United States Patent

[11] **3,633,231**

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[32] Priorities **Oct. 15, 1969**
[33] **Italy**
[31] **23400/A 69;**
Nov. 6, 1968, Italy, No. 23382/A 68; Dec. 10, 1968, Italy, No. 23830/A 68
Continuation-in-part of application Ser. No. 814,261, Apr. 8, 1969, now abandoned. This application Nov. 5, 1969, Ser. No. 874,355

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[54] **SCRUBBING APPARATUS FOR VEHICLE-WASHING STATIONS**
17 Claims, 14 Drawing Figs.

[52] U.S. Cl. ..... **15/21 E,** 15/DIG. 2
[51] Int. Cl. **B60s 3/06**
[50] **Field of Search** ..... 15/DIG. 2, 21 D, 21 E, 53, 97, 302

[56] **References Cited**
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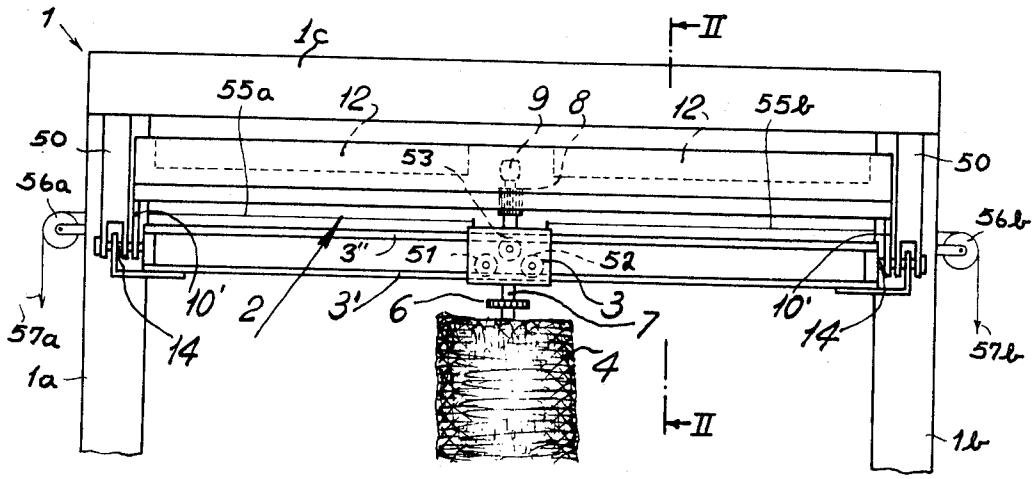
ABSTRACT: One or more scrubbing brushes, rotatable about generally vertical axes, are suspended from respective carriages displaceable across the path of a vehicle on a portal frame movable with reference to that vehicle. The carriages are horizontally biased toward the center of the frame and are guided in a structure which is limitedly swingable about a transverse axis above the vehicle so that a traction roller on the brush shaft engages a friction surface on the guide structure to drive the carriage outwardly, against its biasing force, at certain stages of operation. A deflector engageable by an idler roller on the same shaft prevents contact between the traction roller and the friction surface at other times, this deflector being displaceable by a servomechanism if two oppositely movable brush carriages are provided.



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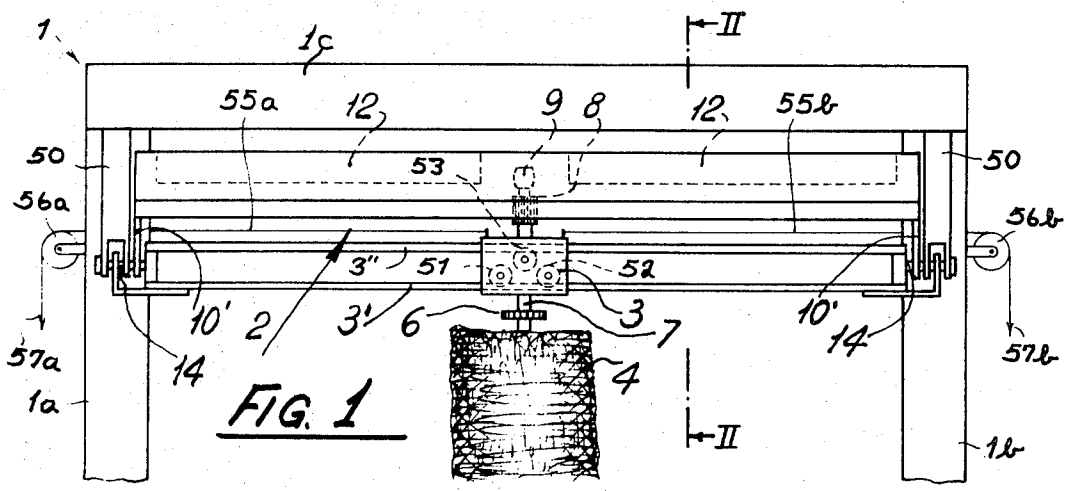

