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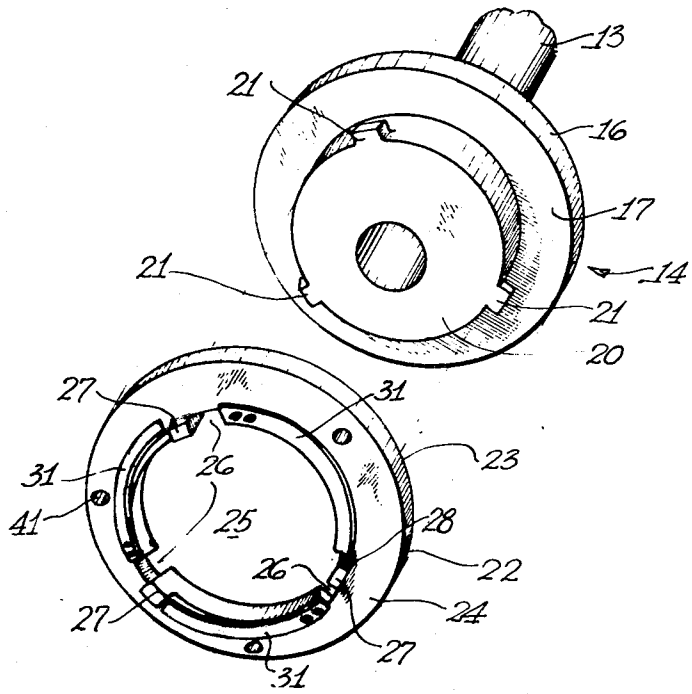
[54] **FLOOR POLISHER DRIVE CONNECTION**
11 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** ..... **15/49 R,** 287/103 R
[51] **Int. Cl.** **A47l 11/164**
[50] **Field of Search** ..... 15/28, 29, 49 R, 50 R, 98, 320; 287/103 R, 103 A; 51/177

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ABSTRACT: A drive connection for a floor polisher which permits ready removal from an attachment of brush units to the vertical shaft driven by the motor. The drive connection includes an annular plate element, which is secured to the brush unit, the plate element being adapted to be locked against a circular flange carried by the shaft, the shaft having lugs which pass through radially extending recesses in the annular plate element and turn in behind the annular plate element. On its rear face, the annular plate element has lug engaging ramps which terminate at lug abutments, the ramps being formed by flexible strips which are normally held away from the rear face adjacent the abutments by urethane plugs received in bores under the flexible strips.



