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## ROTARY BRUSH MEANS AND BRUSH STRIP SLACK ACCUMULATOR THEREFOR

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The present invention relates to a rotary brush means and more particularly to a slack accumulator for a brush strip means adapted to relieve slack produced by longitudinal creepage of brush strip means wound around and along a brush core member during rotation.

Heavy duty rotary type brushes typified by those used in cleaning or sweeping streets or large industrial areas may embody several different constructions. The present invention is directed primarily to a helically wound brush means wherein brush bristles or filaments are first secured in a brush strip member and the brush strip member with filaments is coiled or wound circumferentially around a core to produce a cylindrical brush means. With this type of brush means the brush strip member is subjected to constant longitudinal stress due to the progressive flexing of the brush filaments of each turn as ends thereof contact and strike the surface to be swept. This continual longitudinal stress in turn produces an elongation of the brush strip means. Should both ends of the brush strip means be immovably fixed to the core on which the brush strip means is wound, a slight hump or buckling of the brush strip means is ultimately produced near one of its ends.

Even though the brush strip means are initially carefully wound on the core and a certain amount of initial tension is applied to seat the brush strip means on the core, invariably a small amount of slackness results. This slackness creeps or feeds towards one end of the brush strip means and accumulates at such one end when the brush means is put in operation. Thus, in addition to the elongation due to the constant use of the brush, a certain amount of slack will result initially due to the inherent difficulties of tautly winding a brush strip means on the core.

Heavy-duty rotary brush means of the type described must be dynamically and statically balanced. First, should the brush become circumferentially unbalanced, the unbalance, however slight, will produce an uneven unbalanced rotation of the brush means. The centrifugal force produced by such unbalance at one location on the brush means causes rapid wear of the supporting bearings, reducing bearing life, and thereby adding to the cost of maintenance and operation of a street sweeping machine. In addition, when the brush means is unbalanced the sweeping machine becomes difficult to operate and maneuver, thereby endangering other vehicles on the street as well as the safety of the operator.

Secondly, when a hump or buckling of the brush strip means is produced near one of the ends of the brush the circumference of the brush loses the absolute radial uniformity required for a clean efficient sweeping operation. Since the outer brush filament ends of rotary brush means are accurately trimmed to give a uniform and virtually continuous cylindrical brushing surface, any excrescences or protuberances of the type produced by such buckling will result in an inefficient sweeping operation.

Consequently, there is a need for a means or device that will retain the brush strip means tautly wound on the core yet will absorb or accumulate the initial slack and the creepage resulting from the longitudinal elongation of the brush strip means. The device of the present invention provides a novel means wherein a flexible mem-

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ber is attached to an end of a brush strip member so that the flexible member absorbs or accumulates the aforementioned slack and elongation, thereby allowing the brush strip means to maintain its unbuckled true cylindrical brush surface configuration.

In this invention the flexible member is attached at one end to a nonfixed end of brush strip means and at the other end to the core on which the brush strip means is wound. The flexible member may be attached to the core by means of an adjustable friction clamp whereby the clamp may be periodically readily adjusted to remove slack accumulated in the flexible member. This unique features insures the proper seating of the brush strip means on the core and its configuration at all times.

Accordingly, it is a general object of the present invention to provide a slack accumulator for a rotary brush means that avoids the foregoing disadvantages encountered in such rotary brush means.

An object of the present invention is to disclose and provide a slack accumulator for a rotary brush means that absorbs the slack created in a brush strip means wound on a high-speed rotary brush means.

Another object of the present invention is to disclose and provide a slack accumulator that aids in maintaining the trimmed cylindrical outer sweeping surface of a brush means.

A further object of the present invention is to disclose and provide a slack accumulator to be used on a rotary brush means to preserve the brush in a statically and dynamically balanced condition.

Still another object of the present invention is to disclose and provide a slack accumulator adapted to attach one end of a brush strip means to a brush core and absorb or accumulate any slack in the brush strip means resulting from creepage of the brush strip means due to elongation caused by repeated and continued use.

A further object of the present invention is to disclose and provide a rotary brush means that maintains statical and dynamical balance for substantially the life of the brush filaments.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same become better understood by reference to the following detailed description of the accompanying drawings showing an exemplary embodiment of the invention.

