

Aug. 16, 1960

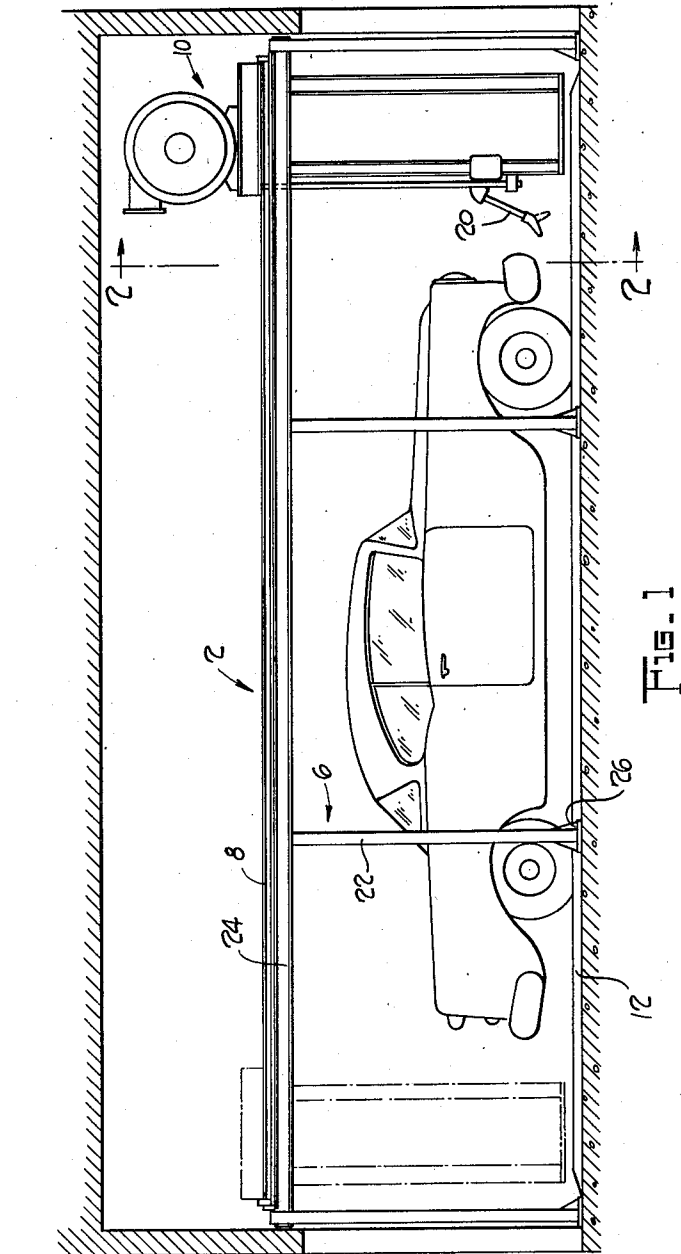
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2,948,907

APPARATUS FOR WASHING AND CLEANING AUTOMOBILES
AND OTHER SURFACES AND THE LIKE

Filed March 31, 1958

11 Sheets-Sheet 1



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11 Sheets-Sheet 2

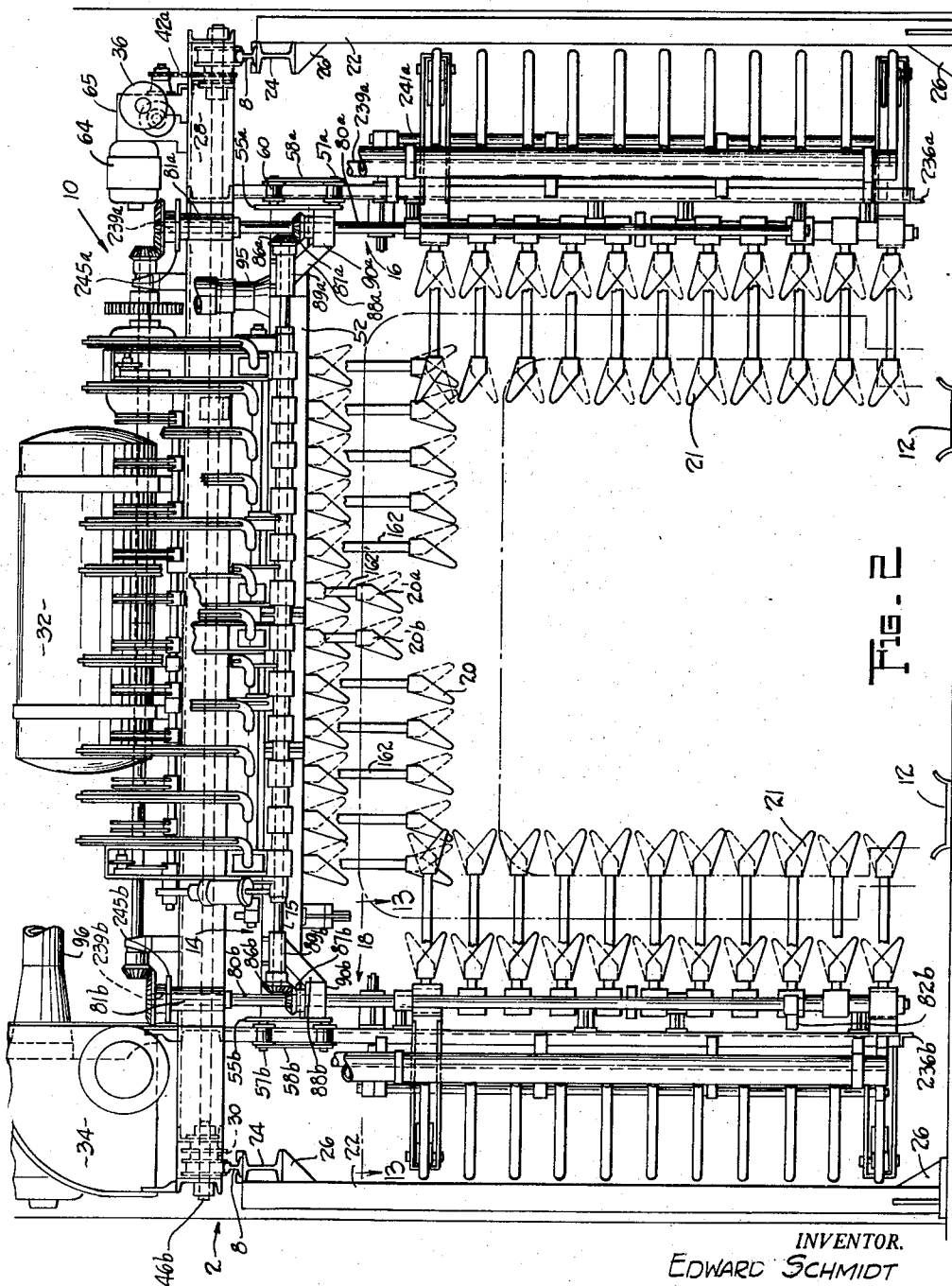


FIG. 2

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FIG. 3

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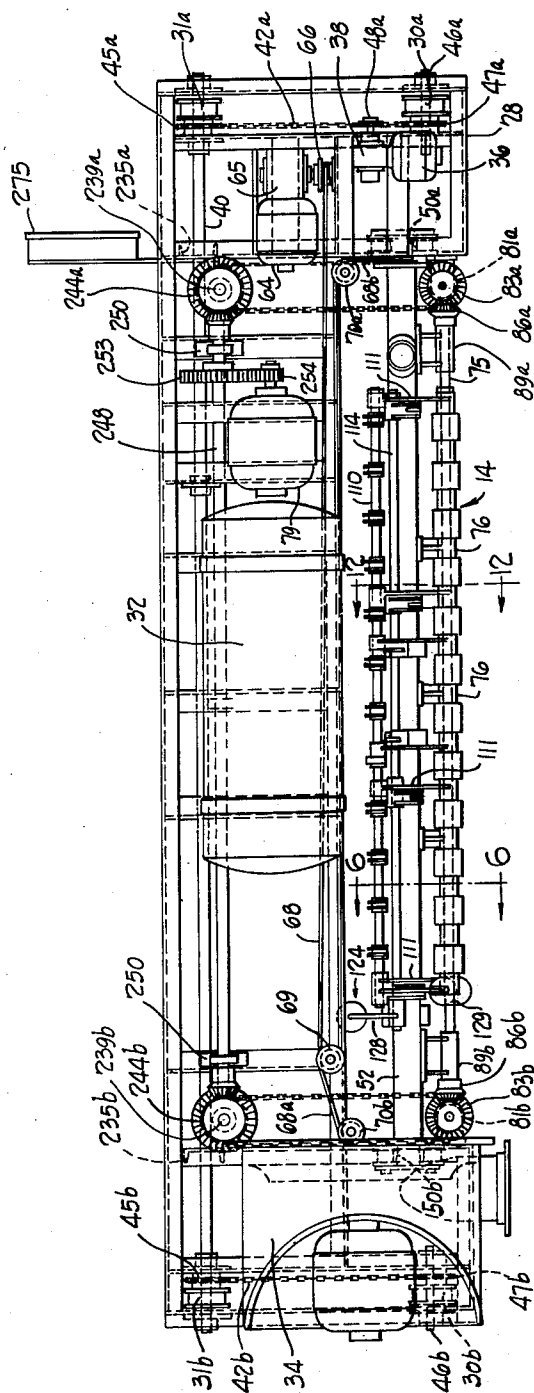