FIG. 1

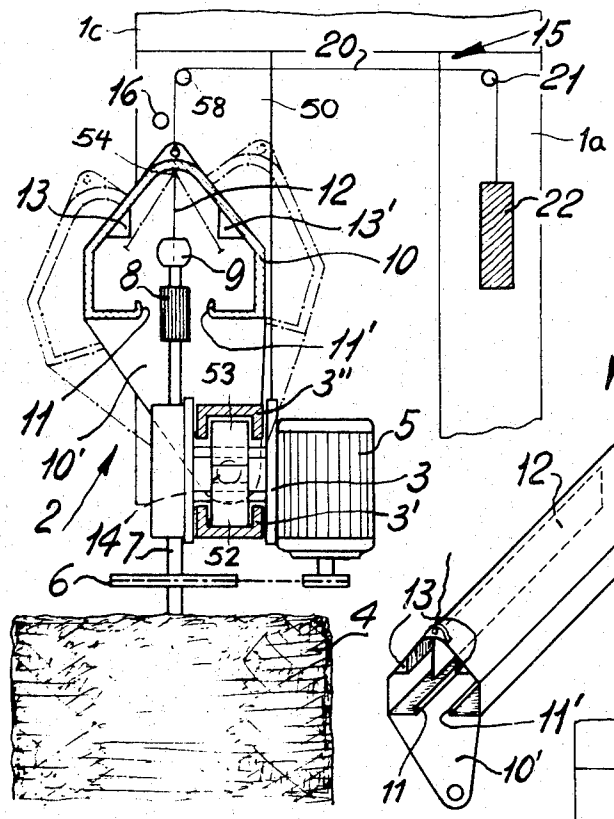

FIG. 2

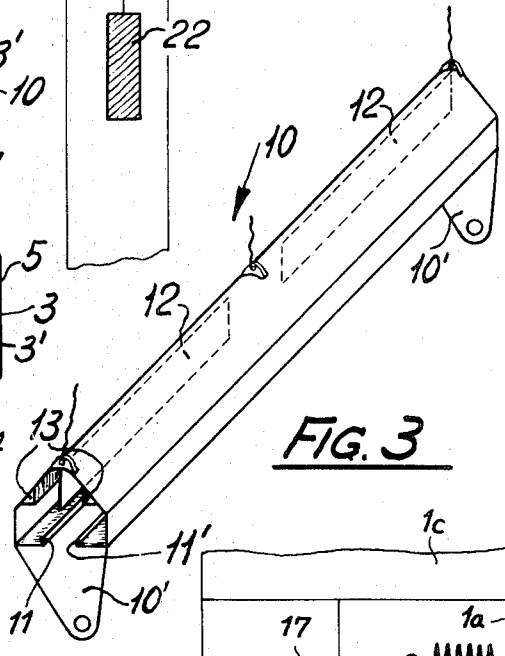

FIG. 3

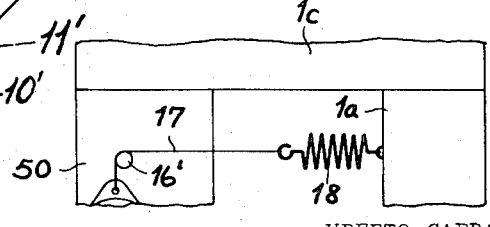

FIG. 2A

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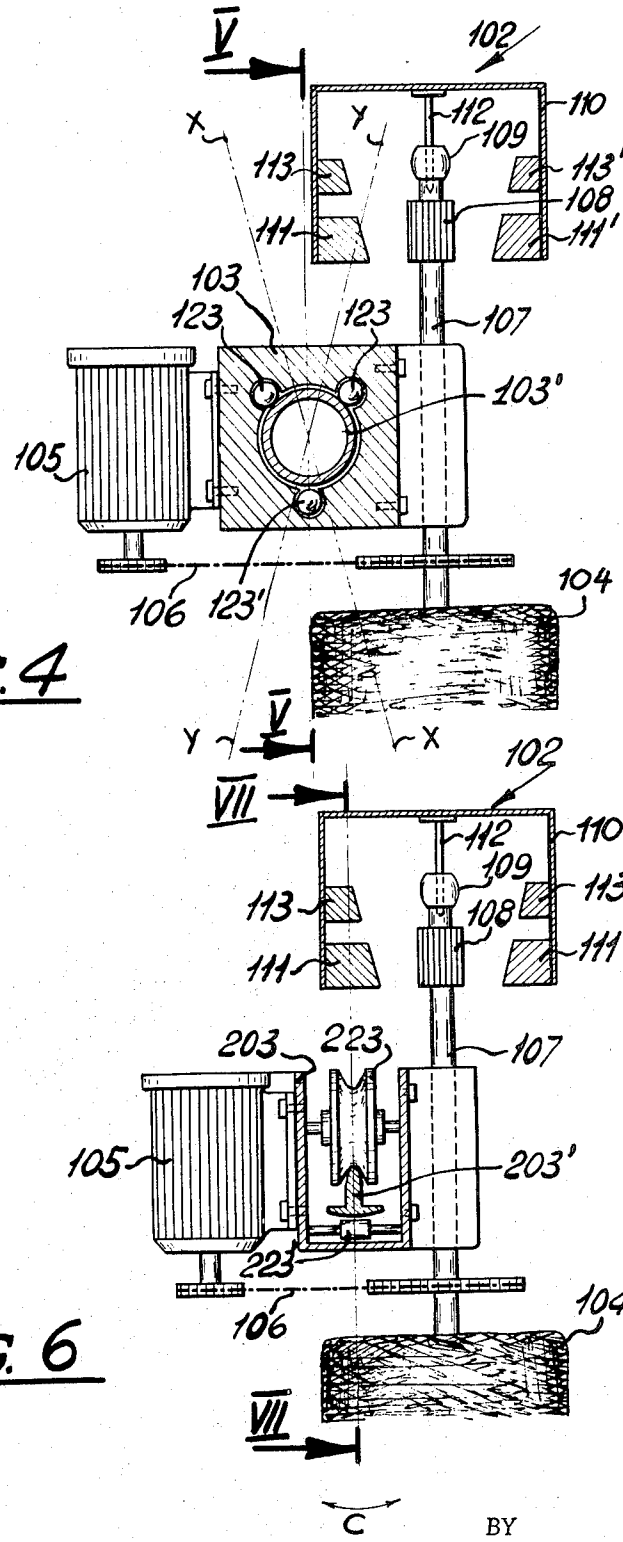