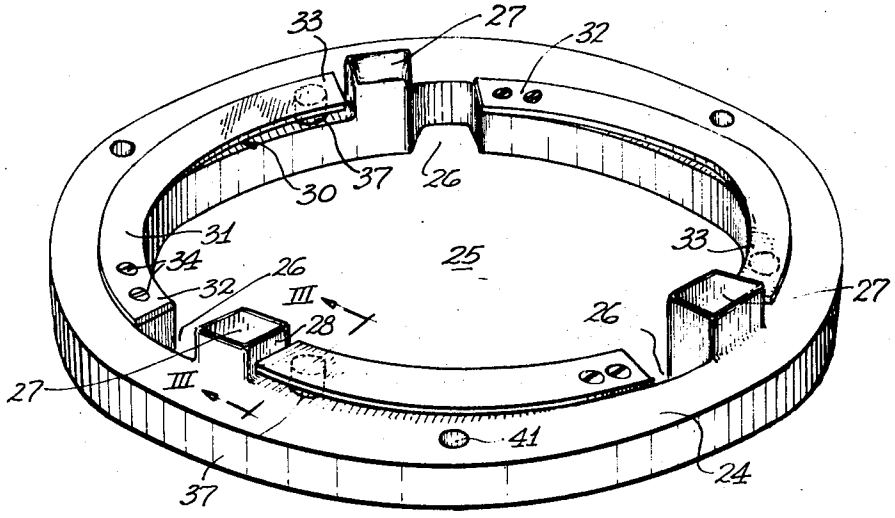


Fig-2

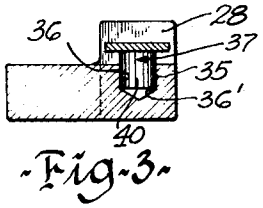


Fig-3

Fig-4

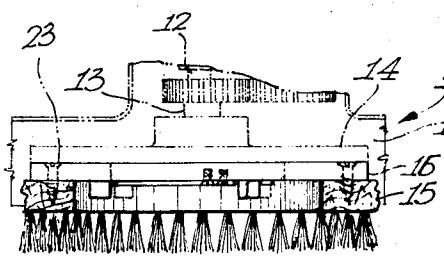


Fig-1

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FLOOR POLISHER DRIVE CONNECTION

BACKGROUND OF THE INVENTION

In floor maintenance machines commonly called floor polishers, it is important that one type of brush or buffer unit be readily removed and replaced by another so as to enable the machine to be used for different operations in floor care. It is also important that the change can be done quickly and that the coupling be capable of standing up to repeated changes particularly in the heavy duty machines used by janitorial services in large buildings.

A common type of coupling now utilized, includes a circular flange on the vertical motor driven shaft of the machine, the flange having a coaxial projection extending below the flange and being provided with radially projecting lugs spaced below the flange. Secured to the brush unit is an annular plate member which forms the second part of the coupling for receiving the coaxial projection so as to move into engagement with the flange. Extending radially outward from the central opening of the plate member are recesses which permit the lugs to pass through the plate member so that when the plate member is turned relative to the flange, the lugs move behind a rear face of the plate member to thereby prevent axial removal of the plate member relative to the flange. To limit the turning of the plate member relative to the flange, the plate member has solid ramps cast on the rear face, so that the lugs slide up the ramps until the lugs jam tight against the ramps as the annular plate is brought into tight engagement with the flange.

This known type of coupling has definite disadvantages. The coupling is designed relative to the direction of rotation of the shaft so that rotation tends to tighten the coupling. The high starting torque frequently causes the plate member to become so tightly wedged, however, that when it is desired to change the brush unit, it cannot be removed. Since the coupling is located between the brush unit and motor within the frame or housing of the machine it is substantially impossible for the operator to apply the proper forces to the coupling to loosen it when it becomes wedged in this manner. Accordingly, considerable operation time of the machine and its operator may be lost. The jamming of the lug with the ramp, whether caused by the high starting torque or by the manner in which the coupling is put together by the operator may very quickly cause deterioration of the lugs and ramps. Moreover, unless the spacing of the lugs and ramps are very accurately formed, one ramp may also be subject to a more severe wedging action with the result that one or more of the ramps become seriously gouged. When the ramps or lugs become worn in this manner, the wedging effort is lost so that a tight coupling is not possible, and as a result the connection may chatter and vibrate sufficiently to result in a poor finish on the floor and serious wear and damage within the machine.

Various attempts have been made to improve the above-described coupling which has become a standard connecting means on many floor polishers. One attempt involves the substitution of a leaf spring means for the ramp, the spring being secured to the plate member at one end and sloping away from the plate member to form a resilient ramp. This design was selected to provide a self-levelling coupling for better operation when the brushes become worn or when the machine is used on an irregular surface. This type of coupling is not believed satisfactory, however, since as the plate member is turned to a coupling position, the lugs ride out onto the free cantilevered ends of the leaf springs which provide little resistance to relative movement between the lugs and the plate member so that a firm connection, which is believed necessary in view of the presence of severe vibrations, is not obtained.

