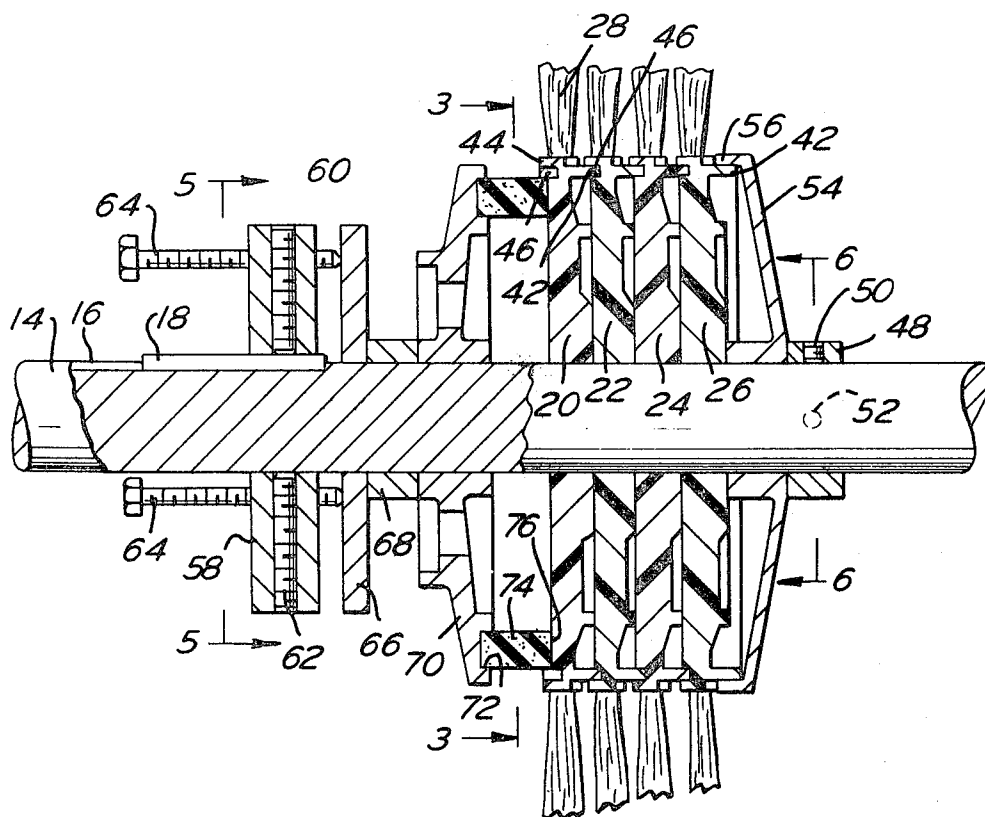


**[11] 3,604,045**

**ABSTRACT:** Rotary brush apparatus is disclosed, wherein a brush member is disposed on a shaft to normally rotate therewith, the brush member being coupled to the shaft by torque limiting means, whereby the brush member is adapted to rotate with respect to the shaft when torque between the brush member and shaft exceeds a predetermined amount.