FIG. 4

FIG. 6

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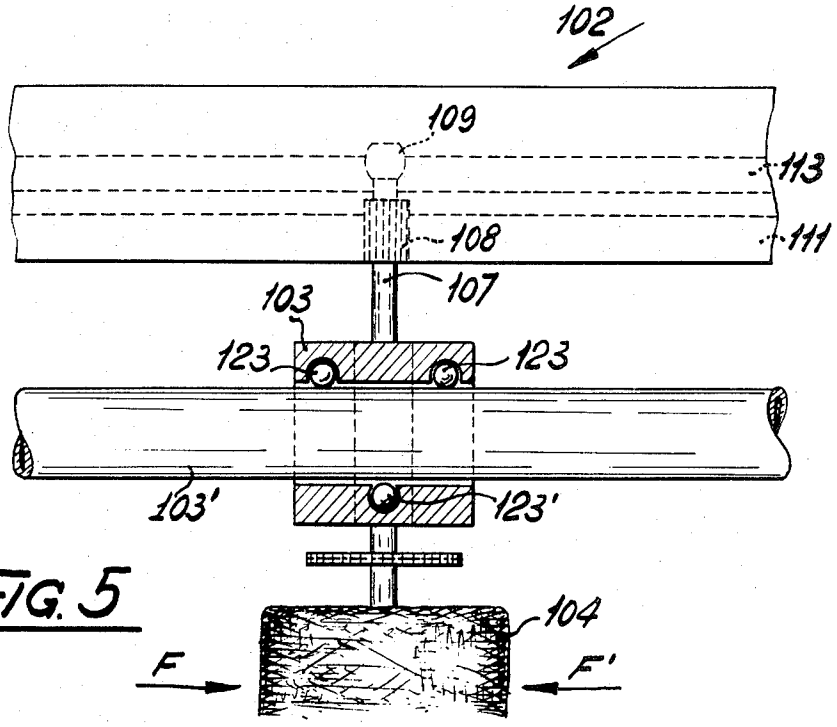

FIG. 5

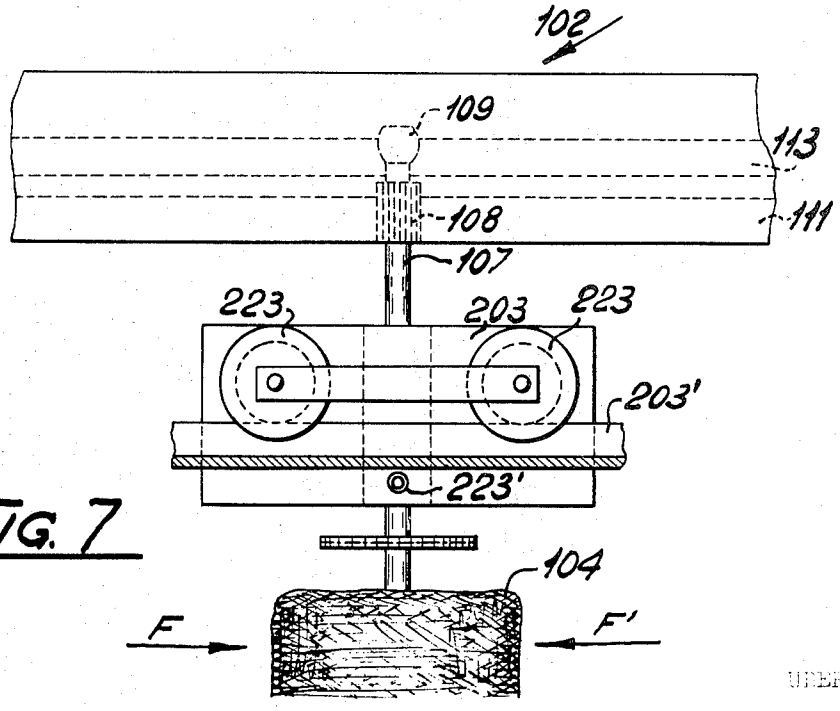

FIG. 7

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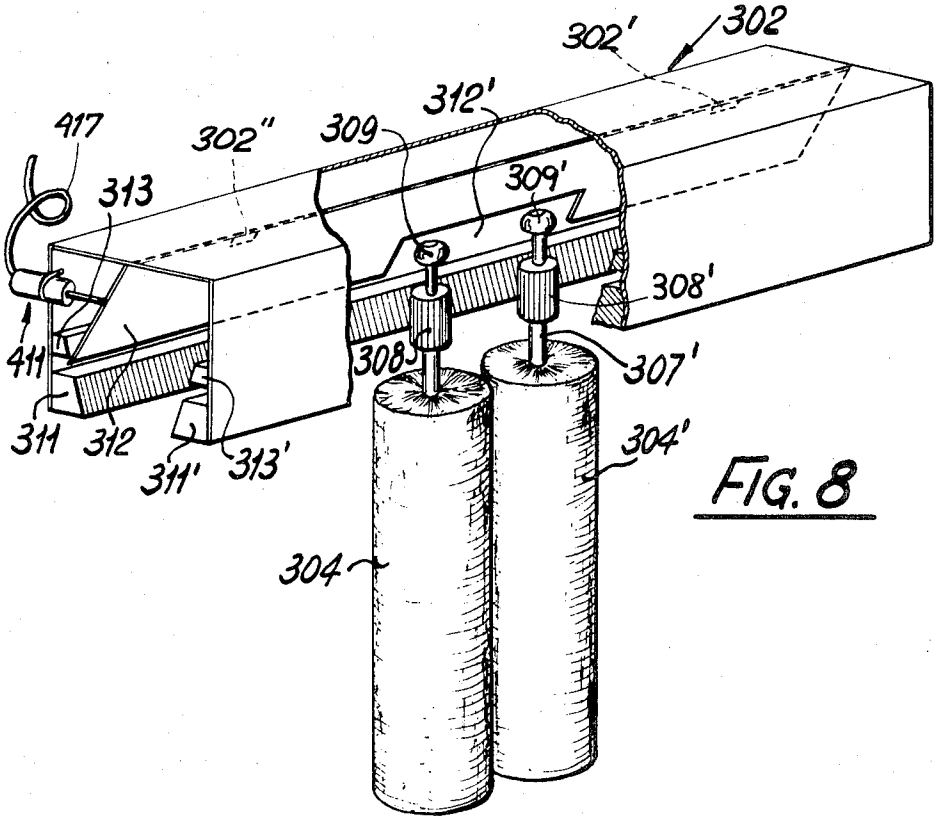

