June 29, 1971 D. E. SCRUGGS ET AL 3,588,937

STREET SWEEPING BROOM CONSTRUCTION WITH INCLINED BRISTLES

Filed Dec. 5, 1968 2 Sheets-Sheet 1

FIG. 1.

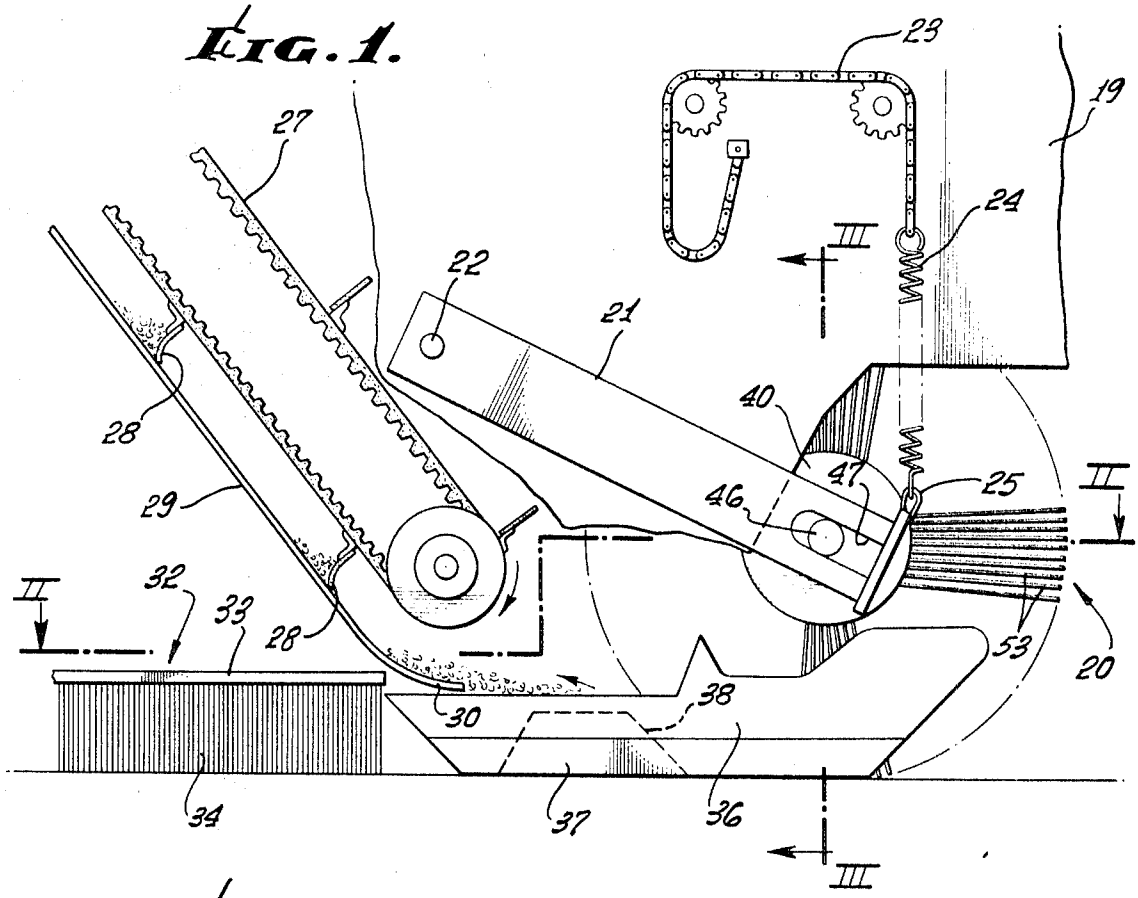


FIG. 3.

