

FIGURE 4 is a horizontal sectional view of same assembly, taken on line 4—4 of FIG. 3, and wherein some parts are broken away; and

FIGURE 5 is a vertical sectional exploded view of the mechanism including the brushes and the drive and supporting means thereof.

Referring now to the drawings, wherein like reference numerals refer to like or structurally equivalent parts and elements throughout the several figures:

As diagrammatically shown in FIG. 1, wherein numeral **10** indicates the outline of the assembly casing, namely the down-turned flange forming edge portion thereof, the device of the invention includes an outer annular brush **11** supported for rotation, say in direction A, about an axis O, and an inner brush **12**, likewise supported for rotation, but in opposite direction B, about the same vertical axis O.

It is therefore believed to be evident that such co-axial arrangement of brushes leads to at least two advantageous effects either in view of structure and in view of operation of the floor caring device, i.e.: the device of the invention may be provided with brushes of very large diameter, such diameter being defined by the overall size of the casing **10**. Therefore relatively low rotational speed may be imparted to the brushes, thus reducing the noise and the vibration of the device; and both the brushes travel on

the floor surface along the same path, thus avoiding any differences in the polishing effects thereof.

The said inner and outer brushes are drivingly connected to drive members **13** and **14**, respectively, provided with outer and inner friction surfaces **15** and **16**, respectively, both in frictional engagement with a motor driven roller **17** located between said surfaces, and preferably consisting of the lower end portion of the shaft of an electric motor **22** (FIG. 3). The diameter of outer surface **15** is obviously less than the diameter of inner surface **16** and, therefore, the rotational speed in direction A of the outer brush **11** is correspondingly less than the rotational speed in counter-direction B of the inner brush B. By proper positioning and sizing of the various frictionally engaged elements the ratio of opposite directions A and B may be adapted for imparting to bristles of the two brushes the most suitable linear speed in respect to the floor surface for correct operation and further for having the oppositely directed torques, resulting by the friction of such bristles on the floor, substantially compensated.

The construction of a preferred form of embodiment of the invention, including the operative parts of FIG. 1, is illustrated in FIGS. 2 to 4 and FIG. 5 in particular shows the components of the mechanism.

In the form of embodiment shown, the said casing **10** is provided with a rubber band **20** (FIGS. 2 and 3) for improving the vacuum cleaning ability of the associated vacuum devices described below, and with an upper cap **21** wherein the motor **22** is housed. According to a known arrangement, a handle **25** is provided, the lower portion of said handle (FIG. 2) being secured to a fork member **23** pivotally connected at **24** to the casing **10**. A conventionally constructed dust collecting bag (not shown) may be detachably secured to said handle **25** and connected, by means of a flexible piping, to an outlet **27** (FIG. 3) wherethrough the dust is exhausted in direction C.

The vacuum cleaning operation may be performed by a conventional centrifugal fan supported and driven by the motor shaft, above its drive roller forming portion **17**, and whose casing is indicated at **28** in FIG. 3. An arc-shaped channel **29** is connected to the inlet of the fan casing **28** and, by means of a flexible joint **30**, to an arc shaped dust collector and conveyor **31**, in the fore portion of casing **10**, in respect with the direction in which the operator generally pushes the floor cleaner and polisher on the floor surface.

The two brushes **11** and **12** are detachably connected, preferably by means of pins having enlarged heads **32** and **33**, respectively, and cooperating with conventionally constructed spring retainers, to rotary members **35** and **36**, respectively. As shown in FIGS. 3 and 5, the said member **35** is made integral with the annular drive member **14** provided with the said inner surface **16**, which may be embodied into a hard rubber band secured inside said member, for noiseless and sure frictional drive.

By means of suitable bearing means, say a ball-bearing **37**, the said member **35** is rotatively supported about a hub portion of said other rotary member **36**, so that the co-axial relationship of the counter-rotating brushes is secured. By means of a pair of other ball-bearings, clearly shown in FIGS. 3 and 5, such member **36** is at its turn rotatively supported about a downwardly directed shaft **38** secured at its upper portion to a brace member **39**, pivotally connected at **40** (see in particular FIG. 4) to the frame structure of the assembly.