FIG. 4

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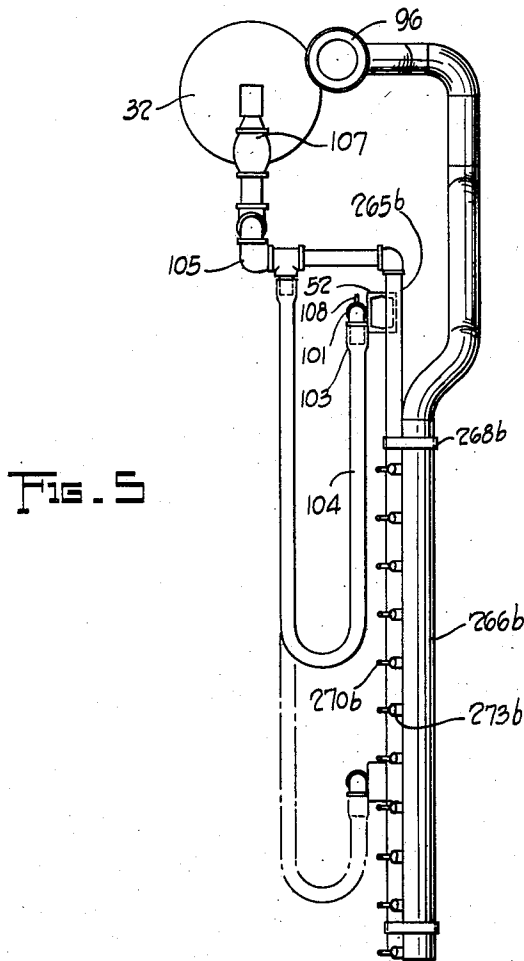
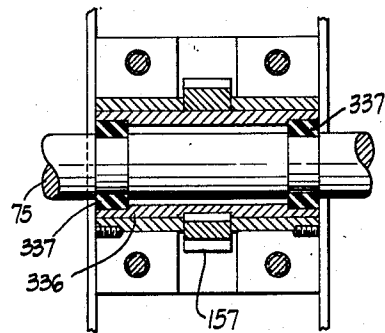
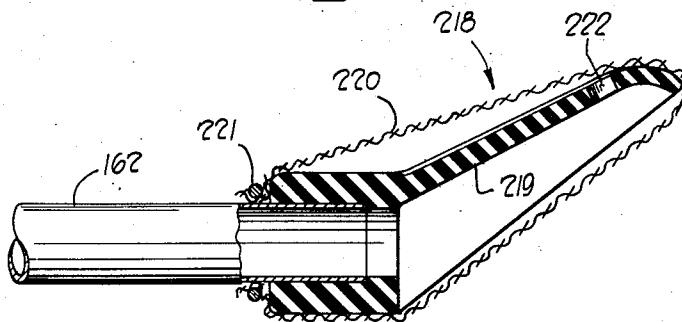
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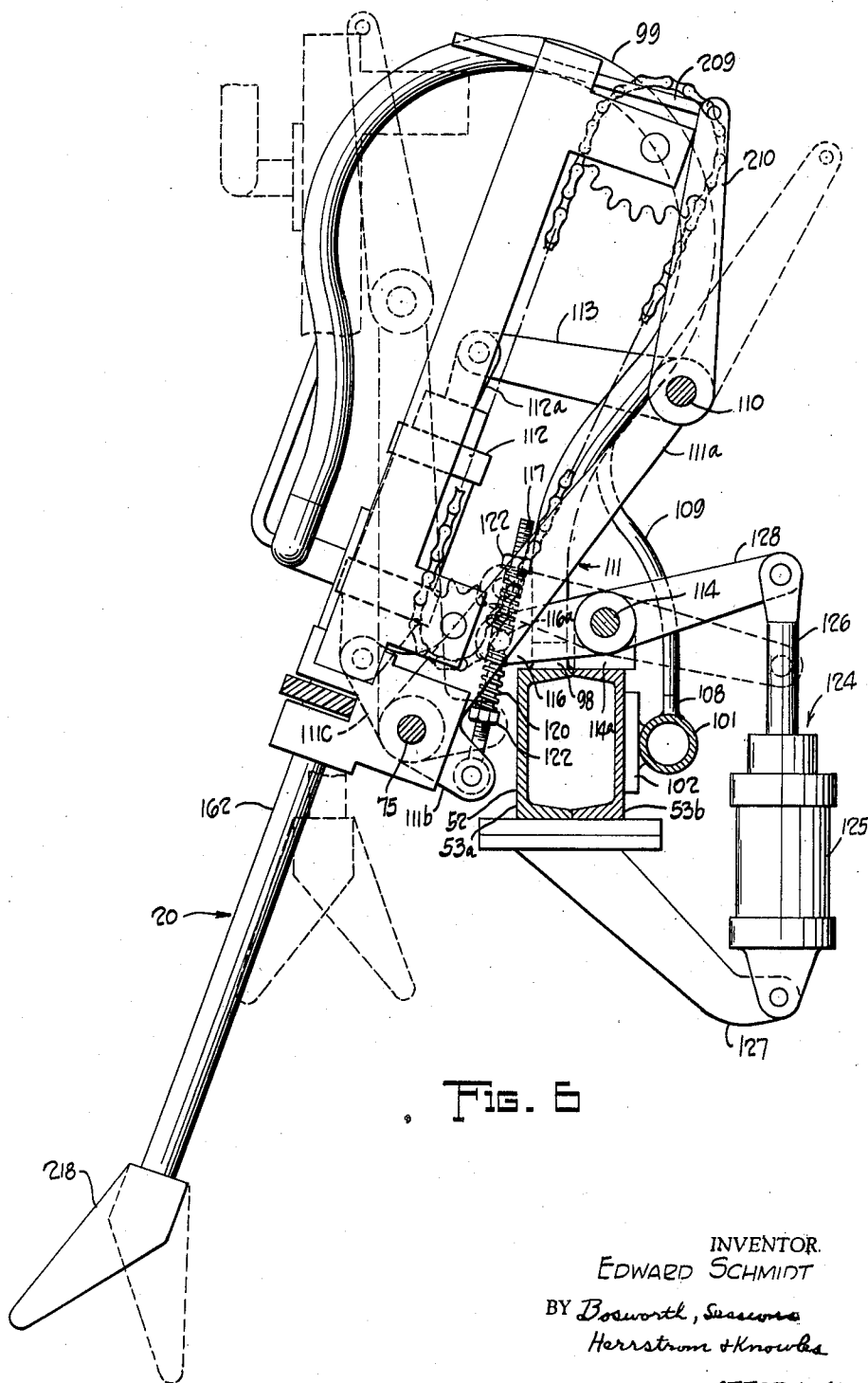
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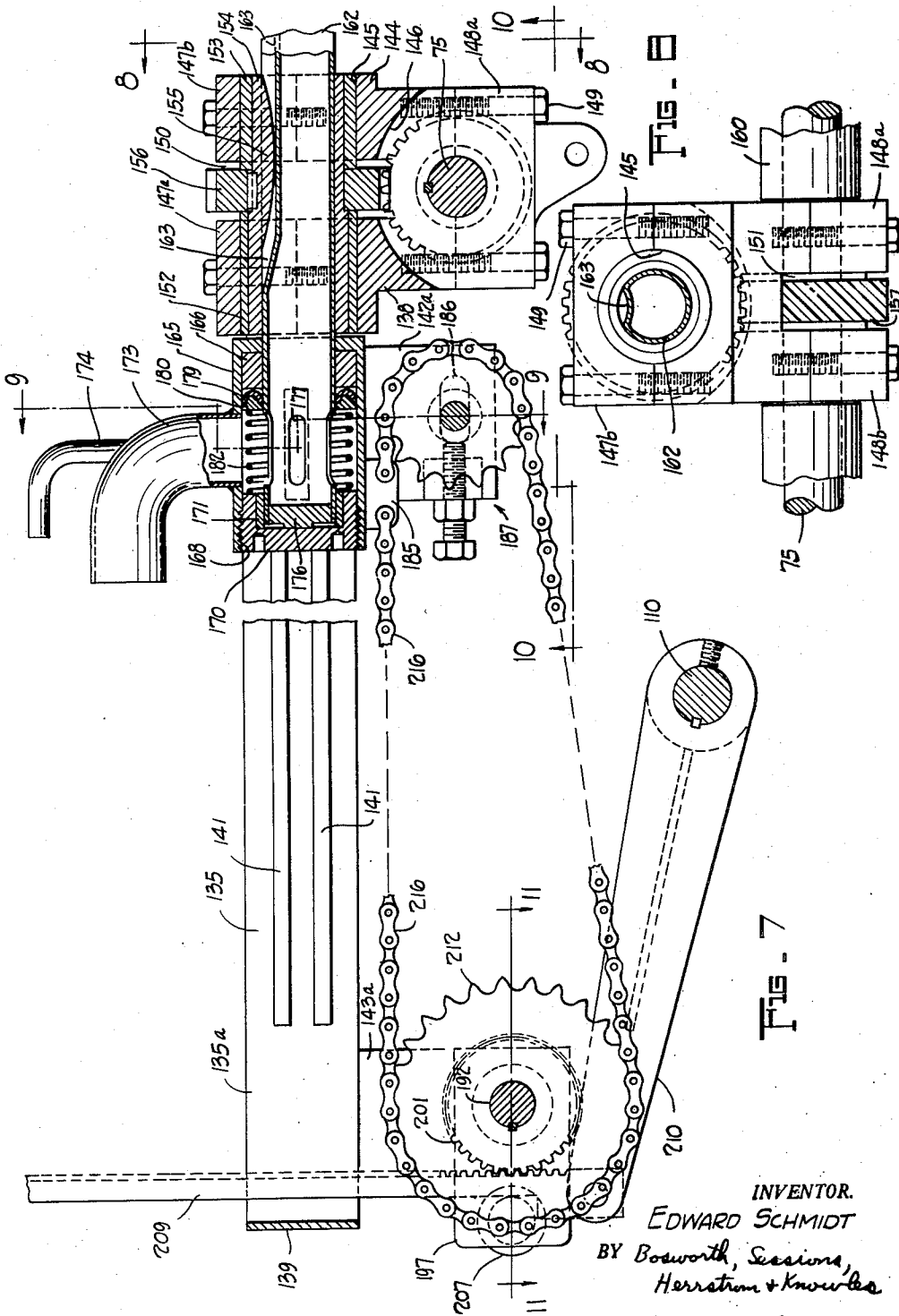


FIG. 7

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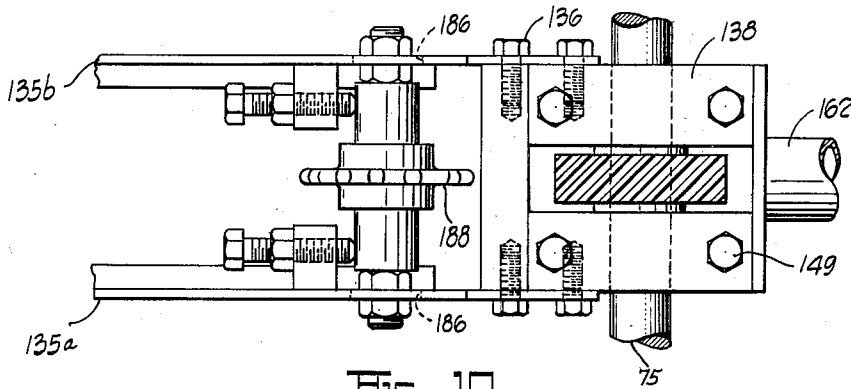


FIG. 10

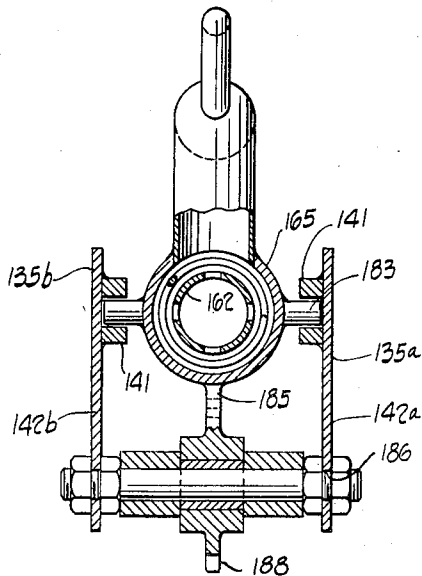


FIG. 9

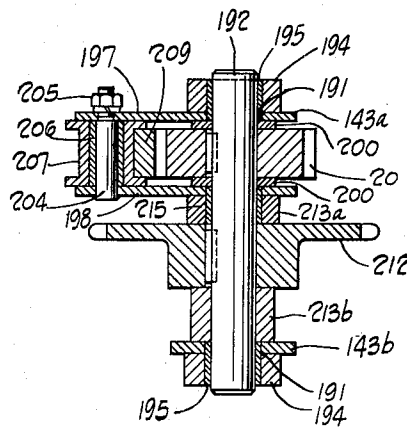


FIG. 11

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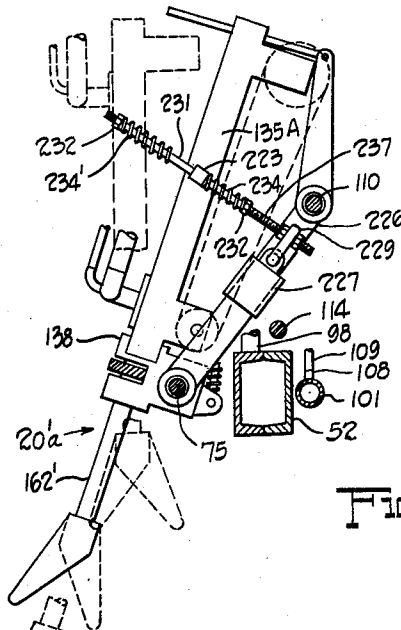


FIG. 12

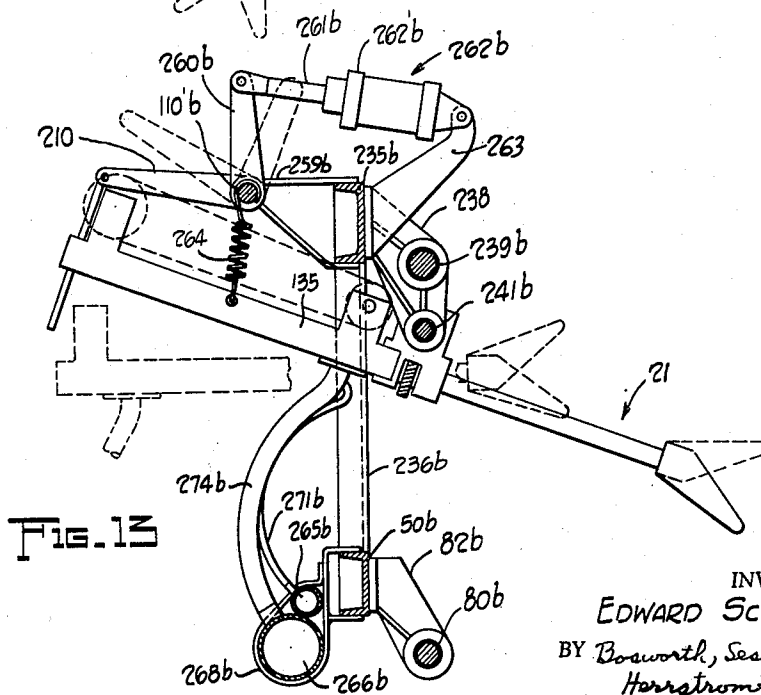


FIG. 13

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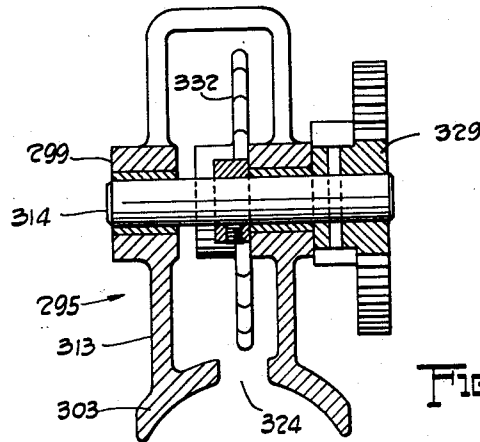