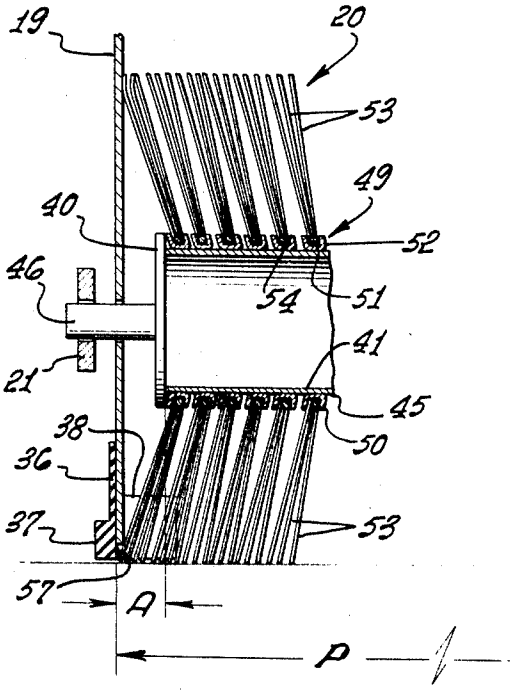
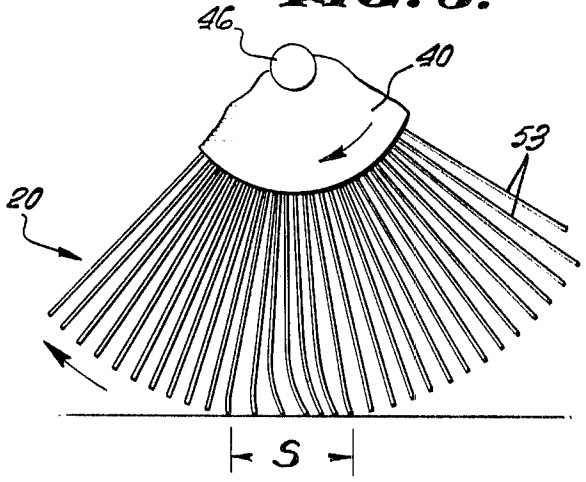


FIG. 5.



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FIG. 2.

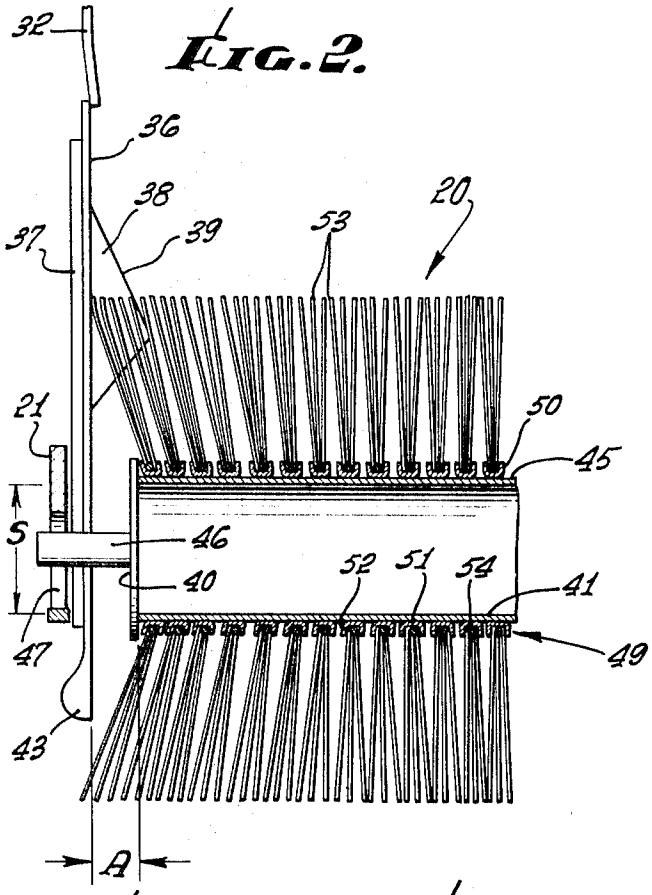


FIG. 7.

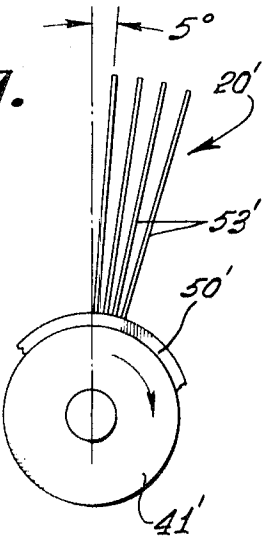


FIG. 8.