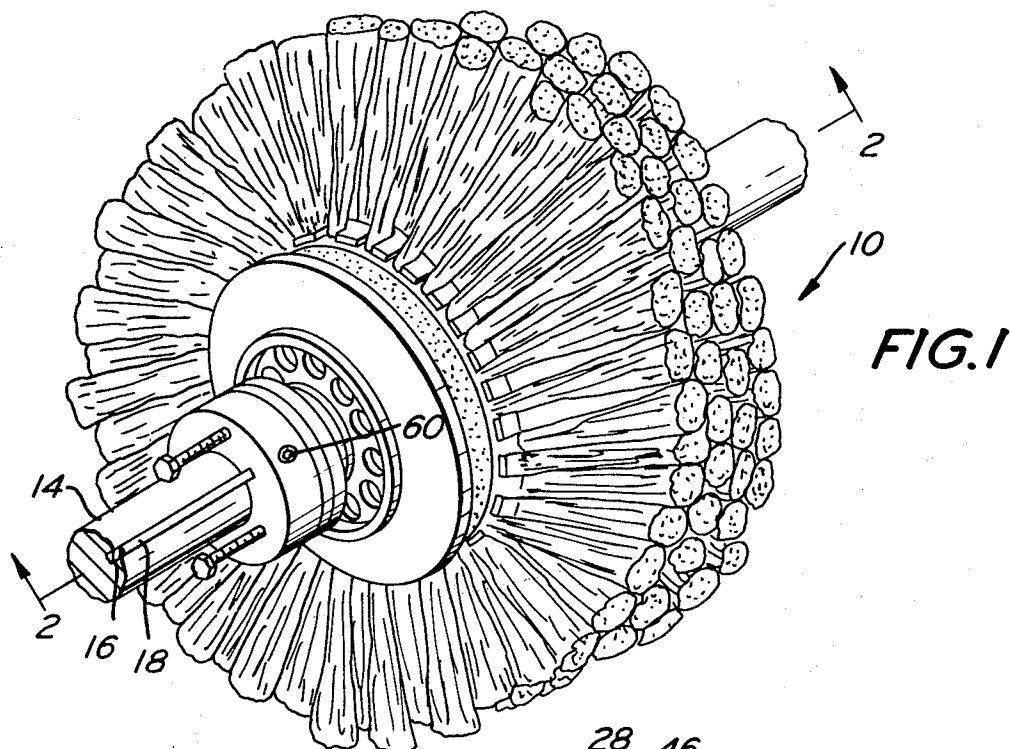
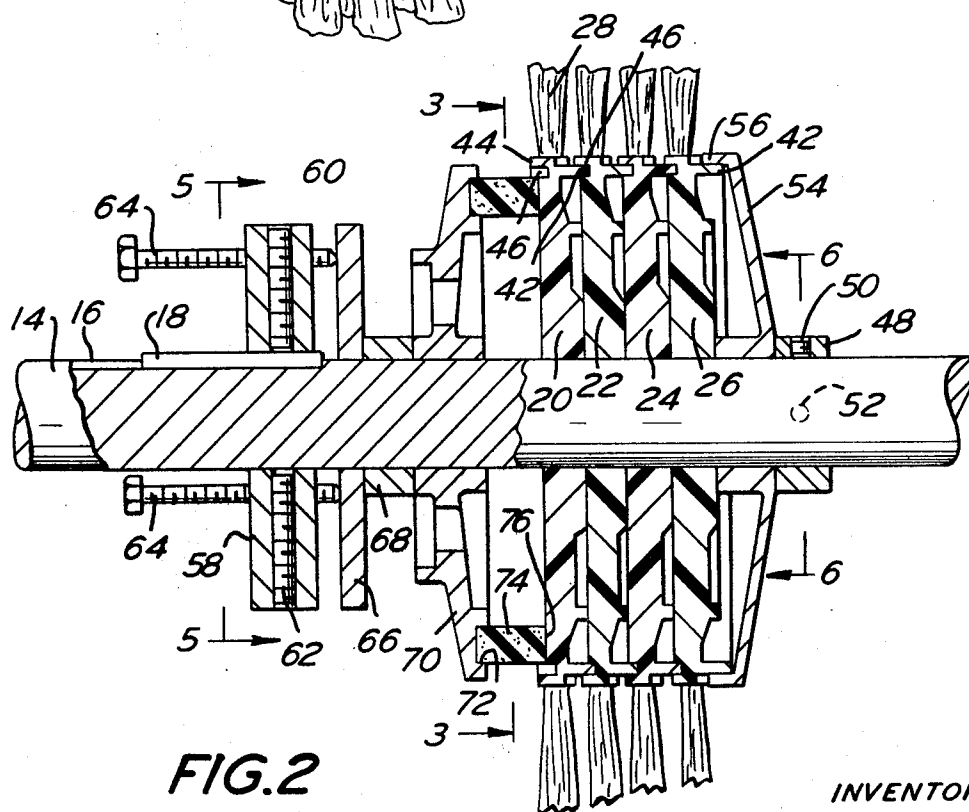