In the drawings:

FIG. 1 shows a front elevation view, partly in section, of a rotary brush means illustrating an exemplary embodiment of the present invention.

FIG. 2 is an end view taken from the left of FIG. 1 showing the slack accumulator of the present invention.

FIG. 3 is a sectional view taken along plane indicated by lines III—III of FIG. 2.

FIG. 4 is an enlarged fragmentary view of a tang attachment at the end of a brush strip.

FIG. 5 is a sectional view taken along plane indicated by lines V—V of FIG. 4.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1, which illustrates a preferred embodiment of the present invention, an exemplary heavy-duty brush means 10. The brush means 10 includes a cylindrical elongated core means 11 which may be either solid or hollow and constructed of metal or wood in well known manner.

An axle 12 supports core means 11 on a street sweeping machine (not shown) in well known manner. Axle 12 may comprise stub axles mounted at ends 13 of core means 11. Axle 12 defines an axis about which brush means 10 is desired to be dynamically balanced.

Core means 11 includes an outer surface 14 provided

with a helical groove 15 extending for the length of the core means. Helical groove 15 may be of any cross-sectional configuration suitably adapted to receive and hold a brush strip means 20, in this example a polygonal cross-sectional configuration is shown. Ends of helical groove 15 terminate in enlarged openings 16 provided in peripheral margins of end plates 13a of the core means, only one groove end being shown, the other end being similarly arranged. Each opening 16 extends to the bottom of the groove 15 and is peripherally or circumferentially elongated. One edge of said opening or aperture 16 is proximate to the end 20a of brush strip means 20.

Received within helical groove 15 and wound tautly around core means 11 is a brush strip means 20. Brush strip means 20 may be of any suitable brush strip type and may be of the type disclosed in copending application No. 119,869 filed June 27, 1961. Generally, brush strip means 20 comprises an elongated channel-like body member 21 as best seen in FIG. 5. Radially outwardly extending brush elements or filaments 22 are foldable within body member 21 and held in place by a retainer element 24 and by intermittently spaced crimps 23 along the upper side wall edges of the body member. The retainer element 24 may be of the twisted pair wire type as disclosed in copending application No. 187,388 filed April 13, 1962, now Patent No. 3,137,021. Material for the brush filament 22 may be synthetic fibers, natural fibers, or metal bristles, whichever of such materials being best adapted for the intended use of the brush means.

At one end of brush strip means 20 there is provided a flexible member 30 which extends longitudinally along the end portion of brush strip means 20 and projects or extends beyond the end extremity of the brush strip means 20. Flexible member 30 may be a suitable wire or stranded wire cable of relatively short length and of sufficient gauge or diameter to provide desired strength. The flexible member 30 may extend along the bottom wall of the brush strip body or, if desired, along one of the legs or side walls of the channel-like body member 21.

A tang member 32 may secure flexible member 30 to the body 21 of the brush strip means 20. Tang member 32 may have an open ended channel-like configuration of slightly larger dimensions than the channel-like body member 21 to receive a portion of body 21 with an end portion of member 30 therebetween. The tang member 32 includes outstretched parallel pointed fingers 33 that are adapted to be bent transversely over top edges of side walls of the body member 21 to tightly clamp the tang member on body member 21 without materially disturbing the brush elements 22. The tang member 32 then tightly frictionally embraces or grasps the channel-like body member 21 to frictionally hold and fix flexible member 30 on the end of body member 21. To facilitate assembly, an end portion of flexible member 30 may be welded to the inner surface of the bottom wall of the tang member 32. Other means may be used to secure flexible member 30 to the tang member or to the brush strip means.

Means for securing the opposite end of member 30 to the core means 11 may comprise a cable clamp 34 adapted to receive the other end of flexible member 30 and frictionally secure it against plate 13a to prevent longitudinal movement. Cable clamp 34 includes a pair of clamp bolts 34a which may be threaded in tapped holes provided in end plate 13a. Cable clamp 34 may be readily loosened to allow periodic slack accumulated in the flexible member 30 to be removed.