SUMMARY

According to one aspect of the present invention, the plate element, which forms one member of the coupling and is adapted to be secured to the brush unit, is of annular configuration to provide a top surface for engagement with the flange of the vertical shaft and an oppositely disposed rear face. The plate element defines an opening for mating reception of the axial projection of the shaft and has a plurality of radially extending recesses spaced circumferentially about the opening for passage of the lugs on reception of the projection in the opening. A plurality of lug-engaging abutment means are circumferentially spaced about the opening and project axially from the rear face, the abutment means having equal spacing to the recesses and being associated one each with the recesses. Ramp means are provided on the rear face for engagement with the lugs and extend from each recess to the associated abutment means, each ramp including a flexible strip secured at one end to the rear face adjacent one of the recesses and defining a lug engaging ramp extending to a free end located adjacent the associated abutment means, and a compressible spring unit contained in a bore under the free end and projecting from the rear face in an uncompressed state for holding the strip at an incline relative to the rear face.

In the present invention, the locking of the two separable members together does not depend on the lugs wedging against a solid ramp as in the commonly used devices. The lugs ride smoothly up the flexible strips and thereby compress the spring units so as to enable the lugs to abut the axially projecting abutment means. Accordingly, the members cannot become jammed and no deterioration of the lugs and ramps occurs because of gouging and vibration. Moreover, as the members are tuned to a coupling position the lugs approach and move over the spring units located under the free ends of the flexible strips so that resistance to turning increases as the lugs approach the abutment means to thereby provide a firm connection.

Preferably, the spring units consist of plugs of urethane which have good resilient characteristics not effected by the presence of moisture and chemicals such as detergents, used in scrubbing and polishing operations.

BRIEF DESCRIPTION OF THE INVENTION

Other features and advantages of the invention will become apparent from the following description of the preferred embodiment of the invention with reference being made to the accompanying drawings in which:

FIG. 1 is a partially sectioned, elevational view of a floor polisher incorporating the coupling of the present invention;

FIG. 2 is a perspective view showing the bottom or rear face of one member of the coupling;

FIG. 3 is a cross-sectional view taken along the line III—III of FIG. 2; and

FIG. 4 is a perspective view of the interconnectable members forming the couple, one member being removed from the other.

DESCRIPTION OF PREFERRED EMBODIMENTS

In FIG. 1, the reference numeral 10 denotes generally a machine of the type for maintaining floor surfaces and although it is used in scrubbing, wax applying and buffing, it is referred to herein as a floor polishing machine or simply a floor machine. The floor machine 10 includes a cover or frame to which the handle (not shown) is attached and on which electric motor 12 is mounted. The motor 12 has a drive output including a vertically disposed, motor driven shaft 13. Secured to the shaft 13 by way of a detachable drive coupling 14, which forms the present invention, is a brush unit 15. Although unit 15 is referred to as a brush unit and is shown as such in the drawings, it is apparent that it may be in the form of a buffing pad or similar attachment used in floor maintenance.

As shown most clearly in FIG. 4, the shaft 13 is provided at its lower end wit a circular flange 16 which is fixed relative to the shaft in coaxial relation. The flange 16 presents a horizontally disposed, flat, annular bottom surface 17. Coaxially disposed within the annular bottom surface 17 is a projection

or hub 20 of circular cross section, and formed integrally with the hub 20 and extending radially therefrom are lugs 21. The lugs 21 are equally spaced about circumference of the hub 20 and are axially spaced from the annular bottom surface 17. The shaft 13, flange 16, hub 20 and lugs 21 may be cast as an integral unit and form one member of the coupling 14.

The other member of the coupling includes a flat annular plate element or member 22. The annular plate member 22 defines a forward or top surface 23, which may have substantially the same dimensions as the annular bottom surface 17, and a rear face 24. The annular plate member 22 has a central opening 25 of a size to closely receive the hub 20, and the thickness of the annular plate member is slightly less than the axial spacing between the lugs 21 and the bottom annular surface 17 defined by the circular flange.

Extending radially from the central opening 25 are a plurality of circumferentially spaced recesses 26 which are equal in number and spacing to the lugs 21 and which are shaped to permit passage of the lugs when the hub 20 is received in the central opening 24. Associated with each recess and spaced a distance around the periphery in the clockwise direction as viewed in FIG. 2 is an abutment means or stop 27 in the form of a projection extending axially from the rear face 24. Each stop 27 has a lug engaging side 28 facing the associated recess thereof, the side 28 projecting substantially perpendicular from the rear face 24.