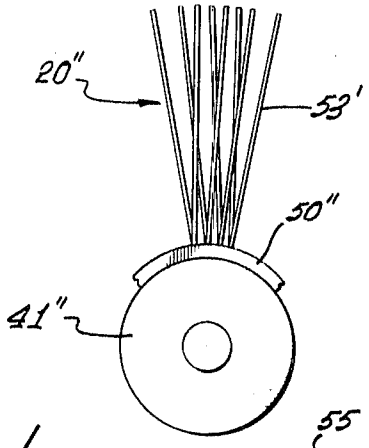


FIG. 6a.

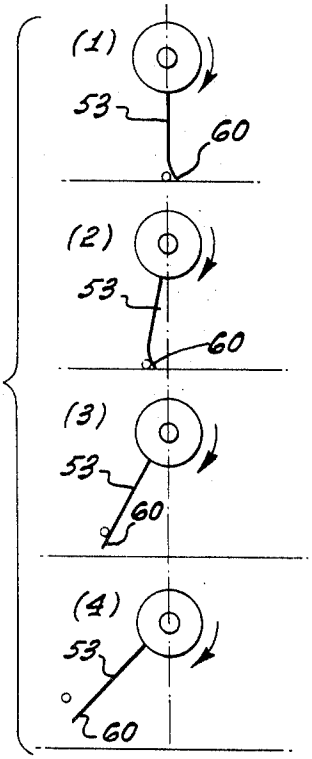


FIG. 6b.

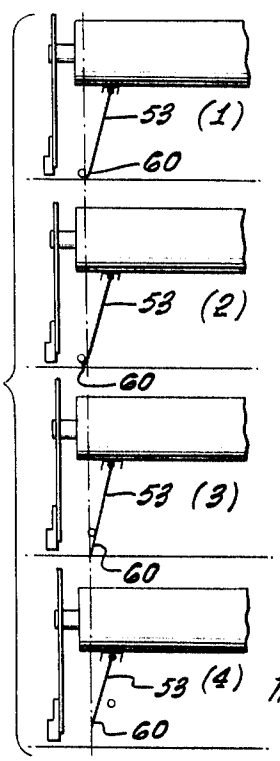
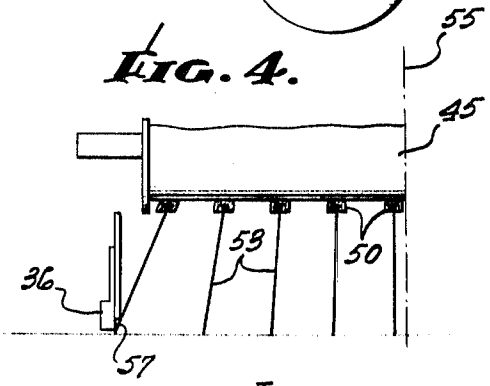


FIG. 4.



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STREET SWEEPING BROOM CONSTRUCTION WITH INCLINED BRISTLES

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Int. Cl. E01h 1/02; A46b 9/02
U.S. Cl. 15—82 11 Claims

ABSTRACT OF THE DISCLOSURE

A street and industrial sweeper broom construction having brush filaments arranged to smoothly and uniformly sweep a surface without the presence of streaks throughout the length of the broom and at surface areas beyond core ends of the broom and extending to dirt and debris guide means on a sweeping machine, said broom construction being readily reversible to obtain maximum wear and having filaments inclined longitudinally to provide continuous effective novel surface sweeping action.

BACKGROUND OF THE INVENTION

Prior proposed street sweeper brooms have included core members having various arrangements of brush bristle means thereon. In some prior brooms, bristles were retained in a spiral or helically grooved core surface and secured by a hand-coiled cable drawn under tension in the grooves of the core. Such bristles were directed radially outwardly with only slight flaring of bristles. Other prior proposed brooms included helical brush strip constructions comprising a continuous preassembled channel section base member with bristles and a wire retainer therein carried by and helically wound around a cylindrical core surface. The bristles were outwardly directed along radians. Still other prior proposed brooms included a core means having brush strip means extending parallel to the axis of the core and providing a plurality of circumferentially spaced rows or layers of brush bristles.