Fig. 18

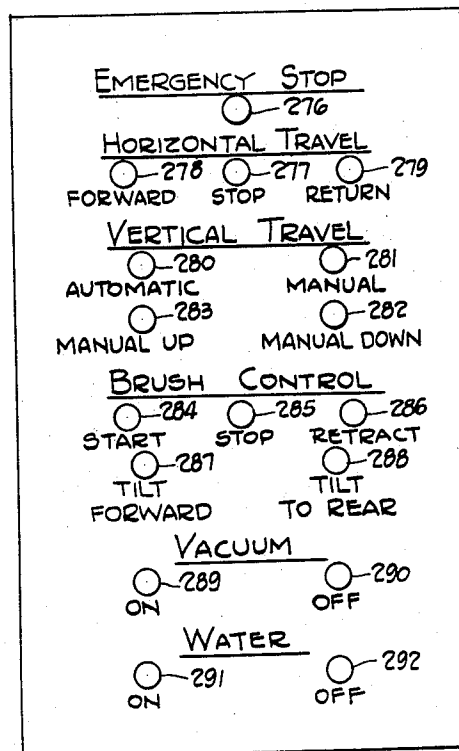


Fig. 14

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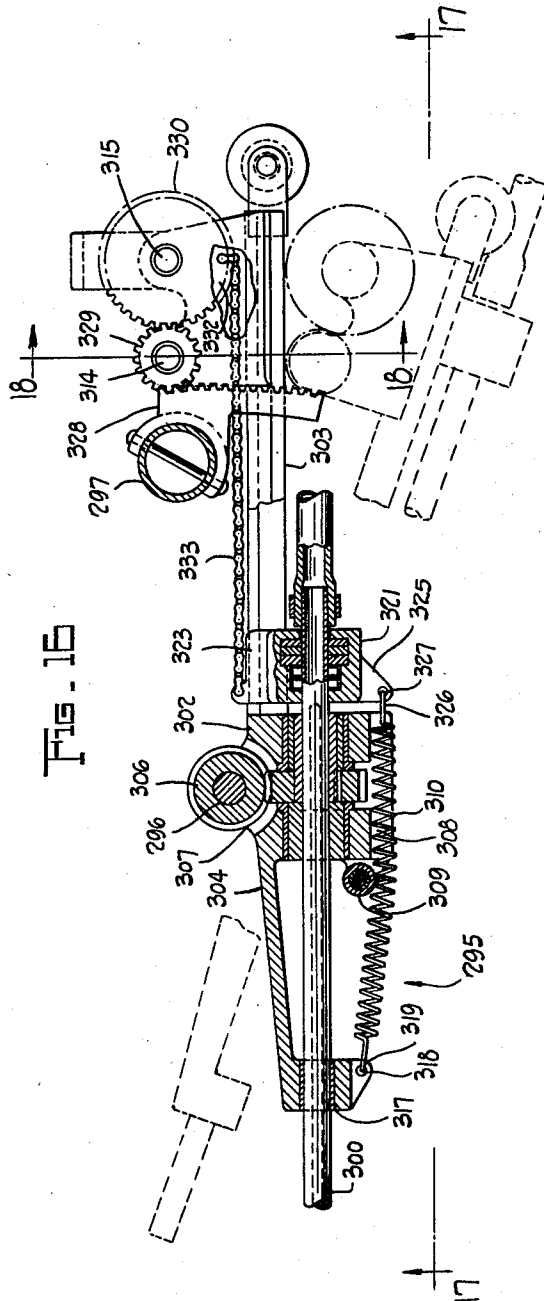
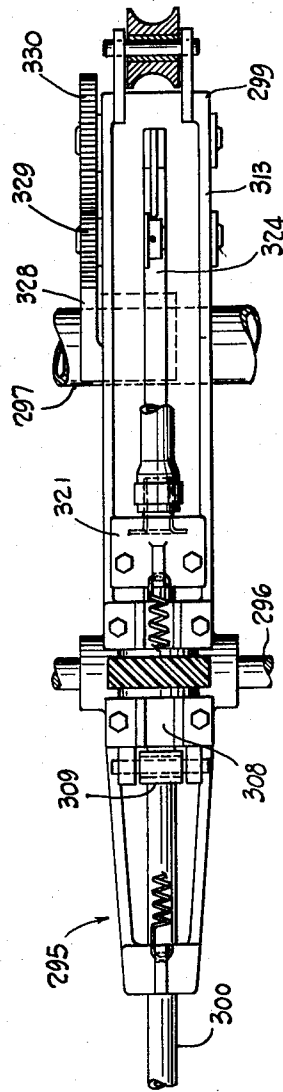
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11 Sheets-Sheet 11



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APPARATUS FOR WASHING AND CLEANING AUTOMOBILES AND OTHER SURFACES AND THE LIKE

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Filed Mar. 31, 1958, Ser. No. 725,260

36 Claims. (Cl. 15—97)

This invention relates to means for cleaning or otherwise treating objects and surfaces and more particularly to apparatus for washing and/or drying automobiles or other vehicles.

Various machines and apparatus have been developed, proposed and disclosed in the prior art for substantially automatically washing, drying and/or cleaning automobiles, buses and other objects having similar surfaces. Such devices have proven of limited utility either because of their inability to follow the contour of the surfaces being cleaned and therefore their failure to wash, dry and/or clean the entire surface or because of their excessive manufacturing and/or operating costs, unwieldy size and/or inefficient operation. More particularly the art has failed to provide automatic washing, drying and/or cleaning apparatus for automobiles and the like which is adapted for practical and economical use by small proprietors and service stations as well as large automobile washing and cleaning establishments.

Therefore a general object of this invention is the provision of improved apparatus for cleaning or treating the surfaces of automobiles and/or other vehicles or objects. Other general objects include the provision of improved cleaning or surface treating apparatus which both washes, dries and/or otherwise treats the surface to be cleaned, which effectively cleans substantially the entire surface irrespective of its contour, which is simple to use, effective and efficient in operation, and economical to manufacture; which requires a minimum of hand or manual labor in conjunction with its use; and which functions, whether the apparatus be passed over the vehicle or object to be cleaned, or the vehicle or object be passed through the apparatus.

Still other objects include the provision of apparatus for cleaning automobiles, or other vehicles, objects or surfaces, which "washes" substantially each increment of the surface thereof a plurality of times during each lineal passage (relative or actual) thereover; which is useful for cleaning vehicles and objects having a relatively wide range of sizes; which reacts and responds to variations, adjacent the cleaning means, in the contour of the surface being cleaned, to maintain the cleaning apparatus in functional contact with the surface as it travels actually or relatively thereover; which cleans with a rotary or scrubbing motion similar to that of the hand; which is substantially automatic in operation; which is adapted to wash or dry substantially the entire upper or decorative body, from bumper to bumper, of an automobile, and/or which includes a plurality of individually responsive washing, drying, cleaning and/or treating means or brushes.

Further objects of this invention are the provision of an improved cleaning means or brush for cleaning automobiles and other vehicles, objects or surfaces, which responds to variations and changes in the contour of the surface being cleaned, adjacent the cleaning means, to maintain itself in substantially continuous functional

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contact with the surface as the surface and the means are moved lineally relative to each other; which is adapted to "go around" obstructions, such as radio antennae and rear view mirrors, which might otherwise obstruct, interfere with or prevent the lineal movement of the cleaning means relative to the surface being cleaned; which washes and/or dries with a rotary or scrubbing motion similar to an ordinary "hand" motion; and/or which is adapted to control en banc a plurality of otherwise individually responsive cleaning means or brushes in response to relatively large variations in the contour of the surface being cleaned.

Other objects are the provision of substantially automatic washing, drying and cleaning apparatus for automobiles, buses and the like having novel and economic structure and principles of operation such that it has utility for installation either where use is substantially continuous and frequent or where use is intermittent and occasional, to the end that apparatus embodying my invention may be economically and practically installed and used in gasoline service stations, garages and similar establishments as well as in establishments devoted substantially only to car washing and cleaning services, and the provision of a washing, drying and/or cleaning apparatus having one or more of the aforesaid advantages and features.

These and other objects and advantages of my invention will become apparent from the following description of a preferred and modified forms thereof, reference being made to the appended drawings in which:

Figure 1 is a side elevation, in outline, of a preferred embodiment of my invention showing an automobile in position to be washed and showing in full outline the position of the cleaning head carrier before functional passage over the automobile and in dotted outline the position of the carrier after such passage.

Figure 2 is a front elevation, on a larger scale, of the carrier shown in Figure 1, the view being taken substantially along the line 2—2 of Figure 1 and with portions of the cleaning fluid and vacuum systems omitted for clarity.

Figure 3 is a side elevation of the carrier and apparatus shown in Figure 2 with certain other of the parts removed for the sake of clarity and also showing the horizontal head in its lowermost position, in dotted lines.

Figure 4 is a plan view of the carrier shown in Figure 3, with certain parts broken away and the brushes removed in order to better show the horizontal head assembly.

Figure 5 is a side elevation of the cleaning fluid and vacuum systems.

Figure 6 is an enlarged section taken along the line 6—6 of Figure 4 showing the brush extended and in normal operating position, and also showing, in dotted lines, the brush retracted.

Figure 7 is a broken longitudinal view, partly in section, of a preferred embodiment of a standard brush unit.

Figure 8 is a section of the brush shown in Figure 7 viewed along the line 8—8 of Figure 7.

Figure 9 is a section of the brush shown in Figure 7, viewed along the line 9—9 of Figure 7, with the chain removed.

Figure 10 is a view of a portion of the brush shown in Figure 7, viewed along the line 10—10 of Figure 7, with the chain removed.

Figure 11 is a section of the brush shown in Figure 7 viewed along the line 11—11 of Figure 7.

Figure 12 is a section viewed generally along the line 12—12 of Figure 4 showing a feeler brush and illustrating the shifted position of the brushes.

Figure 13 is an enlarged view of a vertical head and

brush assembly including the vertical brush retraction means viewed along the line 13—13 of Figure 2.

Figure 14 is a front elevation of a convenient control panel for my invention.

Figure 15 is a sectional view of a representative washing pad and a portion of the brush arm on which it is mounted.

Figure 16 is a broken longitudinal section of a modified form of brush embodying my invention also showing, in dotted lines, the position of the brush when retracted.

Figure 17 is a plan view of the brush shown in Figure 16, viewed along the line 17—17 of Figure 16 with the spring partially removed.

Figure 18 is a section on an enlarged scale of the brush shown in Figure 16, viewed along the line 18—18 of Figure 16, with the chain removed.

Figure 19 is a sectional view showing a modified means, embodying my invention, for mounting a brush on a drive shaft.

In general my invention embodies apparatus comprising a plurality of individual cleaning means or brushes which are preferably adapted to clean the surface of an automobile or other object with a motion somewhat similar to that of a human hand, and which are preferably so arranged and mounted that the paths of adjacent brushes overlap and each brush overlaps its own motion in its own path as it moves lineally relative to the surface being cleaned from end to end thereof. Each brush is adapted to individually respond, as by extending and retracting, to changes and variations in the contour of the surface over which it passes in order to maintain functional contact with the surface and further certain brushes are preferably feeler or pilot brushes which respond to relatively great changes in the contour of the surface to raise or lower a row of brushes en banc. Preferably, and when adapted for use for cleaning automobiles or other vehicles, the apparatus comprises three rows or banks of brushes, two vertical and one horizontal, disposed so as to transversely "encircle" the ornamental surface of the automobile. The vertical banks of brushes clean the respective sides of the automobile and the horizontal bank of brushes cleans the front, top and back thereof. Preferably the brushes in each bank are mounted on a common axis and each brush is adapted to selectively wash or dry the surface being cleaned.

A cleaning apparatus embodying a preferred form of my invention is shown generally at 2 in Figure 1 together with an automobile in position to be cleaned thereby. The cleaning apparatus preferably includes a suitable supporting structure, such as the frame 6, a pair of longitudinally extending horizontal overhead track members 8, and a self-propelled carrier indicated generally at 10. The carrier 10 is adapted to move along the tracks 8 passing over or along the automobile or other vehicle, which stands on the floor or other suitable support, such as wheel tracks 12, within the confines of the apparatus. The carrier preferably includes a horizontal and two vertical cleaning heads or units 14, 16, and 18, respectively (Figure 2), each having a plurality of individual brushes 20 and 21. The brushes 20 and 21 are rotated by suitable means and may be selectively connected with water and vacuum lines for washing or drying the automobile as desired. The brushes are adapted to maintain contact with the respective surface areas of the automobile body as the carrier 10 advances over and past the same.

In practice, as will hereinafter more fully appear, the automobile is positioned, as in Figure 1, the cleaning apparatus is set for wash, the carrier 10 is positioned as shown in full lines in Figure 1, and the apparatus is actuated. The carrier thereupon moves along the overhead tracks 8, passing over the automobile, with the brushes 20 and 21, as a feature of my invention, automatically maintaining functional contact with the automobile body and washing the same. Once the carrier has

passed over the automobile, the brushes and/or heads are retracted and the carrier is returned to the fore end of the automobile. The apparatus may then be set for drying and again actuated, whereupon the carrier again travels over the automobile, the brushes 20 and 21 maintaining contact with the body thereof and drying it. The automobile is then driven away and the apparatus is ready to wash and dry another.

Alternatively, I may use an immobile carrier or two such carriers, one for washing and one for drying, in fixed tandem relationship and draw the automobiles there-through, as by an endless chain, the heads and brushes reacting in the same manner, as when the carrier travels, to maintain functional contact with the automobile body and clean the same.

As best seen in Figure 2 the track members 8 conveniently are horizontally spaced, parallel, longitudinally extending rails, which are supported by and secured to any suitable supporting structure such as, for example, the frame 6, which conveniently comprises stanchions 22, I beams 24 and gusset plates 26 all welded or otherwise rigidly secured together to the end that the track members or rails 8 may carry, guide and provide traction means for the carrier.

The track members 8 are supported at any convenient distance above the floor by the frame 6 depending on the height of the objects to be cleaned and allowing room for the horizontal washing unit 14, and the parallel rows of stanchions 22 are spaced any convenient distance apart depending on the width of the object to be cleaned and allowing room for the vertical washing units 16 and 18. For use as an automobile washer adapted to handle most popular American cars and having a brush retraction distance of 14" I have found a height of about 7'6" from the floor to track members and a width of 12'6" between stanchions to be convenient and thus am able to use my cleaning apparatus in a building which is only 13'5" wide and 12' high.