FIG. 2

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**FIG. 3**

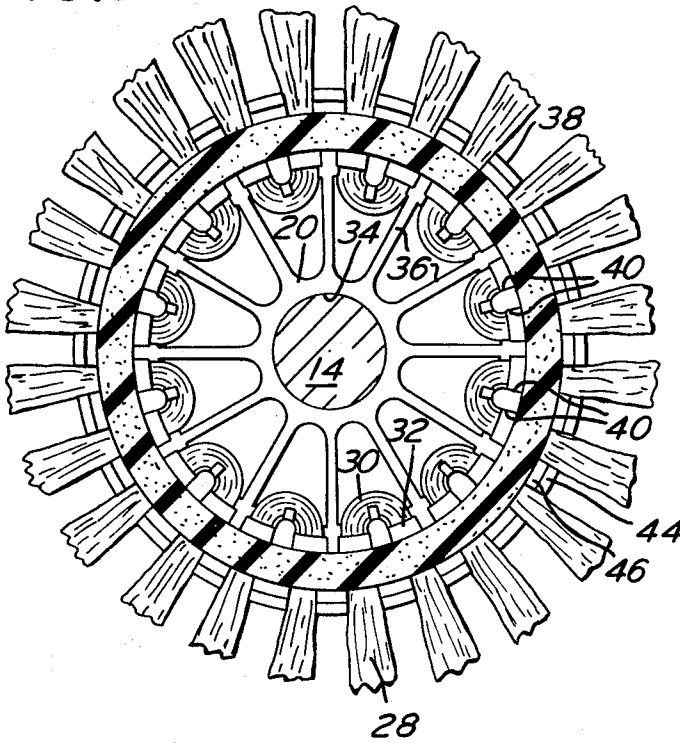


**FIG. 4**

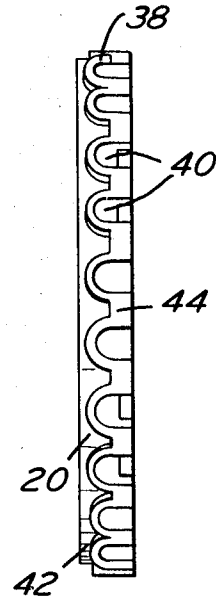
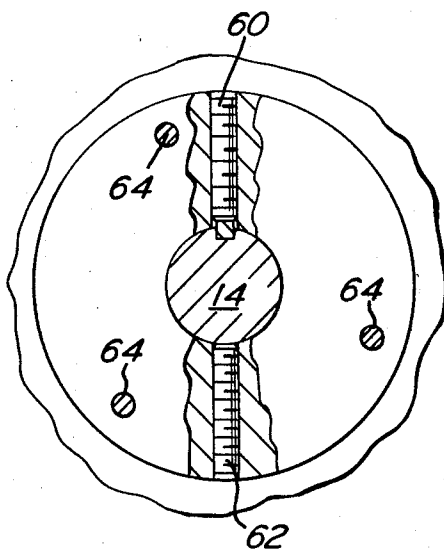


**FIG. 5**

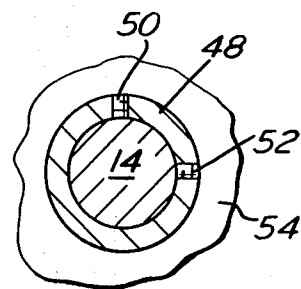


**FIG. 6**

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## ROTARY BRUSH APPARATUS HAVING CONTROLLED SLIPPAGE

This invention relates to rotary brush apparatus, and more particularly, to rotary brush apparatus providing for controlled slippage between a shaft and a brush member disposed on the shaft.

Rotary brushes are known to have wide commercial utility. For example, rotary brushes are widely used in carwashing apparatus.

Rotary brushes used in carwash apparatus are preferably provided with long, relatively flexible bristles. Such bristles are desirable because they minimize the risk of scratching of the car's finish. Certain hazards are known, however, to arise from the use of long, flexible bristles. For example, such bristles are known to have a tendency to become entangled with protuberances such as antennae, windshield wipers, door handles and the like on car bodies. Entanglement of the bristles with such protuberances may result in damage to the bristles, considerably shortening the useful life of the brush. Perhaps more seriously, damage to such protuberances frequently results from entanglement with the bristles of the brush.

The present invention is directed to a brush construction whereby damage to the brush and protuberances is minimized. This beneficial result is obtained by providing a brush construction wherein the force applied to an entangled body part is limited. More particularly, the result stems from the fact that the elements of the brush construction to which the bristles are affixed are yieldably coupled to the shaft of the brush, so that yielding between such elements and the shaft occurs when torque between the elements and the shaft exceeds a predetermined amount.