When such prior proposed brooms were used for a period of time, crowning of street surfaces or improper adjustment of the relationship of the axis of the broom to the street surface produced uneven wearing of an original cylindrical configuration of the broom and such brooms became slightly conical or frusto conical in shape. When such non-uniform wear occurred, it was desirable to reverse the broom so that the wear could be equalized throughout the length of the broom during further use of the broom.

In street sweeper machines such prior proposed brooms were mounted with the vertical plane of the end filaments and core end spaced from the vertical plane of the inboard face of a guide shoe carried by the sweeper machine, the guide shoe serving to direct debris and dirt particles on the street inboardly and into the path of the bristles of the broom. As a result of the space between these two planes, a street sweeping machine often left streaks of unswept material on a street surface. Attempts to solve this streaking problem have been made by providing inwardly extended deflectors on the shoe so that dirt is directed into the sweeping path of the broom. However, streaking still occurred because some dirt was not deflected and was not subjected to the sweeping action.

The present invention contemplates a novel broom construction for sweeping street and industrial surfaces without leaving streaks or lines of material on the surface. A novel broom of the present invention comprises a core member having a cylindrical surface upon which a helically formed brush strip means is carried and contemplates winding of the helical strip on the core member in

such a manner that at the longitudinal center portion of the broom, the brush strip means provides brush filaments extending outwardly along radians lying in a plane normal to the axis of the core member. In opposite directions from the center of the broom, the filaments are then gradually and progressively inclined toward the ends of the broom so that upon reaching each end of the core member the angle of inclination of the brush filaments with respect to a plane transverse and normal to the axis of the core will reach a selected angle, approximately 5°. Such longitudinal inclination of the filaments at the end of the broom causes the bristle tips to move in a vertical plane which may slightly overlap the plane of the inboard face of the guide shoe of the machine. Thus, bristles at the end of the core provide a sweeping action beyond the ends of the core and at the area where streaking has occurred. The slight overlap of the vertical planes causes the effective density of the filaments at the streaking area to be increased to provide effective sweeping to the edge of the sweeping path.

Moreover, the slight and progressively increased inclination of the bristles towards each end of the core member provides a novel action with respect to dirt particles on the surface. As a bristle tip contacts a dirt particle, the dirt particle is flicked not only forwardly of the direction of travel of the bristle tip but also is imparted an inboardly directed force because of the angle of inclination of the bristle. Thus, the inclined brush filaments direct and flick dirt particles slightly inwardly towards the center of the path of the brush.

The primary object of the present invention, therefore, is to disclose and provide a novel street sweeping broom construction which effectively cleans a surface along a sweeping path defined by a sweeping machine.

An object of the present invention is to disclose and provide a novel arrangement of brush filaments on a street sweeping broom to effect a novel surface sweeping action.

Another object of the present invention is to disclose and provide a novel combination of a street sweeping broom and dirt and debris guide means whereby effective sweeping of a surface extending between guide means on such machine is accomplished.

A further object of the present invention is to disclose and provide a novel broom construction of the type above described wherein said broom is readily reversible to obtain maximum wear and effectiveness of the broom construction.

An object of this invention is to disclose and provide a brush or broom having a broom face of varying bristle tip pattern and arrangement where particles of different size and density on a brushing zone are effectively removed therefrom, such varying pattern including varying inclination of filaments in the direction of ends of the broom.

A specific object of the present invention is to disclose and provide a novel construction of a continuous helical brush strip coil which is endwise reversible and which includes bristles longitudinally inclined toward each end of the coil.

Many other objects and advantages of the present invention will be readily apparent from the following description of the drawings in which an exemplary embodiment of the invention is shown.

In the drawings:

FIG. 1 is a fragmentary side elevational view of a portion of a street sweeping machine embodying this invention.

FIG. 2 is a fragmentary sectional view taken in the horizontal planes indicated by lines II—II.

FIG. 3 is a fragmentary sectional view taken in the vertical transverse plane indicated by the line III—III of FIG. 1.

