

Aug. 6, 1963

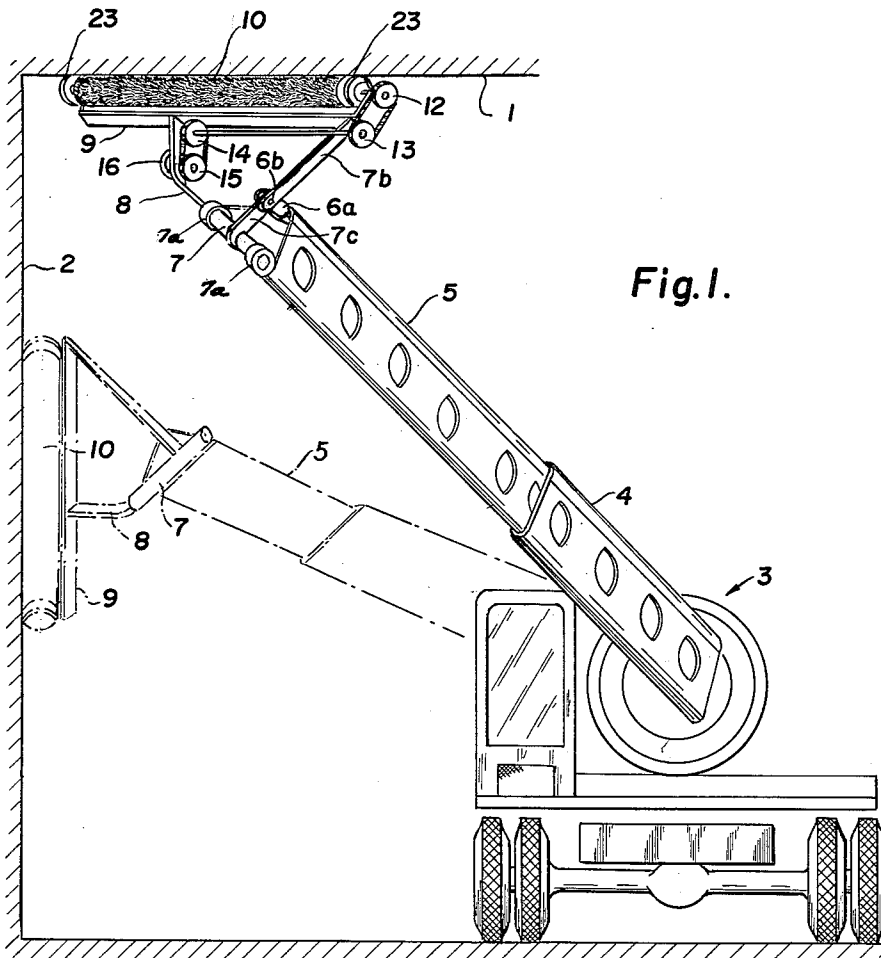
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3,099,852