A ramp means 30 extends from each recess 26 to the associated stop 27. The ramp means includes a flexible strip 31, preferably formed of steel, and being relatively thin in comparison to its width. Each flexible strip 31 is of arcuate shaped so as to curve about the central opening 25 from a fixed end 32 adjacent the recess 26 to a free end 33 terminating at the lug engaging side 28 of the associated stop. The fixed end 32 is secured flatly against the rear face 24 by way of rivets or screws 34 received in appropriate bores in the annular plate member 22.

Located under the free end 33 of each flexible strip 31 is a blind bore 35. The bore 35 has a main outer section 36, and an inner section 36' of smaller cross section, and is preferably in the form of a common bore which terminates in conical inner section as shown in FIG. 3. Received in the bore 35 is a resilient means or compressible spring unit 37 which preferably consists of a simple cylindrical plug 40 of urethane. The plug 40 is slightly smaller in cross section than the main section 36 of the bore and is closely received in the bore. Although the plug 40 is closely received in the main section 36 of the bore, it need not be tightly received, and the plug 40 is of greater length than the main section 36 so that it projects from the rear face 24 in an uncompressed state so as to hold the free end away from the rear face 24. Accordingly, when the annular plate member is uncoupled, the flexible strips 31 slope noticeably away from the rear face 24 to define lug engaging ramps.

The annular plate member 22 is secured to the top of the brush unit 15 by way of screws or similar means passing through bores 41 so that brush unit and annular plate members turn as a unit. The operation of connecting the brush unit 15 to the shaft 13 so that the brush unit will be driven by shaft 13 simply involves holding the brush unit so that annular plate member 22 is brought up to hub 20, orienting the annular plate member to permit the lugs 21 to pass through the recesses 26 as the hub 20 is received in the central opening 25, and then rotating the annular plate member as the surface 23 of the annular plate member engages the bottom surface 17 of circular flange 16 until lugs 21 engage sides 28 of stops 27. During the last step of rotating the annular plate member 22, which step is carried out by turning the brush unit, then held in the hands of the operator, through a fraction of a revolution, the lugs slide along the ramp means 30 as each lug travels towards the associated stop 27. Initially, the turning torque required to turn the annular plate member 22 relative to the circular flange 16 is substantially negligible as the lugs slide freely over the strips 31. As the lugs approach the stops 27, the strips 31, which are pressed towards the rear face 24, apply pressure to the end of the plugs 40. When each plug 40 is initially compressed, its cross-sectional area enlarges so as to completely fill the main outer section 36 of the bore. During further rotation, each lug slides along the strip, which at this stage presents a rather steep ramp, and onto the portion of the strip immediately over the plug. The turning resistance increases during this stage since, due to the nature of urethane, the plug begins to flow down into the inner section 36', and due to the tapered shape of the inner section 36' into which the plug flows, the increase is gradual. The size of the plug is selected, however, so that even as each lug approaches the side 28 of the associated stop, the turning resistance is not great. Preferably, the plug is of sufficient volume to completely fill the bore and to overflow slightly when each lug has been brought against the associated stop. The portion of the plug which overflows around the rim of the bore significantly aids in forming a positive and vibrationless lock between the annular plate member 22 and the shaft 13.

As the spring units are compressed as described above, the coupling becomes very firm since the top surface 23 is forced into tight engagement with the bottom surface 17 of the circular flange by way of the reactionary forces. Nevertheless, unlike known couplings, the same turning force is used to complete the connection each time the brush unit is attached.