FIG. 4 is a fragmentary elevational view of a sweeper broom embodying this invention.

FIG. 5 is a fragmentary end view of the broom shown in FIG. 4.

FIG. 6*a* is a schematic side view of a single brush filament to exemplarily illustrate sweeping action thereof. FIG. 6*b* is a schematic back view of the filament in FIG. 6*a* to illustrate the effect of longitudinal tilting.

FIG. 7 is a fragmentary sectional view of a broom embodying a modification of this invention.

FIG. 8 is a fragmentary sectional view of a broom embodying still another modification of this invention.

A street sweeping machine as for example, a well-known machine made by Wayne Manufacturing Company, adapted to utilize the present invention is fragmentarily illustrated in FIG. 1. Generally speaking, such a sweeping machine includes a chassis **19** (only partially shown) upon which may be mounted a cylindrically configured rotatable street sweeping broom means **20** embodying this invention and supported at opposite ends by rearwardly and downwardly inclined broom support members **21** pivotally mounted at **22** from the machine chassis. The vertical height of the brush may be adjusted by chain means **23** provided with a tension spring **24** connected at **25** to the lower end of the broom support member **21**. Forwardly of the broom **20** is an endless elevator or conveyor belt **27** provided with spaced cleats **28** cooperable with an upwardly inclined wall **29** for receiving, adjacent its bottom portion **30**, debris and dirt swept by broom **20** for transporting said debris and dirt upwardly to a hopper or receptacle provided in the machine.

The street sweeping machine includes means for directing debris on a surface being swept into a confined sweeping path. In this example, such debris directing means includes forwardly extending spaced slightly outwardly flaring side brush means **32** comprising a brush strip support means **33** suitably mounted on chassis **19** and provided with downwardly extending brush bristles **34** adapted to contact the surface to be swept. Forwardly of the brush means **32** may be front debris and dirt deflector means, not shown. Rearwardly of the brush directing means **32**, chassis **19** supports spaced parallel debris guide shoes **36** which extend from brush means **32** rearwardly to a point slightly beyond the back edge of a sweeping zone indicated at S, FIGS. 5 and 2. Guide shoe **36** may include a bottom rubber or resilient strip **37** adapted to slide along the surface being swept, the inboard faces thereof defining a street sweeping path indicated by P, FIG. 3. On the inboard face of guide shoe **36** may be supported a generally triangularly shaped deflector **38** which provides an inwardly directed angularly disposed guide face **39** extending inboardly beyond the plane defined by end face **40** of broom core member **41**. Guide shoe **36** includes an upwardly extending outboardly flared rear side wall portion **43** which facilitates inboard deflection of brush filaments on broom **20** as later described.

Sweeping path P comprises the transverse space between the inboard faces of the guide shoes **36**, and a sweeping zone of approximate width S generally illustrates a working surface area for the sweeping broom. It will be noted that a space occurs between the vertical plane as defined by end face **40** of broom core member **41** and the vertical plane defined by inboard faces of the guide shoes **36**. In broom installations on street sweeping machines the space between these two planes may vary and may be unequal at opposite ends of the broom core depending upon the manner by which the broom core is mounted on broom support members **21** and also upon possible tilt of the longitudinal axis of the broom core depending upon the surface being swept. Triangular deflectors **38** deflect dirt and debris inwardly; however, some debris after passing the innermost edge of deflector **38** moves outboardly towards guide shoe **36**. This outboard movement of debris and dirt behind deflector **38** is not swept by prior brooms and a longitudinal streak of unswept dirt and material remains on the surface after the sweeping machine passes. Such a streaking area is generally indicated at A, FIG. 2.

The broom **20** of the present invention is constructed and arranged to provide means cooperable with guide shoes **36** so that the entire sweeping path P will be effectively swept. Broom **20** may comprise broom core member **41** provided with a cylindrical surface **45** of selected diameter and end plates **40** having outboard end faces spaced from the inboard faces of guide shoes **36**. The core member **41** has a longitudinal axis with stub axles **46** extending into slots **47** provided in broom support members **21** for carrying the broom **20** in a manner which provides quick and convenient removal of the broom from support members **21**. One of stub shafts **46** may be provided with a connection to a driving means, not shown, for rotating the broom in well-known manner.