The wheel tracks 12 are convenient for facilitating the transverse centering of the automobile within the apparatus, although other means or the skill of the driver may be relied upon for centering the automobile.

As previously stated the carrier 10 comprises inter alia (see Figures 2, 3 and 4) the horizontal washing head 14, the right vertical washing head 16 and the left vertical washing head 18, together with the necessary structure, tanks, pumps and motors etc. to enable the carrier and heads to function so as to wash and/or dry the car or surface to be cleaned. In the preferred embodiment of my invention the carrier includes a frame 28 which is supported by flanged wheels 30a and 30b and 31a and 31b on the rails or tracks 8. The frame 28 is conveniently constructed from common angles and channels welded or otherwise secured together so as to form a rigid structure preferably having a form substantially as shown. The frame supports the washing heads 14, 16 and 18, which in turn carry the brushes 20 and 21.

In order to provide an even flow of water or cleaning fluid to and for the brushes I preferably provide tank 32 on the upper side of the frame 28. The tank 32 is connected to a water or cleaning fluid supply source by suitable flexible conduits and suitable means such as a float controlled valve is provided to control the flow of liquid into the tank in response to the level of liquid therein. If desired, means may be incorporated within the tank or the discharge conduits leading therefrom to add detergent or other cleaning compound to the cleaning fluid. In installations where water is used as the cleaning fluid and delivered from the tap lines at sufficient volume, a connection may be made directly from the supply line to the washing heads. Gravity feed from the tank to the brushes normally furnishes sufficient pressure for washing.

In order to provide for drying, an electrically driven

vacuum pump 34 is preferably mounted on the carrier frame 28 and communication is provided between the inlet side of the pump and the brushes as will hereinafter more fully appear.

The proper functioning of my invention requires relative lineal movement between the surface being cleaned and the carrier and such movement is preferably selectively automatic, and at a predetermined and uniform rate for any given passage of surface and carrier. When, as in the preferred embodiment of my invention, the surface to be cleaned remains stationary and the carrier moves, I prefer to provide driving or propelling means mounted thereon to the end that the carrier may be self-propelled, although other driving means such as, for example, a motor driven endless chain carried and supported on the frame 6 and secured to the carrier or a hydraulic motor may be used.

As best seen in Figure 4, my preferred carrier driving means conveniently includes an electric motor 36, a speed reducer 38 and right and left drive chains 42a and 42b, respectively, which drive the carrier wheels. More specifically the rear wheels 31a and 31b are interconnected by drive shaft 40 which extends transversely across the carrier and is supported in suitable bearings mounted on the carrier frame. Right and left rear drive sprockets 45a and 45b, respectively, are mounted on the shaft 40. The front wheels 30a and 30b are mounted on stub axles 46a and 46b, which are carried and supported by suitable bearings mounted on the carrier frame, and which also carry right and left front drive sprockets 47a and 47b respectively. The sprockets 47a and 47b are in respective longitudinal alignment with sprockets 45a and 45b and sprockets 45a and 47a are also longitudinally aligned with reducer sprocket 48a which is mounted on reducer 38. Drive chain 42a encircles and operatively engages sprockets 45a, 47a and 48a and chain 42b encircles and operatively engages sprockets 45b and 47b.

Suitable leads (not shown) connect the motor 36 with a supply source and with the control panel, Figures 3 and 14, which is mounted at any convenient place on or near the apparatus. By closing the proper switch the motor 36 may be actuated to move the carrier in either direction as desired. The motor 36 drives the chain 42a through the reducer 38 and sprocket 48a, and chain 42a drives sprocket 45a (and thereby shaft 40, sprocket 45b and wheels 31a and 31b) and sprocket 47a (and thereby axle 46a and wheel 30a). Sprocket 45b in turn drives chain 42b which drives sprocket 47b and thereby wheel 30b to the end that the carrier has four wheel drive and thus travels evenly along the rails without twisting, binding or racking.

The horizontal cleaning head 14 extends transversely of the carrier and is adapted to wash, dry and/or clean the front, hood, top and rear of an automobile and the corresponding portions of any other surface or body being cleaned. The horizontal surfaces cleaned by the head 14 are often, as with an automobile, in widely varying horizontal planes such that the retraction distance of the individual brushes, as hereinafter set forth, is not sufficient to allow for the variations in height of the horizontal surfaces. Accordingly, means is provided to move the head 14 vertically in response to variations in the contour or height of the horizontal surfaces, which are of greater magnitude than can be accommodated by retraction distance of the individual brushes, while the same maintain functional contact with the surface. In such instances the head 14 may be counterbalanced, if desired.

In order to support and guide the vertical movement or travel of the horizontal head, the forward end of the carrier is provided at each side, externally of the width of the vehicle or object to be cleaned, with vertically extending frame members, 50a and 50b respectively, which are secured as by welding to the main frame

28 of the carrier. The members 50a and 50b preferably are transversely aligned channels having their base portion extending longitudinally and their leg portions extending outwardly towards the adjacent side of the apparatus.

The horizontal washing head 14 is adapted to support the individual horizontal brushes as well as to provide means to transmit cleaning fluid, vacuum and motion thereto and includes suitable framing, shafts and conduits for these purposes. Preferably the head 14 comprises a main beam or girder 52 which conveniently comprises two channel members 53a and 53b (Figure 6) welded together so as to form a hollow box beam. In addition to functioning as the main structural member of the head, I prefer that the beam 52 form a part of the means to transmit vacuum from the pump 34 to each brush and to this end I close the otherwise open ends of the beam 52 as by welding inner guide roller plates 55a and 55b, respectively, thereto (Figures 2 and 3). Alternatively a separate vacuum conduit may be provided and/or beam 52 may take another form sufficient to provide the necessary structural strength to the horizontal head.

The plates 55a and 55b also function as part of the travel or traction means for the head 14. To this end each said plate is preferably of greater area than the end of the beam 52 and is provided with pairs of vertically spaced apertures fore and aft of the beam through which guide roller pins 57 extend. The pins 57 extend between the plates 55a and 55b, respectively, and corresponding and similarly apertured outer guide roller plates 58a and 58b, respectively. The plates 55a and 55b are disposed immediately interiorly of the respective supports 50a and 50b and the plates 58a and 58b are immediately exteriorly thereof. A flanged guide roller 60 is mounted on each of the pins 57 and the disposition of the pins and rollers is such that the rollers track and travel upon the leg portions of the respective supports 50a and 50b.

In order to position the head vertically, I provide hoisting means, which preferably and conveniently includes a hoist motor 64 and speed reducer 65 which are mounted in operative relationship on the carrier frame 28 (to the right as shown in Figures 2 and 4) and a drum 66, which is mounted on the reducer 65 and has its axis extending fore and aft. A suitable cable 68 having branches 68a and 68b secured to and leads from the drum across the carrier and is wreathed around suitable sheaves, such as double sheave 69 and single sheaves 70a and 70b respectively, and is then secured to the respective ends of the beam 52. Rotation of the drum in one direction, clockwise for example, winds or takes up the cable lifting the beam equally at both ends thereby insuring an even, bindless travel thereof, whereas rotation of the drum in the other direction unwinds or slackens the cable permitting the head to lower. Actuation of the hoisting means and more particularly of the motor 64, as to direction of turning and operating periods, and therefore control of the vertical travel of the head 14 is in response to the position and movement of the two center or feeler brushes 20'a and 20'b (Figure 2) of the horizontal head as will more fully appear.

In order to support and provide rotational motion to and for the individual brushes as well as a tilting axis therefor, I preferably provide the horizontal head with a transversely extending drive shaft 75. The shaft 75 is preferably supported for rotation about its longitudinal axis on the forward side of the beam 52 by a plurality of brackets 76 (Figure 4), which are conveniently welded to the beam and are provided with bushings for engagement with the shaft.

In order to rotate the shaft 75 and drive the horizontal brushes, I provide a brush drive motor 79 (Figure 4) which is preferably mounted on the carrier frame

28 and is preferably adapted to drive the vertical brushes as well. Alternatively a separate horizontal brush drive motor may be employed and such a motor may be mounted either on the carrier frame or on the beam 52, in which latter instance the motor would travel with and as a part of the horizontal head 14 and would be connected with a power source by a flexible or retractible cord as may be desired.

When, as I prefer, the brush drive motor is mounted on the carrier frame, I provide means to transmit the driving force from the motor 79, which is disposed in a fixed horizontal plane, to the shaft 75, which is a part of the head 14 and is disposed in a vertically variable horizontal plane.

Preferably such means comprises a pair of vertical shafts 80a and 80b, respectively (see Figures 2, 3 and 4), mounted on the carrier at either end of the shaft 75 and inboard of the supports 50a and 50b and supported for rotational movement by properly bushed brackets 81a and 81b secured to the frame 28 and 82a and 82b secured to the supports 50a and 50b, respectively, at a point below the lowest level of travel of the beam 52. Bevel gears 83a and 83b are mounted on the uppermost ends of the shafts 80a and 80b, respectively, and are operatively connected to and driven by the motor 79 in a manner to be hereinafter more fully described.

Bevel gears 86a and 86b are mounted at the respective ends of the shaft 75 and these gears are engaged and driven by the bevel gears 87a and 87b respectively. Gears 87a and 87b are slidably mounted on the shafts 80a and 80b, respectively, so as to be rotated thereby, and are also secured to the beam 52 near the respective ends thereof so as to move vertically with the beam (and shaft 75) and maintain operative engagement with gears 86a and 86b, respectively, regardless of the vertical level at which the head 14 is located by the hoist motor 64. In order to secure the gears 87a and 87b to the respective shafts 80a and 80b, I conveniently provide the shafts with spaced elongated keyways and provide the gears with elongated shanks or hubs which have keys which are adapted to slide within the respective keyways.

To mount the gears 87a and 87b on the beam 52 I preferably provide plates 88a and 88b, which are welded to and rigidly interconnect bearing blocks 89a and 89b, which are supported by the beam 52 near the respective ends of shafts 75, and bearing blocks 90a and 90b, respectively. The shanks of the gears 87a and 87b are disposed within and rotate within the respective bearing blocks 90a and 90b and are provided with shoulders against which the upper surfaces of the respective blocks bear. Thus when the vertical shafts 80a and 80b are rotated the bevel gears 87a and 87b are turned therewith and drive the gears 86a and 86b, respectively, and thereby the shaft 75. When the motor 64 is actuated to raise the head 14, the upward movement of the beam 52 is transmitted via the blocks 90a and 90b acting on the shoulders of the shanks of gears 87a and 87b and the gears are thereby lifted with the head and maintained in operative engagement with the gears 86a and 86b and when the motor 64 is actuated to lower the head 14 the downward movement of beam 52 lowers the bearing blocks 90a and 90b permitting the gears 87a and 87b to the displaced downwardly by the downward force exerted thereon by the simultaneous lowering of the gears 86a and 86b. Therefore the respective bevel gears remain in operative engagement at all times and without regard to the rotative motion of the shafts 80a and 80b or the vertical position or motion of the head 14.

As previously stated the head 14 also preferably includes a portion of the water or cleaning fluid and vacuum systems to the end that the fluid for washing and vacuum for drying the surface may be conveniently communicated to each brush, although in those installations where a single carrier performs only one operation, as,

for example, where fixed tandem carriers are used, it is only necessary, of course, that the particular system desired be included in the given head. When, as shown, a single carrier is to be used for both the washing and drying cycles, flexible or adjustable conduits are provided between the carrier, which supports the tank 32 and the vacuum pump 34, and the horizontal head in order to allow for the vertical movement thereof. When the beam 52 functions as a portion of the vacuum system, I prefer that a telescoping pipe 95 be secured to and in communication with the interior of the beam and that the upper end of pipe 95 be supported by the carrier frame, although alternative conduits such as, for example, a flexible hose may be used. The pipe 95 is of such dimensions that it telescopes sufficiently to permit the head to travel to the top of the supports 50a and 50b and extends sufficiently to permit the head to travel down the supports to any desired lower level. The pipe 95 is of course air-tight and its upper end is connected by suitable conduit 96, shown in part in Figure 2, with the vacuum pump 34.

Suitable nipples 98 (see Figure 6) one for each horizontal brush, are spaced along the top of the beam 52 and vacuum hoses 99 lead from the nipples 98 to corresponding nipples on the respective brushes.

In order to supply water or cleaning fluid to the brushes I provide a pipe or similar conduit 101 on the head 14. Conveniently the pipe 101 is secured to the rearward side of the beam 52 as, for example, by being welded to a series of straps 102 which are in turn spot welded or otherwise secured to the beam (see Figures 5 and 6). One end, the left as shown, of the pipe 101, is provided with a conventional fitting 103 and a flexible hose 104 is secured thereto. The other end of the hose 104 is secured to piping 105, which is carried by the carrier frame 28 and is in communication with the tank 32. A valve 107, preferably of the solenoid type, controls the flow of water or cleaning fluid from the tank. A plurality of nipples 108, one for each horizontal brush, are spaced along the pipe 101 and hoses 109 lead from the nipples 108 to corresponding nipples on the respective brushes. The hose 104 is of sufficient length to extend from the fixed piping on the carrier to the fitting 103 when the head is at its lowermost level of travel.