FIG. 8

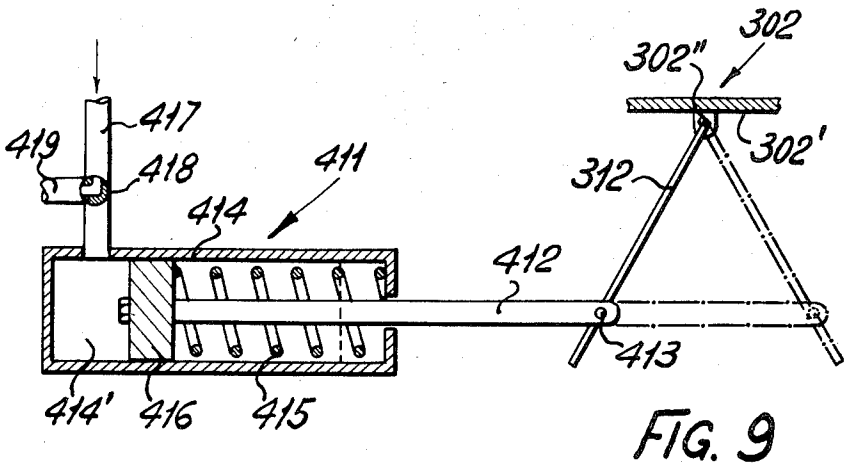

FIG. 9

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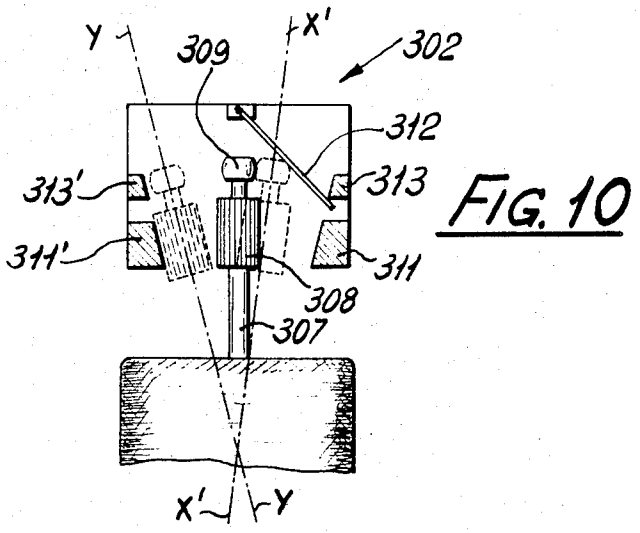

FIG. 10

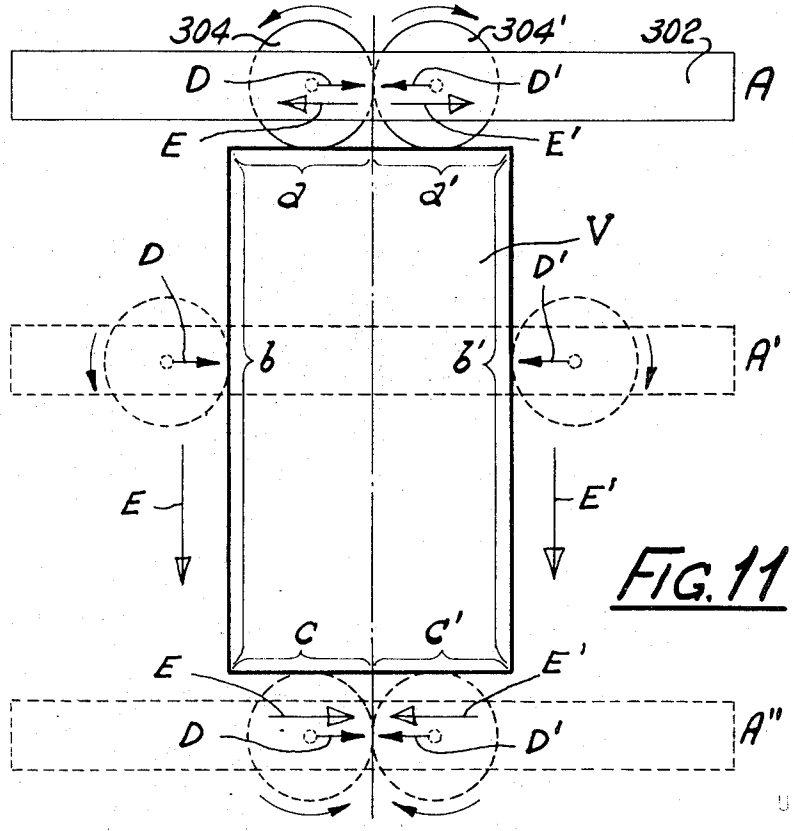

FIG. 11

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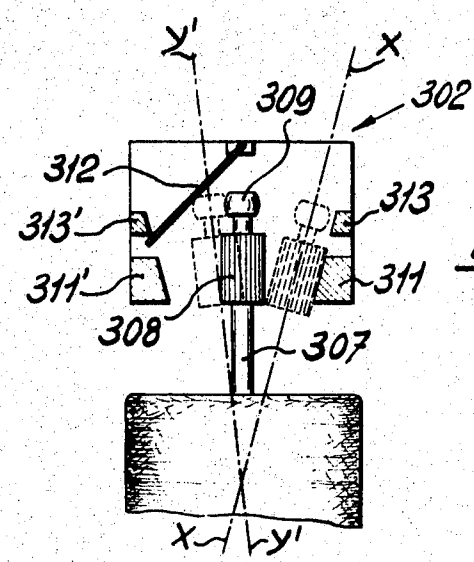