A continuous brush strip means **49** is wound about cylindrical surface **45** of the core member **41**. The continuous brush strip means **49** includes a channel section base member **50** provided with a bottom wall **51** and spaced side walls **52** which define a channel in which is received a folded portion of a brush filament **53** and a retainer member **54**. Such a continuous brush strip construction is formed as a reversible helical coil with filaments arranged symmetrically with respect to the mid-portion of the coil and longitudinally inclined towards opposite ends of the coil as further described hereafter.

As best seen in FIG. 4, broom means **20** is provided with brush strip means **50** wound and positioned thereon in a novel manner for street sweeping purposes. Adjacent a central plane **55** of broom means **20**, the brush strip means **50** and disposed on cylindrical surface **45** with side walls **52** of the channel strip generally disposed radially outwardly so that brush filaments **53** carried thereby are normally disposed along radians with slight flaring of the filaments. Progressively outboardly and in opposite directions from the central plane **55** side walls **52** of the brush strip means are gradually inclined longitudinally toward the end of the broom core member. Such inclination of the walls **52** causes filaments **53** to be inclined longitudinally of the axis of the core member and such inclination becomes progressively greater as the brush strip means approaches the end of the core member. At the end of the core member the side walls **52** of the brush strip means are inclined such that longitudinal inclination of bristles **53** approximates about 5°. The angle of inclination of filaments of the end turn of the brush strip means is sufficient so that end brush filaments **53** extend to and bear against the inboard surface portion **57** of the guide shoe **36** adjacent the sweeping surface. At streak area A, brush filaments are provided on the broom **20** for sweeping contact with area A in a manner more particularly explained hereafter.

Thus, broom **20** comprises longitudinally inclined brush filaments extending from 0° inclination at the central plane of the core member and progressively and gradually increasing to about 5° inclination at the end turns of the brush strip means. Such an arrangement is symmetrical about the central plane and provides reversal of broom **20** in the event filaments become unevenly worn.

The longitudinally inclined brush filaments provide effective sweeping action on a street surface. Such action can best be described by reference to action of a longitudinally inclined brush filament which extends beyond the end face of the core to the inboard guide surface of the guide shoe. When sweeping with a brush filament of the type used on street sweeping machines, such as a synthetic plastic material, for example polypropylene, it is preferable that the height of the broom be adjusted so that the tips of the filaments will touch a surface lightly to provide some rearward flexing of the bristle, and that as the broom is rotated, a filament tip will flick a dirt particle or debris element off the surface and into a path

where it may be deposited upon the bottom wall portion **30** for pickup by the conveyor elevator. In such flicking action of bristle tips at the central plane of the core, a dirt particle will be imparted motion in a direction virtually straight ahead in the path of travel. At the streaking area A, however, because of the longitudinal inclination of the filaments, the bristle ends will not only be bent slightly rearwardly by reason of its tip contact with the surface, but will also be bent slightly outboardly. Thus, such a longitudinally inclined laterally and rearwardy bent filament imparts a flicking action to a particle to direct such a particle not only in the direction of movement of the bristle, but also inboardly or torwards the center of the path because of the outbard deflection of the bristle filament. Thus, particles to be swep in the streak area A are not only brought into contact with end brush filaments, but are also swept forwardly and inwardly.

It should be noted that in the space between the end face and the inboard face of the guide shoe the outermost brush filaments may be pressed and squeezed against the inboard face (FIG. 4). In such condition during rotation, it will be aparent that the the brush filaments of end turns of the brush strip means will be crowded into more closely spaced relation by the inboard face, and therefore, provide a greater density of bristle or filament tips contacting surface A.

Exemplary action of a particle, as a result of the novel arrangement of brush filaments **53** is illustrated in FIGS. 6*a* and 6*b*. In FIG. 6*a* step by step flicking action of a bristle tip **60** on a particle is shown through positions **1** to **4**. Rotary motion of the broom about its longitudinal axis moves the tip **60** forwardly, bending filament **53**, and flipping the dirt particle forwardly and upwardly.