The horizontal head, as stated above, also supports a plurality of cleaning brushes 20 (see Figure 2). In the drawings I have shown 12 horizontal brushes although it is to be understood that the number of brushes provided in any given apparatus is determined by the diameter of the circular area cleaned by an individual brush, the overlap desired between the paths of adjacent brushes and the maximum width of the vehicle, object or surface which any given apparatus is designed to clean. Of the twelve horizontal brushes shown the five outermost on either side are standard brushes and the middle two 20'a and 20'b are feeler brushes and control the vertical travel of the head 14, as will hereinafter more fully appear, although they otherwise have the same characteristics as the standard brushes. I have shown the feeler brushes in the center of the horizontal head because the apparatus is disclosed as an automobile cleaner and the highest points of an automobile at any given transverse plane generally lie along its longitudinal center line. It is to be understood however, that the feeler brushes may be disposed at other locations along the head 14, it being preferred that the feeler brushes be located at or adjacent to the vertical longitudinal plane intersecting the surface being cleaned at the highest level thereof.

Briefly the brushes 20 are adapted to clean the car with a circular motion somewhat similar to that of a human hand, as the same is advanced across the surface in a general fore and aft direction. Additionally the brushes are adapted to individually extend and retract, within predetermined limits, automatically, in response

to changes in the contour of the surface being cleaned adjacent the individual brush, in order to maintain functional contact therewith. Further the cleaning pad of each brush, i.e. the part of the brush having functional contact with the surface, has sufficient give or elasticity to compress or vary its shape so that a ledge, edge or obstruction on the surface will not stop the rotation thereof and each brush as a unit, is preferably adapted to rock transversely of its lineal direction of travel in response to and in order to facilitate avoiding any obstructions. such as a radio aerial or rear view mirrors or the like which might otherwise stop or interfere with the lineal and/or rotational movement of the brush. Although the brushes respond individually to changes in the adjacent contour of the surface, they are preferably mounted on a common shaft; firstly in order that they may be shifted and/or retracted in unison, when and if desired, and in the manner and for the purposes to be hereinafter more fully explained and secondly in order to facilitate, simplify and make more economical the construction and operation of the apparatus.

In order to simplify the description of the brushes I will first describe those portions thereof which, in the preferred form of my invention, are common to or act upon a plurality of brushes and then describe those portions of the brush which are individual to each brush, although occurring in all the brushes, and then briefly set forth with respect to one brush the operation thereof, and finally describe those differences which distinguish the feeler brushes.

The drive shaft 75 is common to all the horizontal brushes and in addition to driving the brushes, that is providing the motive power for the rotational motion of the pad, is the means by which each brush is supported on the head and is the axis about which each brush tilts and is shifted.

As noted my apparatus preferably includes means to retract or withdraw the individual brushes en banc in order to disengage and clear the brush pads from the surface being cleaned. The brushes are retracted en banc for the purpose, inter alia, of permitting the placement of the surface within the apparatus (for example driving the automobile onto the tracks 12) and/or for the purpose of facilitating the rapid return of the carrier to the fore end of the apparatus after the same has passed over the surface and in preparation for the next use thereof.

In the preferred form of my invention the retraction means for the en banc retraction brushes includes a common horizontal retraction shaft 110 (see Figure 6), which is maintained in radially fixed, spacial relationship with the drive shaft 75 by a plurality of transversely spaced crank arms 111. The crank arms 111 are preferably formed with one long and one bifurcated short arm 111a and 111b, respectively. The axis of the crank and the end of the arm 111a are formed with suitable bushings. The crank axis is mounted on the shaft 75 and the arm 111a is mounted on and supports the shaft 110.

The en banc retraction means also includes actuating means for rotating shaft 110 about its axis. To this end I preferably provide a hydraulic cylinder 112 which is secured to one of the crank arms 111 (the leftwardly one, as shown) as by being pivotally mounted on a leg 111c thereof which is conveniently substantially a mirror reflection of 111b. Piston rod 112a is pivotally secured to retraction lever 113 which in turn is fixedly mounted on shaft 110. Piston rod 112a reciprocates within cylinder 112 and suitable connections (not shown) are provided to actuate the piston rod in either direction as desired to the end that when the piston is displaced downwardly, as viewed, the brushes are in their normal extended position and when the piston and cylinder are actuated to displace the piston upwardly the shaft 110 is rotated causing the brushes to retract en banc, in a manner and for the purpose to be hereinafter more fully described,

I also preferably provide means to shift or change en banc the axial orientation of the individual brushes in those washing heads which service continually descending surfaces (such as the rear portion of an automobile) in order that the feeler brushes may lower the washing head to maintain functional contact with the descending surface.

To this end a plurality of bearing blocks 114a are spaced along and mounted on the upper side of the beam 52 and are adapted to support the shifting lever shaft 114. A plurality of bifurcated links 116, equal in number to the number of crank arms 111, plus the number of horizontal brushes 20 are fixedly mounted on the shifting lever shaft 114, and extend in a generally forwardly direction therefrom and are aligned with the crank arms and brushes respectively. A noddle pin 116a is rotatably carried by each link 116 and extends across the bifurcations thereof. The fork of each arm 111b and brush 20 (see below) pivotally supports a tilting eye bolt 117, which extends with a sliding fit through the noddle pin 116a of the corresponding link 116. The relative position of each bolt 117 within the respective pins 116a is resiliently maintained by springs 120, which are disposed about each bolt on either side of the pin and have their remote ends bearing upon adjustable fixed abutments such as the nuts 122.

The springs 120 establish and maintain an equilibrium between the respective links 116, bolts 117 and crank arms 111 and/or brushes 20 and therefore, as will more fully appear, maintain the no load position or free position of the brushes 20 relative to the apparatus and the surface to be cleaned.

In order to shift the brushes, means is provided to rotate shaft 114, whereby to rotate the links 116 to provide a different spacial disposition of the noddle pins 116a to the end that when the equilibrium of the links, bolts and crank arms and/or brushes is re-established by the force of the springs 120 the shaft 110 although still being the same distance from the shaft 75 is at a different place in space relative thereto and the angular relationship between the shaft 110 and the at rest position of each brush remains constant. Preferably and conveniently the means to rotate the shaft 114 and shift the brushes comprises an ordinary double acting hydraulic motor 124 which conveniently is operated by tap line water pressure (connections not shown). The motor 124 comprises a cylinder 125 and a piston rod 126. Cylinder 125 is pivotally mounted on bracket 127, which is secured, as by welding, to the underside of the beam 52 and extends downwardly and rearwardly therefrom. Piston rod 126 is pivotally secured to the shifting lever 128 which is in turn fixedly secured to the shaft 114.

As best seen in Figures 3 and 6 when the brushes are not loaded and the piston is displaced upwardly, as viewed, to the limit of its stroke, the brushes are disposed so as to make an angle of about 20° forwardly of the vertical, and when the piston is displaced downwardly to the limit of its stroke, see dotted lines, the shaft 114 is rotated and the position of the links 116 and pins 116a and therefore of the shaft 110 and the brushes 20 is shifted to the end that the brushes make an angle of about 20° to the rearward of the vertical (the direction of functional advance of the carrier over the surface being viewed as forward). Thus in the preferred embodiment of my invention the shifting mechanism is adapted to maintain the brushes 20 as a whole in proper relationship with the surface being cleaned so that each may individually react to maintain functional contact with the surface in a manner to be hereinafter fully set forth and the shifting of the brush to the rearward of the vertical, as previously noted, is especially adapted for use with surfaces, such as the rearward end of an automobile, which have a prolonged, generally downward slope.

In those instances when shifting is unnecessary because

the surface being cleaned has no generally downward slope, the shifting means including shaft 114 may be dispensed with and the horizontal brushes 20 may take the structure hereinafter described for vertical brushes 21.

Preferably each individual brush includes a cleaning pad or surface which is adapted to make contact with the surface being cleaned and which is rotated about an axis which preferably makes an angle of about 20° with the vertical when unloaded. Each brush also includes means to conduct the water or cleaning fluid and vacuum to the cleaning pad, means responsive to the tilting of the brush to retract the same and means permitting the brush to rock transversely of its path in order to avoid obstructions. In the preferred form of my invention each brush 20 (Figures 7 thru 11) comprises an elongated housing 135 which conveniently includes transversely spaced, flat, parallel side plates 135a and 135b, which are secured at one end as by screws 136 to a pivot and gear block 138 and at the other end to end plate 139, which extends between and is welded to the sides 135a and 135b respectively. The housing 135 is adapted to provide structural strength for the brush as well as track and guide means for facilitating the retraction and extension of the brush arm and supports for that portion of the retraction mechanism which is indigenous to the individual brushes. To this end transversely spaced, mutually parallel, longitudinally extending guide bars 141 are secured, as by welding, to the inner surfaces of the respective sides 135a and 135b, and depending supports 142a and 142b and 143a and 143b are secured to or formed integrally with the sides 135a and 135b, respectively, at the respective ends thereof.

The pivot and gear block 138 is the means by which the brush is mounted on and supported by the head and carrier and provides the means by which the brushes tilt about the shaft 75 as well as the means by which the rotative motion and power of the shaft 75 is transmitted to and actuates the brush arm. Block 138 also includes fork means by which the brush is secured to the balancing means for maintaining the proper spacial relationship of the brush relative to the apparatus and the surface being cleaned.

The block 138 conveniently comprises a body portion 144, which is bifurcated on its upper and lower sides (as viewed) so as to have a longitudinally extending groove 145 and a transversely extending groove 146, and a plurality of U-shaped cap members 147a, and 147b and 148a and 148b, which overlie and extend across the grooves 145 and 146 respectively, are secured as by screws 149 to the body, to the end that the grooves become bores and the block 138 may be supported about the shaft 75 on the one hand and may support the brush arm on the other hand. The caps 147a and 147b and 148a and 148b are respectively spaced apart and the slots 150 and 151 respectively defined therebetween are extended within the body so as to intersect. The caps 148a and 148b are provided with outwardly extending transversely apertured portions which function as a fork for supporting the eye bolt 117.

Bushings 152 and 153 are disposed within the groove or bore 145 and at either side of the slot 150 and a driving sleeve 154 is rotatively disposed within the bushings. The sleeve 154 is preferably formed with the end adjacent the brush housing 135 of greater outside diameter than the other end and is provided with an inner conveniently integral longitudinally extending key portion 155. A helical gear 156 is fixedly mounted on the sleeve 154 and is disposed within the slot 150. The gear 156 is in operative engagement with a similar helical gear 157, which is one of a plurality of such gears mounted and spaced along the shaft 75. The block 138 is rotatively mounted on the shaft 75; the bore 146 engaging the shaft 75 on either side of the gear 157, which is thence disposed within the slot 151 and has its axis at right angles

to the axis of gear 156. Spacers 160 are mounted about the shaft 75 and between adjacent brushes 20 and function to maintain the brushes in their proper place along the shaft. When so mounted and with the balancing means assembled the brush may rotate as a whole about the shaft against the force of springs 120 and simultaneously or otherwise rotation of the shaft drives the sleeve 154 by means of the meshed gears 157 and 156.

The brush arm 162 is preferably a length of tubing having a keyway 163 extending substantially throughout its full length and terminating a few inches short of the brush housing end of the tube. The arm 162 is disposed within and has a sliding fit with the driving sleeve 154, the key 155 being within the keyway 163. The brush housing end of the arm 162 is provided with means by which the arm may be retracted and cleaning fluid and vacuum conveyed to the interior of the arm even though the arm is being rotated. Preferably such means includes a cylindrical lift collar 165, of greater internal diameter than the exterior diameter of the tube or arm 162, which is disposed around the brush housing end of the tube and is restrained from sliding off the tube by a retaining ring 166, which is brazed or pinned to the arm a convenient distance from the end and which is adapted to engage the interior of the collar 165. The open end of the collar 165 extends a short distance beyond the end of the tube and is provided with internal threads 168 which are adapted to receive the end cap 170. The end cap 170 is U-shaped and the interior of the "U" is of sufficient diameter to permit a bushing 171 to be interposed between the cap and the tube. A fitting 173, which is adapted to receive vacuum hose 99 is secured to the collar 165 and is in communication with the interior thereof, conveniently about midway of its length. A second and smaller fitting 174, which is adapted to receive water or cleaning fluid hose 109 is secured to the fitting 173 and is in communication with the interior thereof. The end of the tube 162 is preferably closed by plug 176 and a plurality of radially spaced elongated holes or apertures 177 are provided in the wall of the tube preferably in longitudinal alignment with the area of communication between the fitting 173 and the collar 165. In order to make the collar fluid tight a running seal 179 is disposed within the collar 165, about the tube 162 and against the retaining ring 166. The seal 179 is urged toward the ring 166 by sealing ring 180 in response to the force exerted by spring 182, which is disposed about the tube 162 and functions between the ring 180 and end cap 170. The force exerted by the spring 182 and therefore the effectiveness of the seal may be adjusted by adjusting the position of cap 170.

A pair of longitudinally extending support bars 183 (Figure 9) are secured, as by brazing, to the diametrically opposed exterior sides of the collar 165 and are adapted to slide within and be supported by the guide bars 141. A link 185, the purpose and function of which will be hereinafter more fully explained, is secured to the under side (as viewed) of the collar 165 midway between the supports 183. The collar 165 is thus secured against rotation, although it may move longitudinally within the brush housing 135, whereas the tube 162 may rotate within the collar and is rotated by the shaft 75 acting through the gears 156 and 157 and the driving sleeve 154. The water or cleaning fluid and vacuum are transmitted, as desired, to the interior of the brush arm via the fitting 173, the collar 165 and the ports 177; the seal 179 preventing the same from leaking out between the collar and tube.