FIG. 12

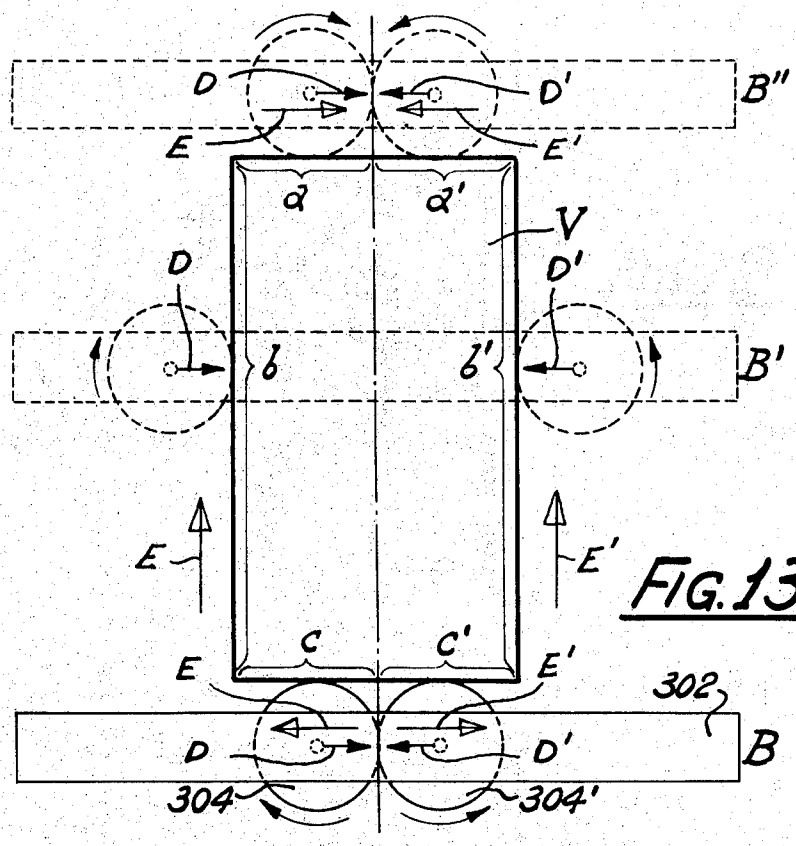

FIG. 13

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SCRUBBING APPARATUS FOR VEHICLE-WASHING STATIONS

This application is a continuation-in-part of my copending application Ser. No. 814,261 filed 8 Apr. 1969 and now abandoned.

My present invention relates to an apparatus for the scrubbing of vehicular surfaces, as used in a washing station for automotive vehicles.

In such washing stations it is customary to provide a portal frame whose uprights or jambs straddle the path of a vehicle to be washed while its lintel extends transversely above this vehicle, the frame of the vehicle being relatively movable in a longitudinal direction (i.e. at right angles to the lintel) during a scrubbing operation. For this purpose the frame jambs may be mounted on rail-supported rollers or the vehicle may be slowly driven or towed through the frame.

In my copending application Ser. No. 707,836 filed 23 Feb. 1968, now U.S. Pat. No. 3,500,487, I have disclosed a frame of this general type on which a rotary scrubbing brush is suspended from a carriage slidably guided along a horizontal track for displacement in one direction or the other under the control of weights connected to the carriage via flexible cables; the weights move in respective wells which can be alternately filled with water and drained so that the carriage is pulled in one direction or the other.

In a system of this type, as noted in my copending application Ser. No. 814,261, it is frequently desirable to arrange the pull of the weights in such a way that the carriage and its brush or brushes will always be urged toward the center of the frame, thereby exerting the necessary pressure upon the lateral surfaces of the vehicle when the brush moves along these surfaces. When scrubbing either the front or the rear end of the vehicle, the brush will be advanced by this pull until it reaches the centerline whereupon a supplemental force must be provided to complete the sweep against the biasing effect of the weights. Thus, again in accordance with the disclosure of my copending application Ser. No. 814,261, the brush carriage is propelled across the remainder of the frame opening by the engagement of a traction roller on the generally vertical brush shaft with a friction surface extending across the top of the frame.

Advantageously, in such a system, the frame carries two parallel friction surfaces which are alternately engageable by the traction roller, depending on whether the brush is tilted out of the plane of the frame in one direction or the other. During the sweep of the front end of a vehicle, for example, the tilt of the brush will be forward so that the traction roller, if mounted at the upper end of the shaft beyond the suspension point, will engage the more rearwardly disposed guide surface; the opposite will be true during the scrubbing of the rear end of the vehicle. When sweeping along the side, the brush may swing in one direction or the other, depending on its sense or rotation; in either case it would not be desirable to displace the carriage from the position reached at the end of the preceding scrubbing stage, i.e. the sweeping of the front or rear surface. Thus, means should be provided for blocking the engagement of the traction roller with either of these friction surfaces during certain stages of operation.

Such blocking means, as likewise disclosed in my copending application Ser. No. 814,261, advantageously may take the form of a deflecting strip engageable by an idler roller on the shaft, the strip being swingable about a horizontal axis parallel to the friction surface so as to lie alternately on one or the other side of the shaft.

An object of my present invention is to provide an improved mounting for the brush carriage which, without enabling any untimely engagement between the traction roller and an associated friction surface, allows the brush shaft to be swung through a greater angle of tilt than normally necessary upon encountering salient formations on a vehicular surface to be scrubbed.

Another object of the present invention is to provide stable low-friction guidance for the shaft-supporting carriage.

It is also an object of my invention to provide means for allowing the use of a deflector, of the general type described and illustrated in my copending application Ser. No. 814,261, with a pair of symmetrically displaceable carriages designed to scrub opposite sides of a vehicle.

According to an important feature of my invention, the deflector and the guide track for the brush-supporting carriage are part of a structure which extends across substantially the entire width of the portal frame, advantageously just below its lintel, and is oscillatable about a horizontal axis against a stabilizing force tending to maintain it in a median position in which the brush shaft is tiltable against the vertical by only a small angle on either side. Thus, with the shaft swung out into one of its normal limiting positions, an additional deflection is possible by swinging the entire guide structure against a stabilizing force which may be supplied by a weight, a spring or equivalent restoring means.

In this manner, I eliminate the need for a flexible joint in the shaft itself as described and illustrated in my copending application Ser. No. 814,261.

According to another feature of my invention, advantageously but not necessarily combined with the preceding one, the guide track for the brush carriage or carriages is constituted by an elongate element tiltably supporting each carriage, e.g. a rod of circular profile or a rail having an upstanding web. A plurality of longitudinally spaced contactors, such as balls or grooved rollers, engage this element from above while an intermediate contactor is closely spaced from the underside of that element to prevent excessive rocking of the shaft in the plane of the frame.