However, in FIG. 6*b* is illustrated the action of a dirt particle as a result of the longitudinal inclination of the filaments. In FIG. 6*b* the path of a filament during its successive rotation as illustrated in FIG. 6*a* (and corresponding therewith) comprises bending of the bristle tip in an outboard direction or laterally with respect to the direction of movement of the brush filament and in contact with a particle adjacent guide shoe inboard face **57**, it being understood that the illustrated filament is exemplary of any longitudinally inclined filament along the broom length. This view is from back to front or from the right of FIG. 6*a*. At position **2** the filament is still under bending and in contact with a particle. At position **3** the tip has moved above the surface and still lies generally in a vertical plane indicated at E—E. Unbending of the filament in both radial and longitudinal directions tends to move particles sidewise along the broom face, and thus particles are exposed to sweeping action of different bristle tips. Such movement, however, releases the lateral pressure on the filament which unbends and slightly bends in a reverse direction as it returns to its normal straight position, and imparts to the particle an inboard force component to direct the particle toward the center of the path. In position **4**, the tip is substantially above the surface and the particle has moved further inwardly. Thus, throughout end portions of the broom, dirt particles will be directed convergingly inwardly, at the greatest degree at the edges of the sweeping path, and to a lesser degree as the particles are disposed inwardly of the sweeping path. The longitudinal inclination of the brush filaments thus provides an effective sweeping action which in a street sweeping construction cleanly and uniformly sweeps the path defined between the guide shoes of the sweeping machine and prevents the collection of dirt particles in streaks at edges of the path.

In FIG. 7 a modification of broom means **20** is illustrated. Broom means **20'** may comprise a broom core member **41'** having a brush strip means **50'** found thereabout in the manner described in the foregoing embodiment of the invention. In this modification, however, brush strip means **50'** is provided with brush filaments **53'** disposed at a radial angle of approximately 5° to a radian of core member **41'**. Thus, in addition to the longitudinal tilt of the bristles, there is also imparted a rake of approximately 5° to the brush filaments. Such a 5° rake may be imparted to the bristles in the direction of rotation of the broom member so that the bristle tip will have a tendency to dig into the surface being cleaned.

In sweeping surfaces which may have substantial irregularity the provision of a 5° rake of the bristles in the direction of rotation will cause the tips to reach into deeper irregularities of the surface and to impart more energy into the sweeping action.

In the embodiment of broom means **20''** shown in FIG. 8, broom core **41''** may be provided with a brush strip means **50''** provided with brush filaments **53''** having longitudinal inclination with respect to the axis of core member **21''** in the same manner as in the prior embodiments of the invention. In this modification filaments **53''** may include certain filaments having a radial inclination or rake of approximately 5° in the direction of rotation of the broom core or of the broom **21''** and other brush filaments **53''** provided with radial inclination or rake of 5° in the direction opposite to rotation of the broom core. Thus, an intermixture of radially raked longitudinally inclined brush filaments **53''** are provided. The resultant sweeping action is one in which the sweeping effect of the longitudinally inclined filaments and the radial rake in the direction of rotation of the core as described in the second embodiment is present while the oppositely raked bristles provide a softer sweeping or wiping action on the surface.

It will be understood that the brush filament means may include brush filaments of natural and synthetic fibers and that the filaments be provided with a slenderness ratio selected for the particular sweeping condition for which the broom is to be used. The brush filaments may include a relatively hard surfaced filament resistant to abrasion or may include a relatively soft filament. In some instances, it may be desirable to intermix hard and the soft filaments depending upon the character of and condition of the surface to be cleaned.

It will thus be apparent that the relationship of the longitudinally inclined filaments to the surface being swept varies throughout the length of the broom, that the bristle tip pattern at the face of the broom varies and dirt particles, if not swept by one filament may be moved longitudinally of the broom for exposure to a different filament. The inclined filaments at the end portions of the broom provide a relatively lighter and softer broom action than those filaments at the middle portion of the broom. Thus, uniform sweeping is achieved for particles of different size, mass, and density.