POWER OPERATED BRUSH ATTACHMENT FOR EARTH MOVING MACHINE

Filed March 30, 1962

4 Sheets-Sheet 1



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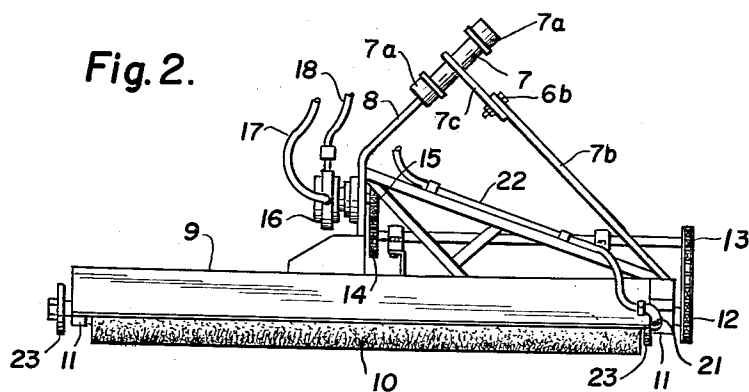
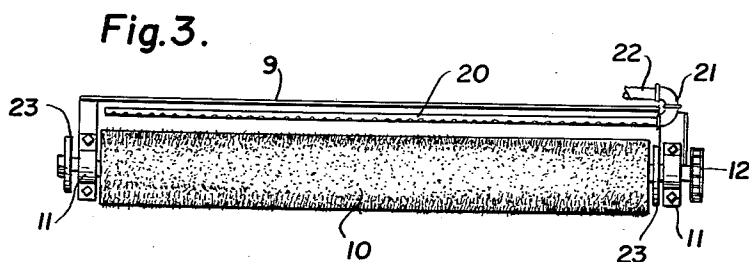
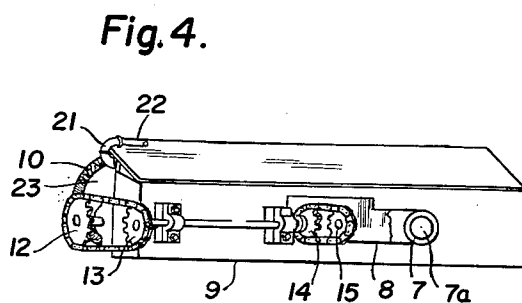
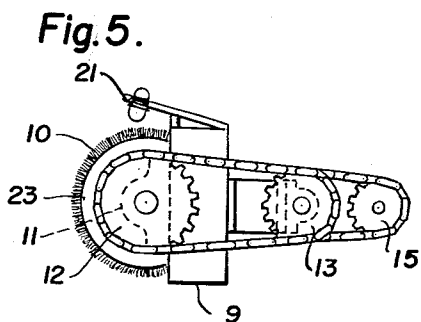
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POWER OPERATED BRUSH ATTACHMENT FOR EARTH MOVING MACHINE

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4 Sheets-Sheet 2



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Fig. 6.

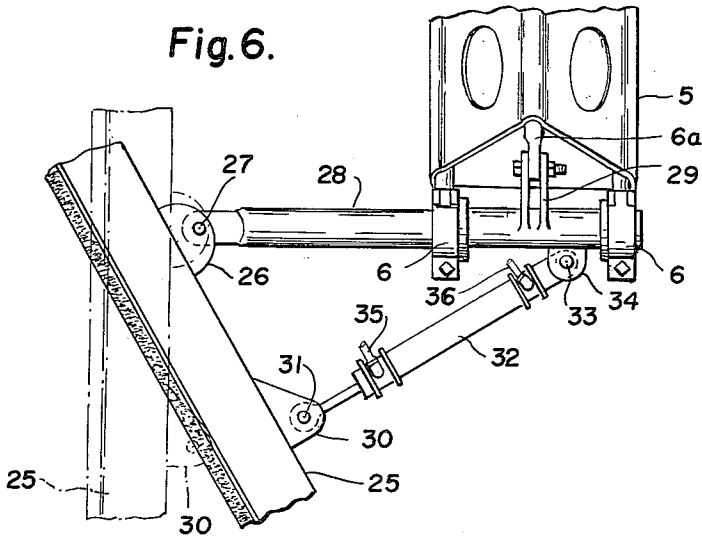


Fig. 7.