According to a further feature of my invention, the brush shafts of two oppositely biased and symmetrically movable carriages coact with a single deflector concurrently engageable by both shafts, the deflector being advantageously a strip or blade provided with a central cutout which clears both shafts in a juxtaposed position of the tow carriages whereby the deflector may be swung to one side or the other before the carriages move apart. Such swinging of the detector is preferably accomplished with the aid of fluid-actuated servo means including a hydraulic or pneumatic piston coupled with the strip for displacing it in timed relationship with the movement of the carriages.

The above and other features of my invention will be described in greater detail hereinafter with reference to the accompanying drawing in which:

FIG. 1 is a front-elevational view of the upper part of an otherwise conventional portal frame equipped with my improved guidance and control means for a suspended scrubbing brush;

FIG. 2 is a cross-sectional view taken on the line II—II of FIG. 1;

FIG. 2A is a fragmentary view similar to the upper part of FIG. 2, showing a modification;

FIG. 3 is a perspective view of a swingable guide structure forming part of the assembly of FIGS. 1 and 2;

FIG. 4 is a view similar to FIG. 2, illustrating another embodiment;

FIG. 5 is a cross-sectional view taken on the line V—V of FIG. 4;

FIG. 6 is a view similar to FIG. 4, illustrating a further modification;

FIG. 7 is a view similar to FIG. 5 taken on the line VII—VII of FIG. 6;

FIG. 8 is a perspective view of the top of the portal frame (parts broken away) with two scrubbing brushes suspended and controlled in accordance with my present improvement;

FIG. 9 is a diagrammatic view of a servosystem for controlling a deflector forming part of the assembly of FIG. 8;

FIG. 10 is a somewhat diagrammatic cross-sectional view of part of the assembly of FIG. 8;

FIG. 11 is a diagrammatic plan view illustrating the displacement of the brush of FIGS. 8–10 in the scrubbing of a vehicle;

FIG. 12 is a view similar to FIG. 10, showing the parts in an alternate operating position; and

FIG. 13 is a view similar to FIG. 11, illustrating another phase in the scrubbing of the vehicle.

In FIGS. 1–3 I have shown part of a portal frame 1 having jambs 1*a*, 1*b* and a lintel 1*c*, this frame being of such size as to span the automotive vehicle in a washing station. Just below the lintel 1*c* the frame carries an assembly 2 for the guidance of a transversely reciprocable carriage 3, this assembly including a structure 10 of inverted-trough shape with a pair of cheek plates 10′ which are pivoted at 14 to a pair of arms 50 depending from an overhanging portion of lintel 1*c*. Pivot pins 14 oscillatably support a guide rail constituted by a pair of confronting channel members 3′, 3″ embracing a group of rollers 51, 52, 53 on carriage 3; rollers 51 and 52 rest on the lower channel member 3′ whereas roller 53 is slightly spaced from the upper member 3″ to engage it upon an excessive lateral swing (in the plane of the frame 1) of a shaft 7 rotatably journaled in carriage 3. Shaft 7 is driven, via a belt or chain transmission 6, from an electric motor 5 secured to the carriage and energized through a flexible cable not shown; the lower end of this shaft supports a scrubbing brush 4 of generally cylindrical configuration. The top of shaft 7 carries a knurled traction roller 8 rigid with the shaft and an idler roller 9 freely rotatable thereon. A pair of inturned edges 11 and 11′ of structure 10, extending over the full length of that structure, confront each other on opposite sides of roller 8 and form friction surfaces alternately engageable therewith when the shaft 7 and its brush 4 swing from their illustrated vertical position in one direction or the other.

A pair of deflecting plates 12 are hingedly mounted at the zenith of structure 10 so as to be swingable about a horizontal axis 54 into either of two limiting positions illustrated in dot-dash lines in FIG. 2. In such a limiting position the deflecting plates 12 rest against one of two longitudinally extending abutments 13, 13′ on either side of idler roller 9; upon movement of shaft 7 to the left or the right of its center position illustrated in FIG. 1, with the brush 4 thrust out of the plane of frame 1 so that traction roller 8 engages one of the two cooperating friction surfaces 11, 11″, its idler roller 9 comes to lie either forwardly or rearwardly of a deflector 12 (as seen in the direction of vehicle motion) so that a reverse swing of the brush will be stopped by contact between idler roller 9 and deflector 12 before the traction roller 8 can engage the opposite friction surface, the deflector then coming to rest against one of the two abutments 13, 13′. With a vehicle V (FIGS. 11—13) approaching the frame 1 (or vice versa) in the forward direction, i.e. so that its front end comes into contact with the brush 4, this brush is deflected forwardly whereby the shaft 7 tilts about the pivotable axis of pins 14 in a clockwise sense as viewed in FIG. 2. Roller 8 thereupon engages the rear edge 11′ of guide structure 10 so that the carriage 3 will move along the rail 3′, 3″ in a direction depending on the sense of rotation of shaft 7.

Carriage 3 is biased into its illustrated central position by a pair of wires 55*a*, 55*b* passing around deflecting rollers 56*a*, 56*b* on frame 1, these wires being anchored to respective weights as diagrammatically represented by arrowheads 57*a*, 57*b*. If the brush 4 is to scrub first the left side of the vehicle, weight 57*b* is rendered effective (as by immersing the weight 57*a* in water in the manner disclosed in my prior U.S. Pat. No. 3,500,487) so that a pull to the right (as viewed in FIG. 1) is exerted upon the carriage; against this pull the carriage is displaced to the left by a counterclockwise rotation of its traction roller 8 as viewed from above. When the brush moves off the left-hand front end of the vehicle, gravity tends to restore the shaft 7 to its normal vertical position; as the brush continues its counterclockwise rotation, however, its frictional engagement with the left vehicle surface (against which it is urged by the rightward pull of wire 55*b*) tends to swing the brush rearwardly so that roller 8 is moved toward the forward friction surface 11. Owing to the interposition of deflector 12, however, the roller 8 is kept out of contact with that surface and does not cause on untimely return movement of the carriage. When, next, the brush clears the side of the vehicle, the pull of wire 55*b* draws the carriage back toward the center of the frame; this coincides with a reversal of the relative motion of frame 1 and vehicle V so that the brush 4 is held in its rearwardly deflected position, with roller 9 still engaging the deflector 12 so that no traction is exerted upon the carriage through roller 8. As the carriage returns to its midposition, roller 9 reaches a clearance between the two deflectors 12 (which could also be combined into a single-deflecting strip, as described hereinafter with reference to FIG. 8) so that roller 8 is now free to cooperate with forward edge 11 in driving the carriage further to the right against the reverse pull of the weights which now biases it in a leftward direction. The scrubbing of the right side of the vehicle and of the remaining half of its rear and front ends then proceeds in a manner analogous to that described above.