The brush coil **49** formed as above described with symmetrically arranged oppositely directed longitudinally inclined filaments is reversible endwise to facilitate installation on a core member and to allow compensation for uneven wear. The width of the zone acted upon by the brush coil may vary depending upon the surface condition of the zone and the type of dirt, debris or other material or particles to be removed from the surface. The exemplary surface zone acted upon by the filaments of the coil construction has been referred to as a street surface; however, other types of surfaces which are large in area relative to the surface zone of the broom may also be effectively subjected to the action of the filaments.

Various modifications and changes may be made within the spirit of the present invention and all such changes coming within the scope of the appended claims are embraced thereby.

We claim:

1. A street sweeping construction comprising, in combination:

spaced guide means for directing particles into a path on a surface to be swept;

said guide means including spaced inboard guide surfaces lying in parallel planes;

a broom core member rotatably mounted between said planes and having a longitudinal axis and end faces spaced from said planes;

and brush filament means carried on said core member and having brush filaments symmetrically arranged about a central plane normal to and passing through said axis and progressively increasingly inclined longitudinally with respect to said axis from said central plane to said core member end faces;

said inclined filaments at said end faces extending to at least said guide surfaces;

said broom core member being normally positioned relative to said surface for bringing said filaments into selected sweeping tip contact therewith;

whereby said inclined filaments upon contact with said surface and particles to be swept thereon serve to flip said particles in the direction of rotation of said broom member and inwardly of the sweeping path.

2. A street sweeping construction as stated in claim **1** wherein

said inclined filaments at said end faces are pressed inboardly of the guide means to provide increased filament density for sweeping the area adjacent said guide faces.

3. A construction as stated in claim **1** wherein the angle of inclination of said filaments changes from 0° at said central plane to about 5° at said core ends.

4. A street sweeping broom construction for uniformly sweeping a path defined by spaced means on a sweeping machine, comprising:

a broom core member having a longitudinal axis and end faces; and

brush filament means carried on said core member and having brush filaments longitudinally inclined in opposite directions from the center portion of said core member in progressively increasing angles of inclination and at the end of said core member extending beyond said end faces thereof and adapted to sweep the space between the end of said core member and sweeping path defining means.

5. A street sweeping broom construction for uniformly sweeping a path defined by spaced means on a sweeping machine, comprising

a broom core member having a longitudinal axis and end faces; and

brush filament means carried on said core member and having brush filaments radially inclined and also longitudinally inclined in opposite directions at the end of said core member extending beyond said end faces thereof and adapted to sweep the space between the end of said core member and sweeping path defining means.

6. A construction as in claim **5** wherein said radially inclined filaments are inclined in opposite directions.

7. A reversible broom construction adapted to prevent formation of streaks along a surface being swept, comprising, in combination:

a rotatable core member provided with a longitudinal axis;

brush means carried by said core member and including a channel-shaped base member having a bottom wall and side walls;

brush filaments retained in said channel-shaped member and extending away from said core member and forming a cylindrical brush configuration;

said brush filaments including filaments inclined longitudinally of said axis outwardly away from the central portion of the core member;

inclined filaments at the end of the core member extending beyond the core member and adapted to bridge the space between the end face of the core member and a guide means on a broom carrier means.

8. A broom as stated in claim **7** wherein the bottom wall of said channel lies parallel to the axis of said core throughout its length, said side walls are progressively inclined, and the longitudinal inclination of said filaments progressively increases towards the ends of said core member.

9. A continuous reversible helical brush coil means for virtually uniform removal of particles from a surface zone, including:

a continuous base strip member having side walls and a bottom wall extending therebetween and providing a channel;

said side walls at symmetrically disposed portions of said base member being inclined longitudinally toward opposite ends of the coil means;

filaments retained in said channel on said base member;

said filaments being imparted corresponding longitudinal inclination by said inclined side walls whereby tip portions of said filaments are adapted to contact a surface zone for uniformly removing particles therefrom.

10. A coil means as stated in claim **9** wherein the inclination of said side walls and corresponding associated filaments progressively increase toward the ends of the coil means.

11. A coil means as stated in claim **10** wherein said inclination at ends of the coil means is approximately 5°.

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U.S. Cl. X.R.

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