When the brush unit is to be removed, it is simply grasped, turned back until the lugs reach the recesses 26 and then pulled away from the shaft 13. When the lugs ride away from the spring units 37, the urethane plugs regain their original shape. Again, as when the coupling is being made, the same turning force is required each time the brush unit is removed. The annular plate member 22 cannot become wedged in a coupling position in spite of high torques which might be transferred through the coupling when the machine is started or when the brush unit encounters varied resistance during operation. Such torques are simply transferred from the lugs 21 to the stop 27. Moreover, since a firm coupling is provided and the connection does not depend on a wedging effect, vibrations and chatter are substantially eliminated and loosening of the connection does not occur. When the coupling is subjected to an unbalanced pressure, such as when the operator of the floor machine alternates pressure on the handle to move the machine from side to side or when the machine is tilted to apply increased pressure on heel marks or spots requiring increased pressure, the urethane plug, and particularly the portion thereof which has spilled over and is flattened between the strip and the rear face of the annular plate member, eliminates the possibility of any clearances occurring between the parts. In other words, the urethane provides a resilient and yet firm pressure between the surfaces of the annular plate member 22 and circular flange 16 so that no chatter can take place.

The urethane plugs have been found superior to other types of springs because of the good resilient characteristics of urethane and its ability to avoid deterioration even though it may be continually subjected to moisture and chemicals such as detergent. Moreover, such plugs are extremely economical to produce.

The embodiment shown in the drawings is shown to illustrate one example of the invention, it being apparent that various other structural arrangements could be utilized. For example, instead of having hub 20, the shaft 13 could be provided with an annular portion projecting axially therefrom, the annular portion having the lugs projecting radially inwardly therefrom. The other member could then take the form of a circular plate member provided with inwardly extending recesses about the periphery thereof. The ramp means and the associated stop means would then be located on the rear face of the circular plate member immediately within the periphery thereof.

Furthermore, although the coupling of the present invention has been illustrated in conjunction with the drive of a floor machine, it is obvious that it could be utilized with like

advantages in other environments for connecting one member to another, such as in drive systems of other machines where it is desirable to uncouple a driven element.

I claim:

1. A coupling comprising first and second joinable members having engageable surfaces, said first member having an element projecting axially from the surface thereof and providing a plurality of circumferentially spaced, radially extending lugs axially spaced from the surface of the first member, said second member being in the form of a flat plate element of a thickness less than the axial spacing between the lugs and the surface of the first member, one of said elements being of circular configuration and the other being of annular configuration to define a circular opening for coaxial mating reception of said one element, said plate element having a plurality of circumferentially spaced recesses disposed for passage of said lugs as said one element is received in said other element, a plurality of lug abutment means projecting axially from a rear face oppositely disposed on said plate element as the engageable surface of said second member, each abutment means being associated with one of said recesses, a plurality of flexible strips each being secured to said rear face at a first end and extending away from one of the recesses to a free end adjacent the associated abutment means, said rear face having a plurality of bores therein located one each under the free end of each flexible strip, a plurality of compressible resilient members contained one each in the bores and in an uncompressed state projecting from said rear face to hold the free end of the strip away from said face, said strips thereby defining lug-engaging ramps so that as said one element is inserted in the opening defined by the other element, the lugs pass through the recesses and as one of said members is rotated relative to the other, said lugs of said first member ride up the flexible strips behind the rear face of the second member and thereby compress the resilient member and engage said abutment means.

2. A coupling comprising first and second members to be joined in coaxial relationship, said member defining engageable annular surfaces, said first member having a central element projecting axially from the annular surface thereof, a plurality of circumferentially spaced lugs projecting radially from said central element and being axially spaced from the annular surface of said first member, said second member having a flat annular plate portion of a thickness less than the axial spacing between said lugs and the annular surface of said first member, said plate portion defining a central opening and having a plurality of circumferentially spaced recesses projecting radially from said opening for passage of said lugs, said plate portion having a face on an opposite side thereof as said annular surface with abutment means projecting axially from said face about said openings, a plurality of ramp defining flexible strips each secured adjacent a first end thereof to said face adjacent an associated recess and extending from the associated recess to an associated one of said abutment means, each strip having a second end thereof adjacent the associated abutment and free to flex relative to said face, said face having a plurality of blind bores therein one each under the free end of one of said strips, a plurality of compressible resilient members one each in said bores and in an uncompressed state projecting from said face to hold the free end of the strip away from the face whereby each strip defines a lug engaging surface sloping upwardly relative to the face from the associated recess towards the associated abutment means.