The alternate tilting of shaft 7 to engage either of the friction surfaces 11, 11′, or to come to rest against an interposed deflector 12, does not require any rocking of the guide structure 10 from its normal position illustrated in full lines in FIG. 2. Under certain conditions, however, e.g. when the brush 4 encounters a sharp projection on the front or rear surface of the vehicle, the swing of the shaft must be increased. In such a situation the entire structure 10 swings about the pivotal axis of pins 14 against a restoring force which in FIG. 2 is represented by a weight 22 attached to a cable 20 passing around deflecting rods 21, 58 on the frame; cable 20 is anchored to the top of structure 10 so as to stabilize its position with the aid of a further deflector rod 16 opposing a counterclockwise swing as viewed in FIG. 2. In lieu of or in addition to a restoring force provided by a weight 22, such a restoring force may also be supplied by a spring 18 anchored to the jamb 1*a* or 1*b* and to a cable 17′ passing around a deflecting rod 16′ as shown in FIG. 2A; it will be understood that several such weights and/or springs may be disposed along the lintel 1*c* for jointly stabilizing the structure 10. Two opposite swungout positions of that structure have been illustrated in dot-dash lines in FIG. 2.

The brush-guiding system 102 shown in FIGS. 4 and 5 is generally similar to that illustrated in the preceding Figures; corresponding elements have been designated by like reference numerals preceded by a "1" in the position of the hundreds digit. The guide element 103′ for the carriage 103 has the form of a round rod traversing the body of the carriage here shown as a solid block. Rotatably imbedded in this block are two longitudinally spaced pairs of balls 123 serving as low-friction bearing elements in contact with the upper rod surface. A similar ball 123′ is disposed between the two pairs of balls 123 and is closely spaced from the lower rod surface but does not normally contact same; the presence of this additional contactor prevents, as in the previous embodiment, any excessive swing of the brush in response to frictional forces F, F′ acting upon the brush during the scrubbing of one of the transverse vehicle surfaces. The number and position of contactors 123, 123′ can, of course, be modified. Rod 103, which may be fixedly held in the cheek plates (not shown) of the guide structure 110, thus enables a pivoting of the vertical plane of symmetry of the carriage block between two limiting positions, relative to the structure, as indicated by lines X—X and U—Y in FIG. 4. In these positions the traction roller 108 engages either of its two friction surfaces 111, 111′ unless the idler roller 109 prevents such engagement by its contact with the swungout deflector 112 resting against abutment 113 or 113′; as in the previous embodiment, roller 109 never engages either of these abutments directly. Structure 110 may again be swingably mounted, e.g. about the axis of rod 103′, on the portal frame which has not been illustrated in FIGS. 4 and 5.

FIG. 6 and 7 show the same basic assembly 102 as FIGS. 4 and 5, yet with a modified carriage 203 and track element 203′ therefor. Element 203′ is a rail of inverted-T profile whose upstanding web is engaged by two grooved rollers 223 journaled in the U-shaped carriage 203. A counterroller 223′

is closely spaced from the underside of the bottom flange of rail **203'**, this underside being cylindrically convex about an axis which coincides with the upper edge of the web. Thus, the carriage **203** and the brush shaft **107** may oscillate freely in a plane transverse to rail **203'**, as indicated by an arrow C in FIG. **6**, with maintenance of a substantially constant spacing between rail **203'** and roller **223'**; a swing in the plane of the frame, however, is again possible only within narrow limits determined by the separation of roller **223'** from rail **203'**.

In FIG. **8** I have shown a guide structure **302** which is substantially identical with structure **102** of FIGS. **4–7** but from which two scrubbing brushes **304**, **304'** are suspended by means of respective shafts **307**, **307'** carrying traction rollers **308**, **308'** and idle roller **309**, **309'**. The two carriages rotatably supporting the shafts **307**, **307'** have been omitted in FIG. **8** but may have any of the constructions illustrated in the preceding Figures. Deflector **312** is here shown as a unitary strip hinged at **302''** to the top of structure **302'** (FIG. **9**) and provided with a central cutout **312'** clearing the two idler roller **309**, **309'** in the juxtaposed position of the two brushes **304**, **304'** and their respective carriages. Strip **312**, which is coextensive with the friction surfaces **311**, **311'** and the abutments **313**, **313'** on opposite sides thereof, can be swung about its hinge axis by a servomechanism **411** shown in greater detail in FIG. **9**. This servomechanism comprises a cylinder **411** to which air, oil or some other hydraulic or pneumatic fluid can be admitted through a flexible conduit **417** and which can be vented via a branch conduits. A piston **416**, urged to the left by a coil spring **415**, has a rod **412** articulated at **413** to the deflecting strip **312** for alternately swinging it between two extreme positions illustrated in full and dot-dash lines in FIG. **9**.

FIG. **10** shows the position of deflector **312** at the beginning of a scrubbing cycle depicted in FIG. **11**. Through proper sychronization of the operation of valve **418** (FIG. **9**) with the relative frame motion and the action of the weights, the deflector position illustrated in FIG. **10** coincides with a frame position A in which the guide structure **302** lies forwardly of the vehicle V and the two counterrotating brushes **304**, **304'** hang close to each other near the centerline of the vehicle.

In FIG. **11**, as well as in FIG. **13** described hereinafter, solid arrows D, D' show the direction of the pull exerted by the weights upon the respective brush carriages whereas hollow arrows E, E' indicate the relative motion of the carriages and the vehicle. The diameter of the brushes has been somewhat exaggerated in comparison with the vehicular outline; naturally, brush carriage may support more than one brush.