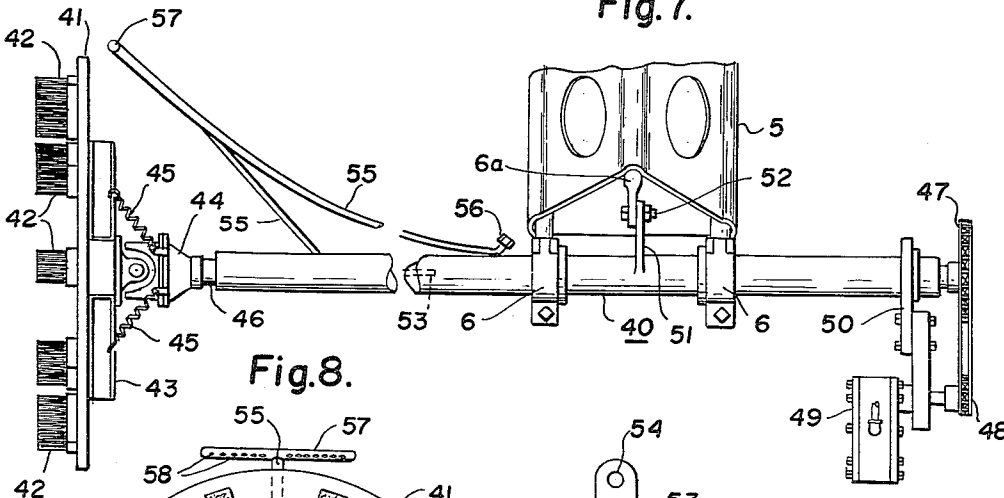


Fig. 8.

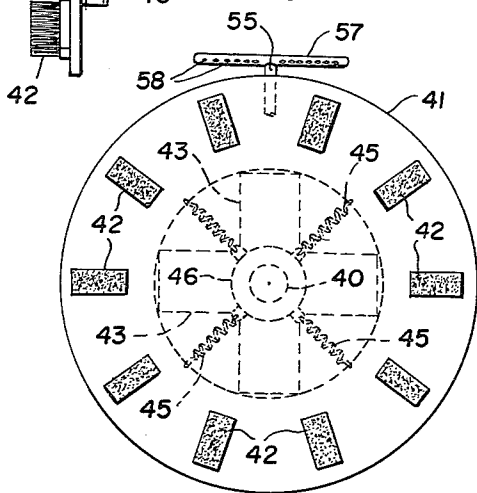
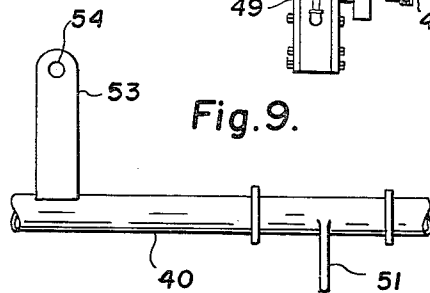


Fig. 9.



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Fig.10.

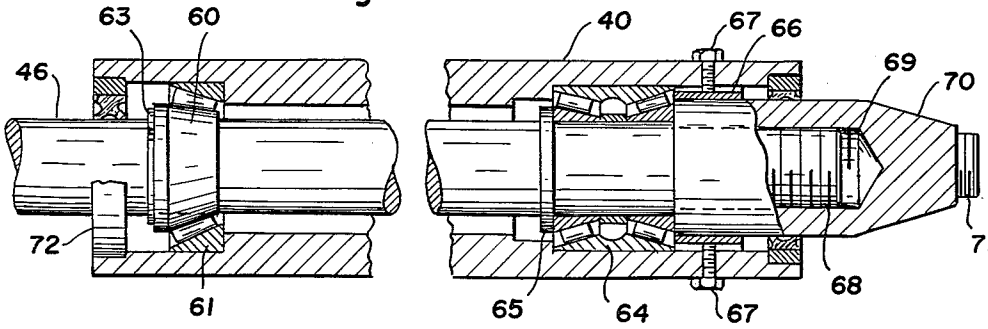


Fig.11.

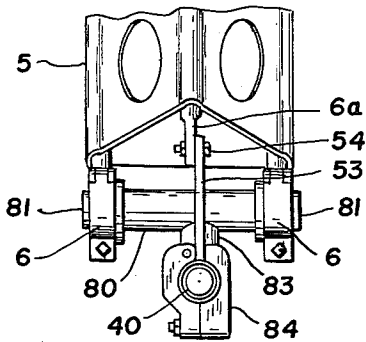
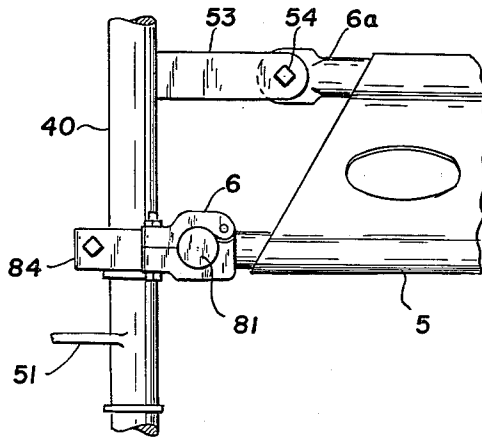


Fig.12.