Normally, the elements of a rotary brush to which the bristles are affixed rotate in unison with the shaft. Relative motion between such elements and the shaft has heretofore been considered a serious problem, since such "slippage" materially reduces the brushing effectiveness of rotary brushes. Indeed, great pains have been taken to guard against such slippage in the design of conventional rotary brushes. It has now been found that by permitting and providing for slippage, but only under controlled conditions, important safety advantages may be realized.

In view of the foregoing, it is an object of this invention to provide a rotary brush construction suitable for use in carwashing equipment.

It is another object to provide a rotary brush construction, suitable for use in carwashing equipment, wherein damage due to entanglement of bristles with protuberances is minimized.

It is still another object to provide a rotary brush construction having controlled slippage between a brush member and its shaft.

Other objects will appear hereinafter.

The foregoing and other objects are realized, in one presently preferred form of the invention, by a rotary brush apparatus comprising a shaft, a brush member rotatably received on the shaft and coaxial therewith, and means normally coupling the brush member to the shaft for rotation in unison therewith. The means coupling the brush member to the shaft includes a torque-limiting means, so that the brush member may rotate with respect to the shaft when torque between the brush member and the shaft exceeds a predetermined amount. Rotation between the brush member and the shaft would, of course, occur in the event of entanglement of the bristles with protruding parts of the object being brushed.

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. 1 is a perspective view showing rotary brush apparatus in accordance with the present invention.

FIG. 2 is a longitudinal cross-sectional view taken along the line 2—2 in FIG. 1.

FIG. 3 is a transverse cross-sectional view taken along the line 3—3 in FIG. 2.

FIG. 4 is a detail view, showing a portion of the present apparatus in side elevation.

FIG. 5 is a cross-sectional view, partially broken away, taken along the line 5—5 in FIG. 2.

FIG. 6 is a cross-sectional view, taken along the line 6—6 in FIG. 2.

Referring now to the drawings in detail, wherein like numerals indicate like elements, there is seen in FIG. 1 a rotary brush apparatus designated generally by the reference numeral 10. The apparatus 10 comprises a brush member, designated generally by the reference numeral 12, rotatably received on and coaxial with a shaft 14.

The shaft 14 may include a keyway 16. A key 18, the purpose of which will be explained later, may be received in the keyway 16.

Referring now to FIGS. 2 and 4, the brush member 12 may comprise individual coaxial disk members 20, 22, 24 and 26, rotatably received on the shaft 14. The disk members 20 to 26 may be, if desired, identical to each other. Bristles 28 are coupled to the respective disk members 20—26, and extend radially outwardly therefrom. The bristles 28 may be coupled to the disk members 20—26 in any suitable manner. By way of illustration, referring to FIG. 3, the bristles 28 in the illustrated embodiment are provided in U-shaped tufts 30, retained in clips 32.

There is seen in FIG. 4, in side elevation, the disk 20. Construction of the disk 20 is typical, the disks 22—26 being substantially identical. Referring to FIGS. 3 and 4, the disk 20 includes a hub portion 34 receivable on the shaft 14. Spokes 36 radiate outwardly from hub portion 34 and engage at outer ends a peripheral rim portion 38. The rim portion 38 includes a series of peripherally spaced sockets 40 for receiving the clips 32. Bristles 28 extend radially outwardly from the disk member 20 through the sockets 40. An axially extending annular flange 42 projects from one face of the disk member 20. A second axially extending annular flange 44 projects from the other face of the disk 20. The flange 44 is discontinuous, being interrupted at spaced portions by the sockets 40.

Referring to FIGS. 3 and 4, an annular groove 46, also discontinuous, is disposed on the other face of disk member 20, just radially inward of the flange 44. The radius of the groove 46 is preferably the same as the radius of the flange 42. Thus, as is perhaps best seen in FIG. 2, the disk members 20—26 may be placed in stacked side-by-side relation, with the annular flange 42 of one disk extending into the groove 46 of the disk member adjacent to it. For example, the flange 42 of disk member 20 extends into the groove 46 of disk member 22. The disk members 20—26 are in abutting face-to-face contact, but are rotatable with respect to each other, as well as to the shaft 14.

Normally, the disk members 20—26 rotate in unison with each other and with the shaft. When so rotating, the disk members 20—26 and their respective bristles 28 provide an elongated rotary brush. Each disk member and its bristles, however, define an individual brush element.

It should be understood that brush elements having structural details other than the above-described details of the disk members 20—26 can be used, the particular above-described disc configuration being merely illustrative.