At the start, the biasing forced D, D' urge both carriages toward the centerline and the brushes **304**, **304'** are swung forwardly by the relative thrust of the vehicle and the frame; this thrust, which could also be generated by a stored biasing force such as the pull of weights, urges the two brushes into firm contact with the forward surface of the vehicle V. The two brush shafts, as illustrated in FIG. **10** for the shaft **307**, now occupy the position X—X in which their traction rollers bear upon the friction surface **311'** whereby the two carriages move outwardly in opposite directions as brushes **304** and **304'** rotate clockwise and counterclockwise, respectively.

It should be observed that, with the controlled displacement of deflector **312**, it is not essential that the longitudinal axis of the vehicle V be exactly perpendicular to the plane of the frame since the system will operate properly even if one of the brushes is deflected before the other, thus starting earlier on its outward travel. As each brush reaches its outermost position, having swept a respective half *a*, *a'* of the front and of the vehicle, it reverses its inclination as previously described so that its shaft occupies the blocked position X'—X' shown in FIG. **10** while the brush sweeps the corresponding lateral surface *b* or *b'*. After passing through an intermediate position A', the frame reaches a terminal position A'' in which the brushes maintain their inclination but move toward each other in response to their biasing forces D and D', their traction rollers being held disengaged from either friction surface **311**, **311'**.

After the brushes have scrubbed their respective halves *c*, *c'* of the rear surface of the vehicle, the inclination of deflector **312** is reversed as shown in FIG. **12**. Now, the return sweep starts as illustrated in FIG. **13**, with the frame moving successively through positions B, B', B''. In position B, again, traction is exerted upon the brush carriages by the engagement of rollers **308**, **308'** with friction surface **311** as illustrated in FIG. **12** for the shafts **308** assuming its limiting position X—X. During the forward sweep along surfaces B and B' the shafts assume the blocked position Y'—Y' in which they remain during the reverse scrubbing of front halves *a*, *a'* in frame position B''.

The swing of structure **10** from its normal position (FIG. **2**), or of equivalent structures shown in other Figures, may be used to operate a switch, not shown, for arresting the relative frame motion to permit the removal of an obstacle (e.g. an object extending from a window of the vehicle) encountered by the brush in its sweep.

I claim:

1. An apparatus for scrubbing vehicular surfaces, comprising:

a portal frame movable relatively to a vehicle to be scrubbed, said frame having a lintel extending transversely above such vehicle;

guide means spanning said frame below said lintel;

at least one carriage pivotally mounted on said guide means for reciprocation across said frame and swinging in a plane transverse thereto;

rotatable brush means suspended from said carriage by a generally vertical shaft rising beyond the swing axis of said carriage to the level of said lintel;

biasing means coupled with said carriage for urging same toward the center of said frame;

drive means on said carriage for rotating said shaft;

a traction roller mounted at the top of said shaft for rotation therewith, said lintel being provided with a friction surface parallel to said swing axis engageable by said roller for entrainment of said carriage in a swung-out position thereof against the force of said biasing means:

and blocking means on said lintel engageable with said shaft for selectively preventing engagement of said friction surface by said roller.

2. An apparatus as defined in claim **1** wherein said drive means is reversible, said guide means being provided with a second friction surface confronting the first-mentioned friction surface with said traction roller interposed therebetween for alternate engagement therewith, said shaft being tiltable into two opposite limiting positions for effecting such engagement, said blocking means being operative to prevent said shaft from reaching either of said limiting positions.

3. An apparatus as defined in claim **2** wherein both said friction surfaces extend over substantially the full length of said lintel, said blocking means comprising a deflector substantially coextensive with said friction surfaces and swingable about an axis parallel thereto for alternate engagement with opposite sides of said shaft.

4. An apparatus as defined in claim **3** wherein said shaft is provided with an idler roller engageable with said deflector.

5. An apparatus as defined in claim **3** wherein said lintel is provided with abutments alternately engageable by said deflector on opposite sides of said shaft.

6. An apparatus as defined in claim **3**, further comprising servo means coupled with said deflector for swinging same into either of two alternate limiting positions.

7. An apparatus as defined in claim **6** wherein said servo means comprises a fluid-actuated piston.

8. An apparatus as defined in claim **2** wherein said guide means comprises a structure swingable about a horizontal axis parallel to said friction surfaces.

9. An apparatus as defined in claim **8** wherein said structure is provided with stabilizing means tending to maintain same in a median position in which said shaft is tiltable against the vertical by only a small angle on either side.

10. An apparatus as defined in claim 9 wherein said stabilizing means comprises a source of restoring force anchored to said structure.

11. An apparatus as defined in claim 2 wherein said guide means comprises an elongate element tiltably supporting said carriage.

12. An apparatus as defined in claim 11 wherein said carriage is provided with a plurality of longitudinally spaced contactors engaging said element from above and an intermediate contactor engageable with the underside of said element for preventing excessive rocking of said shaft in the plane of said frame.

13. An apparatus as defined in claim 12 wherein said element is a rod of circular profile, said contactors being balls journaled in a sleeve surrounding said rod.

14. An apparatus as defined in claim 12 wherein said element is a rail with an upstanding web and a bottom flange having a convex lower surface centered on the upper edge of said web, said longitudinally spaced contactors being grooved rollers riding said web.

15. An apparatus as defined in claim 2, comprising a second carriage on said guide means and second rotatable brush means suspended therefrom with a shaft and drive means therefor substantially duplicating the first-mentioned carriage, brush means, shaft and drive means, said biasing means being coupled with said carriages for urging same toward each other upon the scrubbing of opposite sides of a vehicle, said blocking means comprising a deflector concurrently engageable with both said shafts.

16. An apparatus as defined in claim 15 wherein both said friction surfaces extend over substantially the full length of said lintel, said deflector being a strip substantially coextensive with said friction surfaces and swingable about an axis parallel thereto for alternate engagement with opposite sides of said shafts, said strip having a central cutout clearing both said shafts in a juxtaposed position of said carriages.

17. An apparatus as defined in claim 16, further comprising fluid-actuated servo means coupled with said strip for swinging same into either of two alternate limiting positions.

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