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POWER OPERATED BRUSH ATTACHMENT FOR EARTH MOVING MACHINE

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4 Claims. (Cl. 15—50)

This invention relates to an earth moving machine attachment and, more particularly, to an attachment for supporting a power operated brush.

While power driven brushes, such as used for sweeping streets, are known in the art, they are unsuitable for cleaning walls or ceilings of a tunnel or similar structure. The present conventionally used method for cleaning walls and ceilings of a tunnel is by a crew of men who scrub with the brushes manually. This is very time consuming as well as very costly and for this reason is undesirable, particularly when it is realized that tunnel traffic stoppage for wall cleaning purposes should be very limited in time in order to avoid traffic tie-ups.

An object of the present invention is to provide a power operated brush which overcomes the above-mentioned disadvantages and which is useful for scrubbing walls and ceilings of a tunnel or similar structure very quickly and at a fraction of the cost of the above-mentioned conventional method.

A more specific object of the invention is to provide a novel attachment for an earth moving machine equipped with a boom which is rotatable about its axis, which attachment is adapted to support and provide power to a power driven brush and to adjust the position of the brush so as to enable selective scrubbing of either vertical walls of horizontal ceilings or inclined wall surfaces so as to enable easy and quick cleaning of the entire wall surface of the tunnel or similar outside wall structure. Other objects and advantages will become more apparent from a study of the following description taken with the accompanying drawings wherein:

FIG. 1 is a vertical, elevational view showing an earth moving vehicle provided with a power operated rotatable brush and supporting attachment at the end of a telescoping boom and embodying the principles of my invention;

FIG. 2 is an enlarged view of the attachment and brush shown in FIG. 1, as viewed from the boom;

FIG. 3 is a bottom view of a portion of the structure shown in FIG. 2;

FIG. 4 is a perspective view of a portion of the drive mechanism shown in FIGS. 1 and 2;

FIG. 5 is an end view of the brush and drive shown in the previous figures;

FIG. 6 is a modification of the attachment shown in FIGS. 1 to 5 inclusive, wherein there is additionally provided a hydraulic cylinder 32 for minor pivotal adjustments of the position of the brush;

FIG. 7 is a top view of a further modification embodying a rotary brush mounted on a supporting disc 41, as distinguished from a cylindrical type of brush, and wherein the brush is mounted in position for cleaning vertical walls;

FIG. 8 is an end view taken at the left, as viewed in FIG. 7, showing the rotary brush segments;

FIG. 9 is a fragmentary view of the tubular housing 40 and which illustrates integral flanges 51 and 53 for enabling the housing 40 to be selectively mounted either horizontally, as in FIG. 7, or vertically as shown in FIGS. 11 and 12;

FIG. 10 is a cross-sectional view, with the central portion cut away, of the housing 40 and internal drive shown in FIG. 7;

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FIG. 11 is a top view of the end of the boom when provided with a T shaped attachment 80-83 having a clamp 84 for supporting tubular housing 40 in a vertical position; and,

FIG. 12 is a side view of the structure shown in FIG. 11.