3. A coupling as defined in claim 2, wherein each of said resilient members comprises a urethane plug.

4. A coupling as defined in claim 2, wherein each of said bores has a main section of circular cross section and a lower conical section, and wherein said resilient member consists of a cylindrical plug or urethane for close reception in said main section and having a greater length than said main section.

5. A coupling as defined in claim 2, wherein said flexible strips are arcuately shaped steel members each defining a ramp which curves about a portion of the periphery of the central opening of said second member.

6. In a floor machine of the type having a motor carried on a frame and a floor engaging brush unit mounted to rotate below the frame about a vertical axis; the improvement of a releasable drive coupling for connecting said brush unit to a drive output of said motor, said drive coupling comprising a first member including a vertically disposed, motor-driven shaft, a circular flange formed integrally with said shaft and defining a horizontally disposed annular surface, a coaxial hub of circular cross section extending below said annular surface and having a plurality of lugs projecting radially therefrom in axial spaced relation below said annular surface, a second member secured to the brush unit and including a flat annular plate element having a top surface for engagement with said annular surface of said first member, said plate element being of less thickness than the axial spacing between said lugs and said annular surface of said first member and having a rear face opposite to said top surface, said annular plate element defining a central opening for mating reception of said hub of said first member and having a plurality of radially extending recesses spaced circumferentially about said opening for passage of said lugs during reception of said hub in said opening, a plurality of lug engaging abutment means spaced about the central opening and projecting downward from said rear face, each abutment means being associated with one of the recesses, and a ramp means extending from each recess to the associated abutment means for engagement with one of said lugs during rotation of said second member relative to said first member after passage of said lugs through said recesses, each ramp means including an arcuate shaped flexible strip secured to said rear face at one end adjacent one of the recesses and defining a lug-engaging ramp curved about a portion of the periphery of said central opening to a free end located adjacent the associated abutment means, said rear face having a bore under the free end of each strip, and a plug of urethane contained in each bore and projecting from said rear face for urging said free end of said strip away from said rear face.

7. A drive coupling as defined in claim 6, wherein said bore has an outer main section of circular cross section and an inner conical section, and wherein said urethane plug is of cylindrical shape for close reception in said main section and has a length greater than said main section.

8. A coupling member for a brush unit in a floor machine of the type having a frame carried motor and a depending motor drive shaft having circuit flange formed integrally with said shaft, the shaft including an axial projection of circular cross section extending below the circular flange and a plurality of lugs projecting radially from the projection in axial spaced relation to the circular flange; said coupling member comprising a flat annular plate element for securement to said brush unit, said plate element having a top surface for engagement with said circular flange and an oppositely disposed rear face, said plate element defining a central opening for mating reception of said axial projection of said shaft and having a plurality of radially extending recesses spaced circumferentially about said opening for passage of said lugs on reception of said projection in said opening, a plurality of lug engaging abutment means circumferentially spaced about said opening and projecting axially from said rear face, said abutment means having equal spacing to said recesses and being associated one each with said recesses, and a ramp means on said rear face and extending from each recess to the associated abutment means, each ramp means including a flexible strip secured at one end to said rear face adjacent one of the recesses and defining a lug-engaging ramp extending to a free end located adjacent the associated abutment means, said rear face having a bore under each free end, and a compressible spring unit contained in each bore and projecting from the rear face in an uncompressed state for holding said flexible strip in a sloping relation to said rear face.

9. A coupling member as defined in claim 8, wherein the flexible strip is an arcuate-shaped member formed of steel and curving about a portion of the periphery of the central opening, and wherein said spring unit is a plug or urethane.

10. A coupling member as defined in claim 9, wherein the bore has an outer main section and an inner section of smaller cross section than the main section, said plug having a cross section substantially as great as said main section and being of greater length than said main section.

11. A coupling member as defined in claim 9, wherein said plug has a volume slightly greater than the total volume of the bore.