The inner drive member **13**, including the outer friction surface **15**, is made integral with a rotary member **41** rotatively supported, by means of a ball-bearing **43**, about the hub portion **44** of a second brace member **42** which is also pivoted at **40** to the structure of the assembly.

The hole of said hub portion **44** is noticeably larger than the diameter of said shaft **38**, so that a relative lateral shifting of a substantial amplitude of said brace members **39** and **42** about their common pivot **40** is admitted.

From what has been set out above and by a consideration of the accompanying drawing it will be therefore understood that the said brace **42** acts on the mount for inner drive member **13**, that said brace member **39** acts on the mount for outer drive member **14**, that both said brace members or levers **39** and **42** may independently pivot about pivot **40** and, as a consequence thereof, the said friction surfaces **15** and **16** may be independently urged against the motor driven roller **17** in the desired frictional engagement. The said pivot **40**, at its turn, forms the mount means for both said brace members or levers **39** and **42** in respect to the assembly's frame structure.

The required resilient biasing of friction surface **15** and **16** against the motor driven roller **17** is preferably attained by means of a coil spring **45** having its end portions connected at **46** and at **47** to the said brace member **39** and to the other brace member **42**, respectively, for urging on said brace members a force directed as indicated by arrows in FIG. 4 and causing perfectly balanced pressures in directions D and E respectively (FIG. 5) of the said surfaces **15** and respectively **16** on diametrally opposed parts of the motor driven roller **17**.

The independency of pivoting of the two mounts about pivot **40** ensures the required frictional engagement between the described various drive and driving members even if the frictional surfaces **15** and **16** wear differently and/or if some imprecision of assemblage occurs. In fact, the two mounts **39** and **42** behave as a whole about the pivot **40** for self-adaptation against the roller **17**.

In addition, in consideration of the fact that for proper drive the pressure in direction D of the convex frictional surface at **15** must be proportionally greater than the pressure required for drive the concave surface at **16** (due to the more favourable frictional contact), the connection at **47** (FIG. 4) of spring **45** to the brace member **42** is located at a greater spacing from pivot **40** than the opposite connection at **46** to the brace **39**, for greater leverage.

It will be noticed that, while the two drive members **13** and **14** are supported by two differing mounts, namely by the braces **39** and respectively **42**, both the brush supporting members **35** and **36** are rotatably supported by the one mount **39**. Therefore, a condition of non-co-axiality unavoidably exists between the drive member **13** and the driven member **36**. To overcome such condition, the rotation of the said drive member is transmitted to the driven member by means of a pin **48** (FIG. 5) radially slidable in a slot **49** of a disk member secured to the hub portion of said driven member **36**. Therefore the two brushes may counter-rotate in quite correct co-axial relationship while the respective drive members **13** and **14** may set in a slightly not co-axial relationship as required for ensuring the frictional engagement of drive and driven parts.

It is therefore believed to be evident that the present invention includes a plurality of advantageous features, and it will be understood too that each of the new features described and any combination thereof may also find useful application in other types of floor polishing machines and devices differing from the one described.

Without further analysis, the foregoing will so fully reveal the gist of this invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of this invention and, therefore, such adaptations should and are intended to be comprehended within the spirit and meaning of equivalents of the invention, as defined in and by the appended claims.

Having thus described the invention and the mode of carrying out thereof, what is claimed as new and desired to have protected by Letters Patent is:

1. A rotary brush assembly comprising, in combination, support means; a pivot pin fixedly carried by said support means; a pair of levers turnably supported by said pivot pin; an outer annular drive member having an inner friction surface and an inner drive member having an outer friction surface surrounded by and spaced from said inner friction surface; a pair of connecting means respectively connecting said outer and inner drive members to said levers for rotary movement with respect thereto about a pair of axes, respectively, parallel to said pivot pin and located closely adjacent to each other; a rotary driving pin parallel to said pivot pin and carried by said support means, said driving pin being located between and engaging said friction surfaces; spring means operatively connected with said levers and acting through the latter on said drive members for urging said friction surfaces against said driving pin; and an outer annular brush and an inner brush located within and surrounded by said outer brush, said outer and inner brushes being respectively connected to said outer and inner drive members for rotary movement therewith.