Referring more particularly to FIGURE 1 of the drawing numeral 1 denotes a ceiling and numeral 2 denotes a side wall of a tunnel or similar structure. Numeral 3 generally denotes an earth moving machine of any well known type, such as one well known under the trademark "Gradall," manufactured by The Warner & Swasey Co., Cleveland, Ohio. Such machine is provided with a boom comprising telescoping boom elements 4 and 5 which are power operated to enable selective lengthening or shortening of the boom. The boom is of triangular cross-section and is rotatable about its own axis to a limited degree, usually through a total angle of 90°, that is, 45° counterclockwise from a neutral position and 45° clockwise from such position, which neutral position corresponds to that wherein the base of the triangular cross-section of the boom is parallel to the roadway surface.

In accordance with the present invention, the earth scooping bucket attachment is removed from the end of the boom by unclamping clamps 6 (as shown more clearly in FIG. 6) and disconnecting the joint with rigid portion 6a integrally secured to the boom 5. In place thereof, there is substituted, in accordance with this invention, a tubular shaft 7 having an integral central flange 7c rigidly fastened by bolt 6b, together with extension 7b, to the fixed connection 6a, as shown also in FIG. 2. An integral extension 8 is provided on one of the clamps 7a, which extension is rigidly fastened to a U-shaped bracket 9 which is adapted to support a cylindrical shaped brush 10 by means of clamps 11 on the legs of the bracket which provide bearings for rotational drive of the brush 10. At one end of an integral shaft, axially of brush 10, there is rigidly secured a gear 12 driven by a chain which is driven by another gear 13 having at the end of its rigid shaft another gear 14 driven by chain coupled to still another gear 15 directly coupled to the rotor of a fluid or hydraulic motor 16. This motor is fed by pipes 17 and 18 which conduct a liquid or other fluid to effect rotation of the fluid motor 16.

Washing liquid is sprayed onto brush 10 by a perforated pipe 20 connected to pipe sections 21 and 22. Stop discs 23 are rigidly mounted on the shaft of brush 10 for the purpose of limiting the amount of bending of the hairs of the brush to avoid crushing of the hairs.

It will be noted that brush 10 is in a plane at right angles to the boom and is disposed at an angle of about 45° relative to the tubular shaft 7 so that when the boom is in its normal or neutral position, insofar as rotation about its own axis is concerned, by rotating the boom 45° counterclockwise, the brush will be positioned against the vertical wall 2, as shown in dot and dash lines in FIG. 1. And when the boom is rotated clockwise from its neutral position through an angle of 45°, it will assume the position against the ceiling 1, as shown in full lines in FIG. 1.

In operation, therefore, the vertical walls of a tunnel may be cleaned throughout their height merely by increasing the length of the boom, as well as its angle relative to the roadway surface. However, when it is desired to change from cleaning walls to cleaning the ceiling 1, the operator flips a conventional switch (not shown) for effecting rotation of the boom about its own axis through an angle of 90° whereupon the brush will engage the ceiling 1. Thereafter, the ceiling is cleaned along different portions thereof by travel of the vehicle as well as by telescoping the boom and changing its angle with respect to the roadway.

In some instances it is not possible to obtain a full 90° rotation of the boom about its own axis, since this is the limiting amount of angular movement in conventional earth moving machines, such as that of the Gradall type. Or perhaps due to a crown in the roadway and tilting of the vehicle, the 90° rotation is not quite enough to change the position of the brush from the vertical wall to the ceiling.

FIG. 6 shows a modification for overcoming this deficiency, which modification is similar to the structure shown in FIGURES 1 to 5 inclusive with the addition of a hydraulic cylinder 32 having a piston which is pivoted to bracket 30 at 31 to effect tilting movement of the brush supporting element 25 when the piston is extended or retracted, so as to tilt the brush about pivot 27 in a connecting bracket 26, which pivot is provided at the end of a tubular shaft 28 having flanges 29 rigidly bolted to the fixed rod 6a at the apex of the boom element 5. The other end of cylinder 32 is pivoted on bracket 34 rigidly secured to tubular shaft 28, the pivot being about axis 33.

The operation of the brush element 25 shown in FIG. 6 is the same as that of brush 10 in FIG. 1 with the mere addition of a vernier pivotal adjustment through perhaps an angle of 20° or 25° provided by hydraulic cylinder 32, the control element of which (not shown) may be located in the cab of the machine by connecting fluid lines 35 and 36 to the cab, in a well known manner.