As noted above the brush is adapted to retract in response to obstructions on or changes in the contour of the surface being cleaned and in response to the tilting of the brush about the shaft 75 by said obstructions and changes in surface contours. In order to so retract the brush I preferably provide the supports 142a and 142b,

(Figures 9 and 10) at the pivot and gear block end of the brush housing 135, with opposed, elongated longitudinally extending slots 186. A sprocket 188 is supported and mounted for rotation in the slots 186 and conventional adjusting means indicated generally at 187 for locating and positioning the sprocket, are preferably carried by the supports 142a and 142b on the side of the sprocket remote from the block 138.

The brush retraction means also includes the supports 143a and 143b (Figures 7 and 11), which rotatably support axle 192 as by means of hubs 194 and bushings 195. An extension 197 is secured to support 143a and extends therefrom in a direction parallel with the housing 135 and away from the gear block 138. A gear rack roller bracket 198 is rotatably mounted on the axle 192 and extends parallel with the support extension 197 and the lower portion of the adjacent support 143a. Spacers 200 and retraction gear 201 are mounted on the axle 192 between the bracket 198 and support 143a and extension 197, gear 201 being fixedly mounted on the axle in order to rotate therewith. Preferably a non-rotatable shaft 204 is disposed between the extension 197 and bracket 198 in spaced relation with the gear 201. The shaft 204 is conveniently threaded at one end and is mounted with its other end secured to the bracket, for example, and its threaded end extending through the support extension and receiving a nut 205. A bushing 206 is mounted on the shaft 204 and flanged idler roll 207 is supported for rotation thereon. An elongated toothed retraction or gear rack 209 is disposed between the gear 201 and the idler roll 207 with the teeth of the rack in operative engagement with the gear. One end of the rack 209 extends between the sides 135a and 135b of the housing 135 and within the confines of the end plate 139, and the other end of the rack is pivotally secured to the retraction lever 210, which is fixedly mounted on retraction shaft 110. There is a retraction lever for each brush and all of the levers 210 extend from shaft 110 at the same angle and are parallel.

Sprocket 212 and spacers 213a and 213b are also mounted on axle 192 intermediate the bracket 198 and the support 143b and are so arranged that the teeth of sprocket 212 are aligned with the teeth of sprocket 188. A bushing 215 is preferably interposed between the spacer 213a and the bracket 198, on the one hand, and the axle 192, on the other hand, and the sprocket 212 is adapted to rotate with the axle 192. A chain 216 extends around the sprockets 188 and 212 and has its ends secured to the respective ends of link 185. Thus when sprocket 212 is turned in a clockwise direction, as viewed in Figure 6, the chain 216 moves in a similar direction and moves the link 185 toward the end 139 of housing 135 and since the link is secured to the collar 165 and thereby to the brush arm, the brush arm is retracted or withdrawn into the housing 135. Rotation of the sprocket 212 in the opposite or counterclockwise direction causes the arm to be extended or returned toward its original position. The distance the arm is retracted or extended depends on the angle through which sprocket 212 is turned by rack 209. The arm is shown in a fully extended position.

In practice and as previously noted, the arm extends at an angle of about 20° forward of the vertical, or rearward thereto if shifted, under the influence of spring 120. Should the arm as it travels over the surface in its normal forward position, for example, be impeded by an obstruction or a rising surface the arm is tilted about shaft 75, as an axis, toward the vertical and against the force of the springs 120. This causes the brush housing (see Figure 6) to move in a counterclockwise direction as viewed, i.e., away from the lever 210. Gear 201 moves with the brush rolling along the rack 209 and being rotated thereby in a clockwise direction. Since the gear and the sprocket 212 are fixedly mounted on shaft 192, the sprocket is also rotated in a clockwise direction and raises, retracts or withdraws the brush in the aforesaid

manner until further tilting ceases, because the brush is retracted sufficiently to pass over the obstruction or rise on the surface. The brush remains retracted so long as it remains tilted from its normal position. When the obstruction is passed, the force of the spring 120 return the brush to its normal position. This causes the remote (leftward as viewed) end of the brush to move in a clockwise direction reversing the sequence of action just described and extending the brush.

When it is desired to retract the brushes en banc, shaft 110 is rotated by the cylinder 112 in a clockwise direction, as viewed, in the manner described above. This turns the levers 210 in a similar direction and has the effect of pulling each respective rack 209 rightwardly as viewed, in other words the clockwise movement of lever 210 moves the free end of each rack closer to and in a direction toward the brush housing. This produces the same relative motion between each gear 201 and each rack as when each brush is tilted out of or further from its normal position and therefore also results in a clockwise movement of each sprocket 212 and a retraction of all of the brush arms.

In the preferred form of my invention shown, the brush arms have a retraction length or distance of about 14" although other lengths may be used. Thus the brush is adapted to retract or extend, when tilted about the axis of the drive shaft, as a result of establishing or breaking contact with any obstruction or a change in height of the surface being cleaned.

The open end of the tube or brush arm 162 is provided with a cleaning pad or foot 218 (Figure 15). This cleaning pad or foot conveniently comprises a molded rubber or other soft and flexible elastic member 219 which is shaped substantially like a cupped hand and includes a cylindrical rear portion having a bore which fits over the end of the tube 162 and is secured thereto as by frictional grip or otherwise. A soft porous member 220, preferably of cloth, is stretched around the member 219 and is secured thereto in any convenient manner such as by rubber band 221 which engages the member 220 and holds it against the tube. The forward end of the member 219 is preferably pierced as at 222 in a plurality of places in order that the cleaning fluid and/or vacuum may reach that portion of the cloth. The portion of the cloth 220 which bridges the cupped portion of the member 219 has most of the effective and functional contact with the surface being cleaned, however, the forward portion may effectively clean vertical, overhanging or similar surfaces for example. The member 219 may take other shapes as desired, but I presently believe the shape and form shown to be the most effective.

As previously stated I preferably provide one or more feeler brushes 20'a and 20'b, for example (Figures 2 and 12) which are adapted to control the hoist motor 64 and thereby the vertical travel of the horizontal head. Each feeler brush 20'a and 20'b is, in all respects, similar to the brushes 20 except that the arm 162' is conveniently shorter by perhaps half than the arm 162 of the standard brush and one side of the brush housing pivotally supports a noddle pin 223.

The feeler brush is adapted to control the hoist motor in response to the tilting of the brush resulting from the changes in the contour of the surface being cleaned. To this end I conveniently provide a link or bracket 226 for the brush. Bracket 226 extends between and is supported by shafts 75 and 110 and may, if desired, otherwise be adapted to function in the same manner and for the same purpose as crank arms 111. An electrical switch 227 is mounted on bracket 226 and is connected by suitable leads (not shown) in series with the hoist motor 64 and a switch for reversing the poles of switch 227 and reversing the field of motor 64.

Switch 227 is operated by toggle arm 229 which is biased, within the switch, in a direction away from the feeler brush and the circuit is arranged so that when the

brushes are in their normal position (i.e. 20° forward of vertical) the switch 227 is biased to the open position but when the brushes are in their shifted position (i.e. 20° rearward of vertical) the poles are reversed so that the switch 227 is biased to the closed position and the hoist motor 64 is operated in a direction to lower the horizontal head. When the feeler brush is in its normal position and the toggle arm 229 is moved toward the brush, it closes the circuit and actuates the hoist motor to raise the horizontal head 14 and when the brush is in its shifted position and the toggle arm 229 is moved toward the brush, it opens the circuit.

Rod 231 extends from the toggle arm 229 through and beyond noddle pin 223 and is preferably provided with adjustable abutments 232 on either side of the noddle pin. Springs 234 and 234' are disposed about rod 231 on either side of noddle pin 223 and between the noddle pin and the respective abutments 232. As will hereafter more fully appear the tilting of the brush causes the noddle pin to move against the spring 234' to actuate the toggle arm 229 and switch 227 to close or open the switch and raise or cease to lower the horizontal head depending upon whether the brush is in the normal or shifted position.

The degree of tilting necessary to cause the feeler brush to actuate the switch 227 is predetermined, preferably, so as to permit the brush to retract and extend, as near as possible, to the full extent permitted by the shorter brush arm before the switch 227 is actuated.

As previously noted, the carrier 10 also supports the vertical cleaning heads 16 and 18. As shown in the preferred embodiment of my invention, these heads have a fixed lateral relationship and do not move toward and away from the center of the apparatus. However, it is to be understood that my invention may be adapted for use in situations where the sides of the surfaces being washed are not substantially planar or the changes in the contour are of a greater order than the retraction distance of the individual brushes in which instance beams could be provided to move the respective heads 16 and 18, en banc, toward and away from the center of the apparatus.

In order that the vertical and horizontal brushes do not interfere with each other when the apparatus is in use, the vertical brushes are preferably disposed to the rearward of the horizontal brushes. To this end I prefer that vertically depending supports 235a and 235b be secured to the carrier frame 28 at the rearward portions thereof and extend downwardly therefrom (see Figures 2, 3, 4 and 13). These supports are preferably and conveniently channel members having their leg portions extending toward the exterior of the apparatus. Angle irons 236a and 236b respectively, may extend between and be welded to the respective supports 50a and 235a and 50b and 235b at or near the lower ends thereof to the end that the entire assembly is structurally strong and rigid. The vertical brushes 21 are substantially similar to the horizontal brushes 20 and are preferably driven and supported by a common vertical drive shaft. To this end the supports 235a and 235b are provided with a plurality of vertically spaced brackets 238 which are adapted to support shafts 239a and 239b and vertical drive shafts 241a and 241b, respectively. Since the shafts 239a and 239b preferably terminate just below the midpoint of the shafts 241a and 241b, the lowermost brackets 238' preferably only have means for supporting shafts 241a and 241, respectively.

The upper ends of shafts 239a and 239b are supported by bearing brackets mounted on the carrier frame 28. Bevel gears 244a and 244b are mounted on the upper ends of the shafts 239a and 239b respectively, and sprockets 245a and 245b are mounted just below the gears 244a and 244b, and in horizontal alignment with the sprockets 83a and 83b, respectively, which are mounted on the vertical shafts 80a and 80b as set forth in the description of the horizontal head. Chains 247a and 247b en-

circle the sprockets 83a and 245a and 83b and 245b, respectively, and transmit power and motion from the shafts 239a and 239b to the shafts 80a and 80b.

The main brush drive shaft 248 extends transversely of the carrier and is supported in position on the frame thereof by a plurality of pillow blocks 250. Bevel gears 251a and 251b, respectively, are mounted on the ends of the shaft 248 and are adapted to engage the bevel gears 244a and 244b, respectively. Shaft 248 also carries a main brush drive gear 253, which is in operative relation with pinion 254, which is mounted on the shaft of the brush drive motor 79. Thus upon the actuation of motor 79 the shaft 248 is turned and drives the shafts 239a and 239b and thence the shafts 80a and 80b. The rotative motion and power of shafts 239a and 239b is transferred to the shafts 241a and 241b respectively by means of spur gears, 256a, for example, which are mounted on the shafts 239a and 239b and which respectively engage spur gears, 257a, for example, mounted on shafts 241a and 241b, respectively, at their midpoints.

The vertical cleaning heads 16 and 18 are identical except for the orientation of parts necessitated by the one being on the left side of the apparatus and the other on the right. Further description of the vertical head will be limited, therefore, to a description of head 18, it being understood that similar parts and functions form a part of and are the purpose of head 16.

As shown (see Figure 13), the brushes 21 of the head 18 are not provided with a shifting mechanism although when necessary or desired one may be provided in the manner described above for the horizontal head. Since no shifting mechanism is provided for the vertical brushes, the en banc retraction shaft 110'b of the vertical head 16 need not be supported on and by the brush drive shaft 241b in the manner that shaft 110 is supported on and by shaft 75 (when a shifting mechanism is provided) but is preferably supported on the brackets 259b, which are spaced along and extend outwardly from the support 235b. The side brushes 21 are mounted with their pivot and gear blocks 138 on the shaft 241b and their retraction levers 210 are fixedly secured to the retraction shaft 110'b. Shaft 110'b is rotated to retract the side brushes 21 in substantially the same manner as shaft 110 retracts the horizontal brushes. To this end lever 260b is fixedly mounted on shaft 110'b and is pivotally secured to the piston rod 261b of hydraulic motor 262b, which conveniently is similar to and functions in the same manner and for the same purpose as hydraulic cylinder and piston 112 and 112a described above. The cylinder 262'b of motor 262b is pivotally mounted on bracket 263, which is secured, as by welding, to the inner side of support 235b. When, as shown, no provision is made for shifting the vertical brushes 21, the brush balancing mechanism described in connection with horizontal brushes 20 may be dispensed with and the brushes 21 may be maintained in proper at rest angular relationship with the surface to be cleaned by means of spring 264 which has one end pivotally secured to the brush housing 135 and the other end looped over and rotatably engaging the retraction shaft 110'b. A rod or tubular spacer may be inserted within or about the spring 264 to insure further that the at rest position of the brush is at 20° to the surface.