2. A rotary brush assembly as recited in claim 1 and wherein said spring means is connected to that lever which is connected to said inner drive member at a point more distant from said pivot pin than the connection of said spring means to the other lever so that said spring means acts with a greater leverage on the lever connected to said inner drive member for urging said outer friction surface thereof against said drive pin with a force per unit of area greater than the force per unit of area with which said outer friction surface is urged against said driving pin.

3. A rotary brush assembly comprising, in combination, support means; a pivot pin fixedly carried by said support means; a pair of levers turnably supported by said pivot pin; an outer annular drive member having an inner friction surface and an inner drive member having an outer friction surface surrounded by and spaced from said inner friction surface; a pair of connecting means respectively connecting said outer and inner drive members to said levers for rotary movement with respect thereto about a pair of axes, respectively, parallel to said pivot pin and located closely adjacent to each other; a rotary driving pin parallel to said pivot pin and carried by said support means, said driving pin being located between and engaging said friction surfaces; spring means operatively connected with said levers and acting through the latter on said drive members for urging said friction surfaces against said driving pin; an outer annular brush connected to said outer drive member for rotary movement therewith; an inner brush coaxially arranged within and surrounded by said outer annular brush; means connecting said inner brush to said outer drive member for free rotary movement with respect thereto; and coupling means coupling said inner drive member to said inner brush for rotating the latter with said inner drive member.

4. A rotary brush assembly comprising, in combination, a frame; a pivot pin fixedly carried by said frame; a pair of levers turnably supported by said pivot pin, one of said levers being formed with an opening passing therethrough; a supporting pin parallel to said pivot pin, fixed to the other of said levers, and passing through said opening of

said one lever; an inner drive member extending around said opening of said one lever; means connecting said inner drive member to said one lever for free rotary movement about said opening thereof, said inner drive member having an outer friction surface; a disc coaxial with said supporting pin; means supporting said disc on said supporting pin for free rotary movement with respect thereto; motion transmitting means cooperating with said inner drive member and said disc for transmitting rotation of said inner drive member to said disc; an outer drive member having an inner friction surface surrounding and spaced from said outer friction surface of said inner drive member; means mounting said outer drive member on said disc for free rotary movement with respect thereto; an inner brush connected to said disc for rotary movement therewith and an outer annular brush surrounding said inner brush and connected to said outer drive member for rotary movement therewith, whereby said inner and outer brushes will be respectively driven by said inner and outer drive members; a rotary driving pin supported by said frame, parallel to said pivot pin, and located between and engaging said friction surfaces; and spring means cooperating with said levers for urging the latter to turn respectively in directions which urge said friction surfaces against said driving pin.

5. Rotary brush assembly comprising, in combination, an inner brush and an outer annular brush surrounding said inner brush; an inner drive member having an outer friction surface and an outer drive member having an inner friction surface surrounding and spaced from said outer friction surface forming an annular gap between themselves, said drive members being mounted relatively movable towards and away from each other; means operatively connecting said inner and outer brushes to said iner and outer drive members, respectively, for rotary movement therewith; a rotary driving pin located between and engaging said friction surfaces; and means cooperating with said relatively movable drive members for urging the same with said friction surfaces thereof against said driving pin.

6. Rotary brush assembly comprising, in combination, an inner brush and an outer annular brush surrounding said inner brush; an inner drive member having an outer friction surface and an outer drive member having an inner friction surface surrounding and spaced from said outer friction surface; means operatively connecting said inner and outer brushes to said inner and outer drive members, respectively, for rotary movement therewith; a rotary driving pin located between and engaging said friction surfaces; means cooperating with said drive members for urging said friction surfaces thereof against said driving pin; and driving means operatively connected to said rotary pin for driving the same and for thereby rotating said inner and outer drive members and said brushes.

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