FIGURES 7 to 12 inclusive show a further modification of an attachment for mounting a rotary brush of disc shaped outline, as distinguished from a cylindrical shaped brush. Referring to FIG. 7, numeral 40 denotes a tube or housing clamped by means of clamps 6 and stationarily held by means of flange 51 secured, by bolt 52, to rod 6a. The rotary brush comprises a disc shaped mounting plate 41 on which a plurality of brush elements 42 are mounted in spaced relationship about the peripheral and central portions thereof. Backing braces 43 are secured to the rear surface of plate 41. Helical springs 45 are provided, each having one end secured to backing braces 43, and the other end, to spider 44, there being a pivotal or a universal joint connection between the backing braces 43 and spider 44 to allow slight angular movement of the brush about the axis of drive shaft 46. Drive shaft 46 rotates the plate 41 about its axis and extends through the tube 40 and its end portion emerges from said tube at the opposite end. On such end portion there is rigidly secured a gear 47 which is driven by chain and gear 48 directly coupled to the rotor of a fluid or hydraulic motor 49 which is actuated by the operation of a suitable control element in the cab of the earth moving vehicle. Thus, hydraulic-powered rotation of the brush about the axis of shaft 46 is obtained whereby the vertical walls of a building or tunnel may be scrubbed. The liquid may be sprayed onto the brush segments by means of a pipe 57 through perforations, which pipe is fed by pipe sections 55 and 58 which are connected by suitable couplings, such as 56, to flexible pipes (not shown) extending either through or alongside boom 5 to the cab.

FIG. 10 shows the details of the drive connection within tube 40, including a rotatable shaft 46 having a bearing retainer ring 63 surrounding it and provided with a roller bearing 60—61 and a second roller bearing 64, along one side of which is a retainer ring 65 and along another side of which is a sleeve bearing 66 rigidly held by tightening up of bolts 67. The internally threaded portion 69 of the tapered extension 70 is screw threaded to the threaded end portion 68 of the shaft 46. A threaded shank 71 is provided at the end of extension 70 for connection to spider 44 of the universal joint.

A unique feature of the construction shown in FIG. 7 is that by the provision of an additional T shaped fitting 80—83 and clamp 84, as shown in FIGURES 11 and 12, the tube 40 may be supported vertically instead of horizontally. More specifically, if it should be desired to scrub the ceiling instead of the wall of a tunnel, tube 40

is removed from clamps 6 shown in FIG. 7 and a T shaped element 81—83 (see FIGS. 11 and 12) is put in its place and the tube 40 is thereafter clamped in clamp 84 thereof so as to extend vertically, as shown in FIGS. 11 and 12, whereby the brush is moved against the ceiling, that is, 90° with respect to the position shown in FIG. 7. As shown in FIG. 12, flange 53, rigidly fastened to tube 40, is secured by bolt 54 to the stationary rod 6a to steady or reinforce the support of tube 40 in its vertical position.

The above described T connection 80—83 is necessary merely because a 90° rotation of boom 5 about its own axis cannot always be assured in conventional earth moving machines. Of course, if such rotation were possible, the brush could be moved from the vertical to the horizontal or position merely by rotation of boom 5 about its own axis.

Some special earth moving machines have booms rotatable substantially 360° about the boom axis, making it more suitable with the present invention. In some instances, further movement of either the cylindrical brush 10 or rotary brush 42 may be obtained by attaching portion 7c or FIG. 2, or 51 of FIG. 7, to the conventional movable rod contained within boom 5 for effecting tilting movement about the axis of tube 7 or 40, instead of fixing it rigidly to boom 5 by connection to the stationary element 6a.