In order to supply water or cleaning fluid and vacuum to the vertical brushes (see Figures 5 and 13), I preferably provide a vertical water or cleaning fluid pipe 265b and vacuum conduit 266b. The pipes 265b and 266b are preferably carried by the support 50b and are held in position by brackets 268b, which are secured to and spaced on the supports 50b, so as not to interfere with the travel of the horizontal head. The pipe 265b is connected in a conventional manner to the fixed piping 105 and is thus in communication with the tank 32. A plurality of nipples 270b are spaced along the pipe 265b and hoses 271b lead from the respective

nipples 270b to the respective fittings 174 of the vertical brushes 21. Similarly the conduit 266b is connected in a conventional manner to conduit 96 and thereby to the vacuum pump 34. A plurality of nipples 273b are spaced along the conduit 266b and vacuum hoses 274b lead from the respective nipples 273b to the fittings 173 of the respective vertical brushes 21.

A control panel 275 (see Figures 3 and 14) is conveniently provided and mounted at a convenient place on the apparatus or at or near where the same is installed and proper leads connect the panel with a power source and with the respective motors, valves, etc., which are to be controlled thereby. Conveniently the panel includes, for example, controls for the carrier travel, the horizontal head travel, the brushes, the vacuum system, the water or cleaning fluid system and an emergency stop control switch 276 for stopping the entire apparatus at one time.

The carrier control switches include stop, forward and return buttons 277, 278 and 279, respectively, for actuating the travel or carrier advancing motor 36. The horizontal head or vertical travel control switches include buttons 280 and 281, respectively, for selecting automatic control whereby the vertical travel is controlled by the feeler brushes in the manner described above or manual control, as well as manual up and manual down buttons 282 and 283, respectively, for controlling hoist motor 64 when the vertical travel of the horizontal head is under manual control. The brush controls include stop and start buttons 284 and 285 for the brush drive motor 79; switch 286 to control the hydraulic retraction motors 112 and 262 and buttons 287 and 288 for controlling the hydraulic shifting motor 124 to tilt the horizontal brushes forward or rearward as desired. The vacuum controls include buttons 289 and 290, respectively, for actuating and deactuating the vacuum pump, and the water or cleaning fluid controls include buttons 291 and 292, respectively, for controlling the solenoid valve 107 at the discharge of the tank 32.

In operation as an automobile cleaner, for example, the automobile is driven, while the brushes are retracted, onto the tracks 12 and within the apparatus and positioned substantially as shown in Figure 1. The vertical travel control is set for manual operation and the carrier 10 and horizontal head are positioned so that when extended the horizontal brushes are in operative contact with the front bumpers and the horizontal brushes are tilted forwardly. The operator actuates switch 286 to extend all the brushes, button 284 to start them rotating and button 291 to start the flow of water or cleaning fluid. Under manual control the forward and rearward sides of the front bumper are washed and the brushes are positioned on the mud plate which extends between the bumper and the grill. The switch 280 is then actuated making operation automatic and causing the carrier to travel in a forward direction. All of the brushes continue to rotate. The horizontal brushes meeting the obstruction of the grill are tilted rearwardly causing them to retract in the manner hereinbefore described. The feeler brushes are similarly tilted and because the grill has a vertical height greater than the retraction distance of the feeler brushes they actuate the hoist motor 64 to raise the horizontal head. When the feeler brushes clear the top of the grill they resume their normal position under the influence of the springs 120 thereby deactuating the motor 64. The carrier continues to travel forwardly over the car with the horizontal brushes maintaining functional contact with and washing the hood thereof. When the horizontal brushes reach the windshield, the horizontal head is again raised sufficiently to permit the brushes to pass over the windshield to the top of the car. Meanwhile the vertical brushes are washing the respective sides of the car each brush extending and retracting as necessary to follow the contour thereof. As the horizontal head passes the highest point in the

car the horizontal brushes are preferably shifted either by actuation of the switch 288 by the operator or by the operation of an automatic switch (not shown) actuated by the carrier. The carrier continues to travel over the car, the feeler brushes controlling the hoist motor in the manner described above to maintain contact with the downwardly sloping rear end of the car. When the carrier has passed completely over the car, switch 286 is actuated to retract all the brushes, switch 292 is actuated to stop the flow of water or cleaning fluid and switch 279 is actuated to return the carrier to the forward end of the automobile. With the carrier once again at the forward end of the automobile, switch 289 is actuated to start the vacuum pump and the carrier is once again passed over the automobile in the manner just described, the vacuum drying the surface thereof. If desired the drying means or step may be omitted.

An automobile cleaner embodying the preferred forms of my invention may have an overall length of about 29', an overall width of about 13'5" and a height of just over 12'. The standard brushes in such instance preferably have a retraction distance of 14" and are so arranged that the maximum clearance between the opposed rows of vertical brushes is 7' and between the floor and the completely retracted and raised horizontal brushes is 6'8". Apparatus of such dimensions and characteristics is adapted to clean most of the popular automobiles now in use or being sold in America. However, as previously indicated, the overall dimensions of the apparatus embodying my invention, the retraction distance and the number of the brushes may be varied at the user's discretion and in view of the nature of the object or surface to be cleaned thereby. I presently prefer that the carrier in a typical installation wherein the apparatus is used as an automobile washer move forward at a speed of about 12½ feet per minute and return at a speed of about 25 feet per minute, thus taking about 2 minutes to pass over the ordinary automobile and one minute to return to the starting position and I prefer that the brushes rotate at about 200 r.p.m., although it is to be understood that these speeds are not critical and are given only by way of example.

A modified form of brush embodying my invention is shown in Figures 16-18 and is indicated generally at 295. The brush 295, as with the brush 20, may be used in either a horizontal or a vertical head but for convenience will be described as though mounted on the beam 52 of the head 14 hereinbefore described. It is to be understood, however, that the structural form of the head 14 as with the preferred form of my invention need not take the form of a single beam so long as the head provides structural support for the brushes and includes means to transmit rotary motion and power, water or cleaning fluid, and vacuum to the brush, and it is to be further understood that the considerations regarding the purpose and need for shifting and/or en banc retraction are as pertinent to the modified brush as to the preferred brush. Brush 295 is preferably mounted on drive shaft 296 which is substantially similar to drive shaft 75 and is conveniently mounted on beam 52 in the same manner as shaft 75. Shaft 296 supplies rotative motion and power to the brush and is the axis about which the brush tilts for purposes of actuating the individual brush retraction mechanism; although it is to be understood with regard to both forms of my invention herein described that rotative motion and power may be supplied each brush by an individual motor carried thereby and that the shaft 296 or equivalent mounting may then be used only as a tilting axis. Further the term rotative motion as used with respect to both the preferred and modified forms of my invention includes, inter alia and for example, both continuous motion in one direction or oscillatory motion in any degree of arc desired.

In order to provide for the en banc retraction of brush 295 retraction shaft 297 is supported on and by drive

shaft 296 in substantially the same manner as retraction shaft 110 is supported on shaft 75. Shaft 297 functions and is actuated to retract the brush 295 in substantially the same manner as shaft 110.

Each brush 295 comprises a housing member 299, which provides the main structural support for the brush and a brush arm 300, which is adapted for reciprocation (retraction and extension) relative to the housing and has at its end nearer the surface to be cleaned a washing pad, not shown, which is similar in office and function to the pad shown in the preferred form of my invention. The housing 299 includes a gear and pivot portion 302, an elongated retraction means supporting portion 303 and an elongated brush arm support 304. The gear and pivot portion 302 is similar in function to the gear and pivot block 138. Preferably the brushes 295 are mounted on the shaft 296 and rotative motion and power is transferred from the shaft to the brush arm 300, in a manner similar to that in the preferred brush, by means of helical gears 306 and 307 on the shaft 296 and brush arm 300, respectively. Additionally gear and pivot portion 302 of brush 295 is provided with a semi-circular longitudinally extending groove 308 in its face remote from the shaft 296 and an idler roller 309, which serve to guide and support spring 310.

Retraction means supporting portion 303 of housing 299 conveniently has a cross section of arcuate shape and is provided at the end remote from the drive shaft with parallel depending side extensions 313 which support axles 314 and 315.

The brush arm support 304 preferably is formed integrally with brush housing portions 302 and 303 and is provided with a bushed bore 317 which encircles and supports the brush arm 300. Brush arm support 304 also provides a fixed anchorage, as by eye 318, for the end 319 of spring 310.

Brush arm 300 is substantially similar to brush arm 162 except that the end thereof which is remote from the pad and is disposed within collar 321 is flanged. Collar 321 performs the same functions as collar 165 albeit the structural details may differ as for example with respect to the connections with the hoses supplying water or cleaning fluid. In order to prevent collar 321 from rotating a projection, ridge or flange 323 is formed thereon and is adapted to slide within the longitudinally extending slot 324 formed in portion 303 of housing 299. A second projection or flange 325 is provided on the collar 321 in longitudinal alignment with the groove 308 and the other end 326 of spring 310 is secured thereto as, for example, by means of the eye 327. Thus one end of spring 310 is secured to the brush arm at the end thereof remote from the pad and the other end of the spring is secured to the brush housing nearer the pad end of the brush arm than the location of the remote end of the arm when the arm is fully extended, to the end that the spring 310 tends to maintain the brush arm in its fully extended position. In the fully extended position the arm and brush preferably make an angle of from 20° to 30° with the vertical plane, the same as with the preferred embodiment of my invention.

A plurality of gear segment racks 328, one for each brush, are fixedly mounted on the shaft 297 and each said rack is disposed in operative engagement with the adjacent brush 295 and more particularly with the intermediate gear 329, which is mounted on axle 314 exteriorly of the side extensions 313. The gear racks are arcuate relative to the center line of the drive shaft 296 and are so disposed as to lie just to one side of the path traced by the portion 303 of housing 299 when the brush is tilted about the drive shaft. Gear 329 is in operative engagement with gear 330 which is mounted on shaft 315. Shaft 315 also carries sprocket 332 the teeth of which are in longitudinal alignment with the slot 324 and therefore with flange 323. A chain 333 is fixedly

secured to the flange 323 and the sprocket 332 and is adapted to be wound on the sprocket.

In this form of my invention the brush is, as previously stated, maintained in equilibrium and in the extended position by the spring 310. When the brush encounters an obstruction, as it travels relative to the surface being cleaned, the extended part thereof is tilted away from the direction of travel. This causes the pad of the brush to move upwardly as viewed, Figure 16, and swings the remote (rightward as viewed) end of the brush downwardly causing gear 329 to roll along gear segment 328. Gear 329 turns gear 330 and thereby axle 315 and sprocket 332 all in a counterclockwise direction as viewed. This causes the chain 333 to be wrapped around or taken up by the sprocket 332 thereby pulling or lifting collar 321 and retracting the brush in opposition to the force of spring 310. When the obstruction is passed and no longer acts to tilt the brush, the spring 310 draws or pulls the collar to the leftward as viewed extending the brush and unwinding the chain 333 thereby rotating the sprocket 332, the axle 315 and gear 330 in a clockwise direction. Gear 330 then turns gear 329, which moves upwardly, as viewed, along the gear rack, returning the brush to its normal operating position relative to the vertical and the surface being cleaned.

Figure 19 discloses means by which either brush 20, 21 or 295 may be mounted so that the pad thereof may have limited lineal movement transverse to the general direction of travel in order to avoid, if necessary, obstructions such as, for example, radio antenna. This may be accomplished by mounting gear 157 on sleeve 336 instead of directly on the drive shaft. Sleeve 336 is of longer length than the thickness of the gear mounted thereon and of greater internal diameter than the external diameter of the drive shaft. Rubber washers 337 are molded to the interior of the sleeve at the respective ends thereof and are secured, as by cementing for example, to the drive shaft. The washers 337 transmit the rotary motion of the shaft to the sleeve and gear and thence to the arm in the aforescribed manner and additionally have sufficient elasticity to permit the respective pivot and gear block to tilt or rock slightly about an axis which is substantially perpendicular to the brush arm and the drive shaft. This slight tilt is sufficient when magnified by the length of the brush arm to permit the brush to tilt or be displaced transversely of the general direction of travel of the brush sufficient to permit the brush to go around or avoid an abrupt sharp obstruction. The elasticity of the rubber washers returns the brush to its normal position when the obstruction initiating the tilting is passed. It should be noted that this tilting does not cause the brush to retract. However, the obstruction may have the effect of tilting the brush about the axis of the shaft as well as the axis perpendicular thereto thereby simultaneously retracting the brush and moving the pad to either side of its normal direction of travel.

Modifications, changes and improvements to the embodiments of my invention herein described may occur to those skilled in the art who come to understand the precepts and principles of my invention. Therefore, I do not wish to be limited in the scope of my patent by the preferred and modified forms of my invention herein illustrated and described nor in any manner inconsistent with the advance by which my invention has promoted the art.

I claim.