Torque limiting means couple the disk members 20—26 to the shaft 14 for rotation therewith. In the illustrated form, the torque-limiting means is a friction clutch arrangement.

Referring to FIGS. 2 and 6, an annular collar 48 is coupled to the shaft 14 for rotation therewith. In the illustrated embodiment, the collar 48 is coupled to the shaft 14 by means of a pair of setscrews 50, 52, set in the collar 48 at right angles. As illustrated, an end plate 54, coaxial with the shaft 14 and disk members 20—26 frictionally engages the collar 48 and endmost disk member 26. The end plate 54 may be provided with an axially extending flange 56, within which the flange 42 of disk member 26 may nest.

Keyed to the shaft 14 by means of the key 18 is a collar 58. Setscrews 60, 62 or the like are provided to fix the axial position of the collar 58 on shaft 14. Peripherally spaced bolts 64 are threaded through the collar 58, and project into engagement with a pressure plate 66, rotatable and slideable on the shaft 14. Also located on the shaft 14, and rotatable and slideable with respect thereto, are an intermediate collar 68 and an end plate 70. The end plate 70 include an axially extending annular groove 72, within which is received a resilient annular clutch member 74. In one operative form, the clutch member 74 is an annular rubber ring. An end face 76 of the clutch member 74 projects into engagement with a face of the disk member 20.

The operation of the above-described apparatus as a torque-limiting means should now be apparent. Referring to FIG. 5, the bolts 64 are spaced at equal intervals around the periphery of the collar 58. Referring again to FIG. 2, tightening of the bolts 64 applies an axially directed force to the pressure plate 66, causing the pressure plate 66 to frictionally engage the intermediate collar 68; and the intermediate collar 68 to frictionally engage the end plate 70. Transmission of the axial force to the end plate 70 forces the end face 76 of the clutch member 74 into clutching engagement with the face of disk member 70. The axially directed force applied to the disk member 20 by clutch member 74 is transmitted through each of the disk members 22-26 and the end plate 54 to the collar 48. Such axial forces result in frictional interengagement between adjacent disk members 20-26 of the stack, and cause the disk members 20-26, end plates 54 and 70, intermediate collar 68 and pressure plate 66 to move in unison with the shaft. Excessive torque between any of the disk members 20-26 and the shaft 14, however, overcomes the frictional forces and results in slippage between adjacent disk members and the shaft 14.

It should be apparent that the bolts 64 provide a convenient means for adjusting the limit torque, above which slippage occurs. Thus, tightening the bolts 64, that is adjusting them so that their ends project further to the right in FIG. 2, results in increased friction forces between the various relatively rotatable brush components, and increases the limit torque. Experimentation with particular brushes in particular applications

permits the operator to arrive at an optimum limit torque, such torque being sufficiently high to prevent slippage in ordinary brush operation, but sufficiently low to insure slippage rather than permit damage to the brush or brushed article due to entanglement of the bristles.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof.

It is claimed:

1. Rotary brush apparatus comprising a shaft, a plurality of individual coaxial elements rotatably mounted on said shaft and having bristle members extending radially therefrom, said coaxial elements disposed in side-by-side relation to define an axially elongated brush, and means coupling said coaxial elements to said shaft so that said elements normally rotate in unison with said shaft, said means coupling said coaxial elements to said shaft including torque-limiting means whereby said coaxial elements are adapted to rotate with respect to said shaft and coaxial elements to said shaft comprising a collar coupled to said shaft for rotation therewith and frictionally coupled to one side of said brush, a second collar coupled to said shaft for rotation therewith remote from said first collar, said torque-limiting means comprising means frictionally coupling said second collar to the other side of said brush, and selectively adjustable means coupled to said second collar and said brush for adjusting the predetermined amount of torque above which said brush member rotates with respect to said shaft.

2. Rotary brush apparatus in accordance with claim 1, wherein said selectively adjustable means comprises axially extending threaded means coupled to said second collar and said brush so that adjustment of said threaded means adjusts frictional forces between said collars and said brush and between adjacent coaxial elements.

3. Rotary brush apparatus in accordance with claim 2, said brush comprising an end plate coaxial with said shaft and disposed on said shaft between said second collar and one of said coaxial elements, and an annular resilient clutch element coupled to said end plate and adapted to frictionally engage said one of said coaxial elements.

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