As best seen in FIG. 1, after the brush strip means 20 has been wound in groove 15 on core means 11 one end of brush strip means 20 is immovably fixed or anchored to core means 11 as by a tang, flexible member 30 and cable clamp. An initial tension may be applied to brush strip means 20 by tightening each turn progressively from the anchored end to seat brush strip means 20 tautly in groove 15. Flexible member 30 at the other end 20a is

then passed through enlarged opening 16 provided in end plate 13a of the core means 11. End 20a of the brush strip means 20 terminates at least just short of the proximate edge of the opening 16. Flexible member 30, after passing through opening 16, is disposed along a chord line of plate 13, the chord line extending from said proximate edge of the opening 16 to the cable clamp 34, and extending generally in the direction of the helical winding of the brush strip means. As best seen in FIG. 2 flexible member 30 is then held tautly in position by cable clamp 34. Brush means 10 is now ready for use and for mounting on a sweeping machine.

When in operation brush means 10 is rotated in the direction as indicated by arrow A in FIG. 2. As the brush means 10 is rotated and the brush filaments 22 contact and strike a surface (not shown) being swept, the progressive flexing of filaments 22 causes the brush strip means 20 to first displace any slack toward one end and then to elongate slightly. This slack and elongation creeps or feeds toward the end 20a of the brush strip means 20 where the device of the present invention is located. As the brush strip means 20 is slightly circumferentially displaced, as by longitudinal creeping thereof during sweeping operations, end 20a may pass the proximate edge of opening 16. Flexible member 30 is provided sufficient space in the enlarged opening 16 so that it may travel with the end 20a and may bend or flex with such creepage, but will not act to restrain nor restrict such creepage. As best seen in FIG. 2 the new position of the end of the brush strip means 20 after elongation is indicated in phantom lines. The slack accumulated in the flexible member 30 and indicated at S can then easily be removed by loosening bolts 34a in the cable clamp 34 and drawing the flexible member tight. A tightening of the cable clamp 34 will then return the brush means 10 to its operative condition with the brush strip means 20 tautly wound in groove 15.

It should be noted that the brush means 10 virtually never becomes dynamically unbalanced due to the creepage of the brush strip means 20. No humps or buckling are created by this creepage in that flexible member 30 accumulates any slack which is periodically removed.

It should be particularly noted that longitudinal displacement of brush strip means 20 is transmitted to a relatively small light weight narrow flexible member in a direction which positions the member 30 progressively closer to the axis of the rotary brush means. Thus the effect of dynamic unbalancing due to shift of material is reduced to the minimum because such shift is toward the axis instead of away from the axis and dynamic balance remains virtually unchanged. Flexible member 30 permits brush means 10 to retain the trimmed cylindrical outer sweeping surface.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

#### I claim:

1. In a rotary brush means including a core means, a preassembled brush strip means helically wound thereon in one direction and including a body member, brush filaments and a retainer element for said filaments, the provision of:

an end plate on said core means having a circumferentially enlarged peripheral opening;  
a flexible cable member passing through said opening;  
first means connecting one end of said cable member with one end of said brush strip means;  
and second means connecting the other end of said cable member with said end plate at a location lying along a chord of said plate defined by said second connecting means and the edge of said opening in proximity to the end of the brush strip means.

2. A slack accumulator means for a brush strip means

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helically wound about a core means in one direction comprising, in combination:

plate means having a peripheral plate margin extending radially beyond the surface of said core means, said plate margin having a peripherally elongated opening defined by spaced edges, one edge being proximate to one end of the brush strip means;

and a slack accumulator flexible member extending through the opening initially at said one edge and having one end connected to the said one end of the brush strip means and having its other end connected to the plate means at a location lying on a chord line extending from said opening and in the general direction of the helical winding of the brush strip means.

3. A slack accumulator means for a brush strip means helically wound about a core means in one direction comprising, in combination:

means on the core means providing an opening therein enlarged in the direction of the helical winding and adjacent one end of the brush strip means;

and a slack accumulating flexible member having one end connected to the said one end of the brush strip means and having its other end connected to the core means at a location beyond said opening and in the general direction of the helical winding.

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4. In combination, a brush strip means helically wound in one direction and adapted to be anchored at one end thereof;

and slack accumulator means movably retaining the other end of the brush strip means,

said slack accumulator means including a flexible member extending generally in the direction of the helical winding of the brush strip means,

means releasably securing the other end of the flexible member,

an enlarged aperture means between said securing means and the adjacent end of the brush strip means to accommodate movement of the flexible member upon displacement of the other end of the brush strip means in the direction of the helical winding.

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