1. Apparatus for cleaning a surface comprising track members supported a predetermined distance above the floor or grade, a carrier mounted on said track members for reciprocal movement thereon said carrier having opposed transversely spaced downwardly extending support members, a horizontal head carried by and adapted for vertical reciprocating movement on said support members, hoisting means for reciprocating said horizontal head, a transversely extending horizontal brush drive shaft rotat-

ably supported on said horizontal head, transversely spaced vertically extending vertical brush drive shafts rotatably supported on said carrier, means to selectively rotate said drive shafts, a plurality of brushes rotatably supported on each said brush drive shaft, a plurality of transversely spaced horizontal brush retraction lever arms rotatably supported on said horizontal brush drive shaft, a transversely extending horizontal brush retraction lever shaft rotatably supported by said retraction lever arms a fixed distance from said horizontal brush drive shaft, a vertically extending vertical brush retraction lever shaft rotatably supported on said carrier and extending parallel with and spaced from each said vertical brush drive shaft respectively, means to selectively actuate said retraction lever shafts, a transversely extending shifting lever shaft rotatably supported on said horizontal head, means to selectively actuate said shifting lever shaft, retraction levers equal in number to the number of said brushes fixedly mounted on said retraction lever shafts respectively, a gear rack pivotally supported at the end of each said retraction lever, each said brush comprising a pivot and gear block portion, a housing secured to said pivot and gear block portion and extending longitudinally therefrom and an arm adapted to retract and extend relative to and within said housing and said pivot and gear block portion, said arm comprising a hollow tube having a longitudinally extending groove in the surface thereof and an open end remote from said pivot and gear block portion, a sleeve within said pivot and gear block portion and having a key for engagement with said groove, gear means carried by said sleeve and adapted to rotate the same, brush sprocket wheels rotatably supported at the respective ends of said housing, chain means wreathed about said sprockets and engaging the end of said arm adjacent said brush housing, a brush housing spur gear rotatably supported on said housing at the end thereof remote from said pivot and gear block portion and adapted to drive the adjacent said brush sprocket, a washing pad disposed over and closing said open end of said arm, said gear racks operatively engaging said brush housing spur gears respectively, a plurality of gears on said drive shafts equal in number to the number of said brushes and adapted to engage said pivot and gear block portion gear means respectively, at least one of said horizontal brushes having a shorter brush arm than others of said horizontal brushes, a switch rod pivotally supported on the housing of each said one horizontal brush, switch means carried by said horizontal head and adapted to control said hoisting means, means biasing said switch means to cause said hoisting means to displace said horizontal head in a predetermined direction, said switch rod being operatively connected to said switch means and adapted to oppose said biasing means, an eye bolt pivotally secured to each said pivot and gear block portion of each said horizontal brush and each said horizontal retraction lever arm, spaced adjustable abutments on said eye bolts, a noddle pin slidably engaging each said eye bolt intermediate said abutments, springs surrounding each said eye bolt and extending between said noddle pin and said abutments respectively, a plurality of shifting lever arms mounted on said shifting lever shaft and pivotally engaging each said noddle pin respectively and resiliently disposing said horizontal brushes and horizontal retraction lever arms in predetermined positions, means resiliently disposing each said vertical brush in a predetermined position and means to selectively conduct cleaning fluid to the interior of said brush arms respectively.

2. The apparatus according to claim 1 with means to create suction in the interior of said brush arms respectively.

3. The apparatus according to claim 1 with flexible bushings disposed intermediate said pivot and gear block portions of said brushes and said drive shafts respectively

to permit said brushes to rock about an axis perpendicular to said respective drive shafts.

4. Apparatus for cleaning a surface comprising track means, a carrier mounted on said track means for reciprocal movement thereon, a horizontal head supported on said carrier for vertical reciprocating movement thereon, hoisting means for reciprocating said horizontal head, a transversely extending horizontal brush drive shaft rotatably supported on said horizontal head, a vertical extending vertical brush drive shaft rotatably supported on said carrier, means to rotate said drive shafts, a plurality of brushes rotatably supported on each said brush drive shaft, a transversely extending horizontal brush retraction lever shaft rotatably supported a fixed distance from said horizontal brush drive shaft, and a vertically extending vertical brush retraction lever shaft rotatably supported a fixed distance from said vertical brush drive shaft, means to selectively actuate said retraction lever shafts, retraction levers equal in number to the number of said brushes fixedly mounted on said retraction lever shafts, respectively, a gear rack pivotally supported at the end of each said retraction lever, each said brush comprising a pivot and gear block portion, a housing secured to said pivot and gear block portion and extending longitudinally therefrom and an arm adapted to retract and extend relative to and within said housing and said pivot and gear block portion, said arm comprising a hollow tube having a longitudinally extending groove in the surface thereof and an open end remote from said pivot and gear block portion, a sleeve within said pivot and gear block portion and having a key for engagement with said groove, gear means carried by said sleeve and adapted to rotate the same, brush sprocket wheels rotatably supported at the respective ends of said housing, chain means wreathed about said sprockets and engaging the end of said arm adjacent said brush housing, a brush housing spur gear rotatably supported on said housing at the end thereof remote from said pivot and gear block portion and adapted to drive the adjacent said brush sprocket, a pad disposed over and closing said open end of said arm, said gear racks operatively engaging said brush housing spur gear respectively, a plurality of gears on said drive shafts equal in number to the number of said brushes and adapted to engage said pivot and gear block portion gear means respectively, at least one of said horizontal brushes having a shorter brush arm than others of said horizontal brushes, a switch rod pivotally supported on the housing of each said horizontal brush, switch means carried by said horizontal head and adapted to control said hoisting means, means biasing said switch means to cause said hoisting means to displace said horizontal head in a predetermined direction, said switch rod being operatively connected to said switch means and adapted to oppose said biasing means, means resiliently disposing said brushes in a predetermined position and means to selectively conduct cleaning fluid to the interior of said brush arms respectively.

5. Apparatus for cleaning a surface comprising a cleaning head, means to move said surface and cleaning head in a predetermined lineal direction relative to each other, a plurality of brushes supported on said cleaning head for pivoting about an axis extending transversely of said predetermined lineal direction, means resiliently biasing each said brush in a predetermined position at a predetermined angle with said surface and predetermined lineal direction, each said brush comprising a housing, an arm mounted on said housing for movement relative thereto and adapted to extend and retract relative thereto, and cleaning pad means on said arm and adapted to engage said surface to clean same, means urging said respective arms into an extended position and retracting said arms when said brushes pivot about said transverse axis and means for moving said respective cleaning pad means in engagement with and relative to said surface in addition

to said relative movement between said cleaning head and surface.

6. The cleaning apparatus according to claim 5 in which at least certain of said brushes also comprise means whereby said certain brushes are selectively displaceable, angularly about respective axes extending perpendicular to said transverse axis.

7. The cleaning apparatus according to claim 6 in which each said certain brush is mounted on a shaft extending concentrically with said transverse axis and said last named means comprises resilient brushing means disposed between each said certain brush and shaft.

8. The cleaning apparatus according to claim 5 in which each said brush arm has a longitudinal axis and said last named means comprises means for rotating each said arm through a predetermined arc about its longitudinal axis.

9. The cleaning apparatus according to claim 8 in which said last named means includes a shaft rotatably supported on said head and extending concentrically with said transverse axis, a plurality of gears mounted on said shaft, gear means carried by each said brush and operatively engaging a said gear respectively and means to rotate said shaft.

10. The apparatus according to claim 9 in which each said gear means includes a longitudinally extending keyway in said arm, a sleeve rotatably supported in said brush housing and having a key engaging in said keyway, and a gear fixedly mounted on said sleeve and engaging a said shaft gear respectively.

11. The cleaning apparatus according to claim 5 with means to reciprocate said cleaning head in a plane angularly related to said predetermined lineal direction.

12. The cleaning apparatus according to claim 11 in which at least one said brush is a feeler brush and said last named means is responsive to a predetermined pivoting of said feeler brush about said transverse axis, to reciprocate said cleaning head.

13. The cleaning apparatus according to claim 12 in which said feeler brush has an arm which is shorter than the other said brush arms and said last named means includes motor means disposing said cleaning head to move in one direction, switch means for controlling said motor means and means operably interconnecting said switch means and said feeler brush to actuate said switch means in response to each said feeler brush pivoting a predetermined degree about said transverse axis.

14. The cleaning apparatus according to claim 5 with means to retract the said arms of at least a portion of said brushes en banc.

15. The cleaning apparatus according to claim 14 in which said brush arm retraction and extension means includes a plurality of gear rack means carried by said head and gear means carried by said brushes and engaging said gear rack means for rolling engagement therewith and said en banc retraction means includes a shaft rotatably supported on said head, a plurality of levers pivotally supporting said gear rack means respectively and fixedly secured to said shaft and means for selectively rotating said shaft to move said levers through a predetermined arc whereby to displace said pivotal connection between said levers and gear rack means respectively and to move said gear rack means in engagement with said gear means.

16. The cleaning apparatus according to claim 5 with means for selectively changing the predetermined angle at which certain of said brushes are biased by said resilient brush biasing means.

17. The cleaning apparatus according to claim 5 in which each said brush arm is hollow and said apparatus includes means for selectively conducting cleaning fluid means to the interior of said arms respectively.

18. The apparatus according to claim 17 in which said cleaning fluid means includes suction.

19. The cleaning apparatus according to claim 5 with a plurality of said brushes arranged in tandem relative to said predetermined direction of relative motion.

20. Apparatus for cleaning a surface comprising a cleaning head, means to move said surface and cleaning head in a predetermined lineal direction relative to each other, shaft means supported on said head and having a longitudinal axis extending transversely of said predetermined lineal direction, a brush supported on said shaft means for pivotal motion about said longitudinal axis, means resiliently biasing said brush in a predetermined position at a predetermined angle with said surface and predetermined lineal direction, said brush comprising a housing, an arm mounted on said housing for movement relative thereto and adapted to extend and retract relative thereto, and cleaning pad means on said arm and adapted to engage said surface to clean same, means urging said arm into an extended position and retracting said arm when said brush pivots about said shaft means.

21. The cleaning apparatus according to claim 20 in which said brush extension and retraction means includes gear rack means carried by said head, gear means rotatably supported on said brush housing and having rolling engagement with said gear rack means when said brush pivots about said shaft means, chain means operably interconnecting said arm and said gear means and adapted to retract said arm when said gear means rotates in a predetermined direction and said means resiliently biasing said brush comprises spring means acting to oppose said rotation of said gear means.

22. The apparatus according to claim 21 in which said spring means engages and acts between said brush housing and said brush arm and urges said arm into said extended position.

23. The apparatus according to claim 21 in which said spring means engages and acts between said head and brush housing respectively and biases said brush to pivot about said shaft means to engage said gear means and gear rack means to rotate said gear means in a direction opposite to said predetermined rotational direction.

24. The apparatus according to claim 23 in which said means resiliently biasing said brush in a predetermined position includes abutment means carried by said head and brush housing respectively and said spring means acts therebetween.

25. The cleaning apparatus according to claim 24 with means for selectively changing the angle at which said brush is biased relative to said surface by said resilient biasing means.

26. The apparatus according to claim 25 in which said brush housing abutment means includes eye bolt means pivotally mounted on said brush housing and spaced abutments carried by said eye bolt means, said head abutment means includes a noddle pin slidably engaging said eye bolt means intermediate said spaced abutments, said spring means includes springs surrounding said eye bolt means and noddle pin and said abutments respectively and said last named means includes a shaft rotatably supported on said head, a lever fixedly secured to said shaft and pivotally secured to said noddle pin and motor means for rotating said shaft through a predetermined angle.

27. The cleaning apparatus according to claim 21 with means to retract said brush arm independently of the pivoting of said brush about said shaft means.

28. The cleaning apparatus according to claim 27 in which said gear rack means is pivotally secured to said head and said independent retraction means includes means to displace said pivotal connection between said gear rack means and said head to engage said gear means and said gear rack means to rotate said gear means in the direction opposite to said predetermined rotational direction.

29. The cleaning apparatus according to claim 28 in which said independent retraction means includes a shaft rotatably supported on said head, a lever fixedly secured

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to said shaft and pivotally secured to and supporting said gear rack means and motor means for rotating said shaft through a predetermined angle.

30. The cleaning apparatus according to claim 20 with means whereby said brush is selectively displaceable about an axis extending perpendicular to said shaft means.

31. The cleaning apparatus according to claim 30 in which said last named means comprises resilient bushing means disposed between said brush and shaft means.

32. The cleaning apparatus according to claim 20 in which said brush arm is hollow and said apparatus includes means for selectively conducting cleaning fluid means to the interior of said arm.

33. The apparatus according to claim 32 in which said cleaning fluid means includes suction.

34. The cleaning apparatus according to claim 20 in which said arm is hollow and said cleaning pad means includes a partially open hollow flexible resilient supporting member having communication with the interior of said arm and a porous covering overlying said partially open portion of said supporting member and adapted to engage said surface.

35. The cleaning apparatus according to claim 34 in which said arm has an open end and said supporting member is substantially cup shaped with an open area adjacent said surface and a hollow neck disposed about said arm and providing communication between said arm and said open area and said porous member comprises a sheet material enveloping said member and covering said open

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area and said cleaning pad means includes fastening means securing said sheet material about said arm.

36. Apparatus for cleaning a surface, said apparatus comprising a plurality of cleaning heads and means to move said surface and cleaning heads in a predetermined lineal direction relative to each other, said cleaning heads being arranged in tandem relative to said lineal direction, each said cleaning head comprising a plurality of brushes supported on said cleaning head for pivoting about an axis extending transversely of said predetermined lineal direction, means resiliently biasing each said brush in a predetermined position at a predetermined angle with said surface and predetermined lineal direction, each said brush comprising a housing, an arm mounted on said housing for movement relative thereto and adapted to extend and retract relative thereto, and cleaning pad means on said arm and adapted to engage said surface to clean same, means urging said respective arms into an extended position and retracting said arms when said brushes pivot about said transverse axis and means for moving said respective cleaning pad means in engagement with and relative to said surface in addition to said relative movement between said cleaning head and surface.

References Cited in the file of this patent

UNITED STATES PATENTS

2,637,054	Holmes	May 5, 1953
2,647,272	Holmes	Aug. 4, 1953
2,658,216	Shusett et al.	Nov. 10, 1953