Instead of brush 10 of FIG. 1 or brushes 42 of FIGS. 7—8, abrasive, polishing or smoothing materials may be substituted as friction elements instead of brushing elements. For example, instead of brushes 42, carborundum blocks or pieces of wood may be substituted, or disc 41 may be faced with a flat surface of wood or other material for the purpose of smoothing surfaces of cement.

Thus it will be seen that I have provided an efficient earth moving machine attachment for adjustably supporting either a cylindrical brush or a disc shaped rotary brush in a manner so that the brush can be used for scrubbing either a vertical wall or ceiling of a tunnel, or a wall of any intermediate inclination, thereby enabling complete cleaning of all surfaces of a tunnel, such as one having an arched roof or inclined roof, merely by operating suitable control elements, thereby enabling scrubbing of the tunnel or the like in a small fraction of the time presently possible with known means.

While I have illustrated and described several embodiments of my invention, it will be understood that these are by way of illustration only, and that various changes and modifications may be made within the contemplation of my invention and within the scope of the following claims.

I claim:

1. In combination with an earth moving vehicle having a boom formed of telescoping elements of triangular cross-section extending angularly upwardly from said vehicle, and including means for rotating said boom about its axis through an angle of about 90°; a framework including means for clamping the framework against the end face of the outermost of said telescoping elements and in a plane at right angles to the longitudinal axis of the boom, a cylindrical brush rotatably mounted on said framework in substantially the same plane thereof and disposed at an angle of about 45° with respect to the base of the triangular cross-section of said outermost telescoping element, a hydraulic motor mounted on said framework, control means mounted on said vehicle for controlling operation of said hydraulic motor, sprocket and chain drive means rotatably mounted on said framework in substantially the same plane thereof and coupling said motor to said brush, flexible hoses extending parallel to said boom and carrying hydraulic fluid from said vehicle to said motor, the base of the triangular cross-section of said outermost telescoping element being at a neutral position parallel to the roadway when axially rotated about 45° from either extreme position, said framework being rotatable, by

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axial rotation of said boom by said means through an angle of about 45° from said neutral position in one direction to position the axis of said brush vertically so as to enable it to wash vertical walls as the vehicle is driven forwardly, said framework being rotatable through an angle of 45° in an opposite direction from said neutral position so that when the boom is tilted upwardly, the axis of said brush will extend horizontally, parallel to the roadway surface so as to enable it to wash ceilings as the vehicle is driven forwardly, and when rotated to intermediate positions, said brush is enabled to wash differently inclined surfaces while said vehicle is driven forwardly.

2. The combination recited in claim 1 together with a hydraulic cylinder and piston combination having one end pivotally mounted with respect to said outermost telescoping element and the other end being pivotally secured to a pivotal supporting element for said brush to increase the angular range of said pivotal rotation of the boom in either direction from the neutral position to more than 45°.

3. In combination with an earth moving type vehicle having a boom formed of telescoping elements of triangular cross-section and including means for rotating said boom about its longitudinal axis through an angle of about 90° to compensate for tilt of the vehicle due to a high crown in the road, clamps disposed at the ends of the base of the triangular cross-section of the outermost boom element, a hollow cylindrical tube clamped between said ends of said clamps, a flange extending at 90° from said tube, a rod extending from the apex of said triangular cross-section and which is rigidly connected to said flange, a drive shaft extending through said tube having end portions projecting outwardly of both ends of said tube, a

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hydraulic motor mounted on one end of said tube and a chain drive driven thereby which is coupled to one end of said shaft, a disc shaped rotary brush secured to the other end of said shaft and including spring means to permit yieldability of the brush, whereby rotation of said hydraulic motor will effect rotation of said brush about the axis of said drive shaft to enable cleaning of vertical walls as said vehicle is driven forwardly.

4. The combination recited in claim 3 together with a connector extending at right angles from said tube for attachment to said rod at the apex of said triangular cross-section, and clamping means attached to said tube at right angles to said connector and including means for attachment by said clamps at said ends of said base of the triangular cross-section of the outermost boom element for selectively supporting said tube and drive shaft vertically instead of horizontally to enable cleaning of ceilings.

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