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CAR WASHING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a car washing apparatus suitable for gas stations, taxi companies, vehicle servicing factories and others.

2. Description of the Prior Art

For car wash, there has been known a rotary brush type car washing apparatus which makes a rotary brush come into contact with an outside surface of a motor vehicle to take out stains while jetting or spraying cleaning liquid such as a cleaning agent and water through a nozzle(s) toward a motor vehicle. Such a car washing apparatus is designed so that a gate-like traveling frame incorporating the nozzle and the rotary brush travels in the forward and backward directions of the motor vehicle to automatically clean the entire outside surface of the motor vehicle. Also known is a so-called brushless type car washing apparatus which uses no rotary brush and includes a plurality of nozzles arranged along a gate-like traveling frame. More specifically, side nozzles arranged transversely on leg portions of the traveling frame in confronting relation discharge or jet cleaning liquid toward the side surfaces of the motor vehicle while upper nozzles

arranged downwardly discharge the cleaning liquid toward the front, rear and top surfaces of the motor vehicle. In this state, the traveling frame moves in the forward and backward directions of the motor vehicle, thus automatically cleaning the entire appearance of the motor vehicle. In this case, the traveling frame is of the type that travels on two rails placed on the ground or that travels on two rails installed on a frame for accommodating the motor vehicle.

There is a problem which arises with the aforesaid rotary brush type car washing apparatus, however, in that, since the rotary brush is directly brought into contact with the outside surface of the motor vehicle, the coated surface will be damaged in rotary brush, and further since the rotary brush is made to move along predetermined paths, the cleaning is possible only within the movable range of the rotary brush so that limitation is imposed on the size of the motor vehicle being washed. In addition, for surely making contact with various motor vehicles such as a sedan type and a wagon type, there is a need to set up a large number of rotary brushes on the traveling frame, which makes the system complicated.

On the other hand, in the case of the aforementioned brushless type car washing apparatus, the cuts in the coated surface are avoidable because of no use of the rotary brush. However, since the cleaning liquid is coincidentally

discharged from the plurality of nozzles under a high pressure, a large amount of water is used at the car washing, besides a large-sized pressurizing pump is required, with the result that difficulty is encountered to simplify the structure of the apparatus. Moreover, since the upper nozzles are made to merely move in the forward and backward directions of the motor vehicle while being kept at a constant height, if the upper nozzles are once set for a tall motor vehicle such as a wagon type, in the case of cleaning a shorter motor vehicle such as a sedan type, the upper nozzles greatly separates from a hood, roof and trunk of the motor vehicle so that the cleaning liquid discharging effect lowers to make it difficult to surely clean the outside surface of the motor vehicle. Contrary to this, if the upper nozzles are set at a low position, they may come into contact with a roof section of the tall motor vehicle.

SUMMARY OF THE INVENTION

The present invention has been developed in order to eliminate the above-mentioned problems, and it is therefore a primary object of the present invention to provide a car washing apparatus capable of enlarging an applicable range in size of a motor vehicle being washed and of making the entire structure of the apparatus compact, in addition to reducing

the amount of water used to enhance the car washing efficiency and adjusting the cleaning liquid discharging position in accordance with the height of the motor vehicle to surely clean the outside surface of the motor vehicle.

For this purpose, a car washing apparatus according to the present invention has the following aspects.

In accordance with a first aspect of this invention, a car washing apparatus being of a gate configuration comprises a traveling frame traveling in the forward and backward directions of a motor vehicle placed or housed therein, side nozzles disposed on leg portions of the traveling frame in opposed relation to each other for discharging cleaning liquid toward the motor vehicle, an elevating frame provided on the traveling frame to be movable up and down in accordance with the height of the motor vehicle, and an upper nozzle(s) placed on the elevating frame for discharging the cleaning liquid toward the motor vehicle.

In this case, the cleaning liquid signifies water, a cleaning agent and others, and the side nozzles and the upper nozzles can appropriately switch these liquids and discharge it thereto.

In the aforementioned car washing apparatus, the traveling frame and the elevating frame can be equipped with a blowoff opening for arranging and discharging air fed. In

addition, the traveling frame can be provided with a blower for supplying air to the blowoff opening. Further, each of the traveling frame and the elevating frame can include wax discharging nozzles for discharging a liquid wax toward the motor vehicle. The upper nozzles and the wax discharging nozzles can be fixed in an elevating frame side blowoff section. In this instance, if the blowoff section is attached through a first rocking mechanism to the elevating frame, the upper nozzles and the wax discharging nozzles can respectively take rocking or swinging motions. Further, if guide rails are provided along the leg portions of the traveling frame and guide rollers engaging with the guide rails are provided at both right and left hand end portions of the elevating frame, the elevating frame can smoothly move up and down.

In the car washing apparatus according to the first aspect, the elevating frame carries the upper nozzles and is suspended from the traveling frame to be movable up and down so that it can elevate in accordance with a height of a motor vehicle being housed, with the result that the upper nozzles on the elevating frame can keep an optimal distance from the roof of the motor vehicle irrespective of the height of the motor vehicle. Further, in the case of the arrangement in which the wax discharging nozzles are placed in both the right and left hand sides of the traveling frame and the

elevating frame, the liquid wax can be discharged from the wax discharging nozzles after the outside surface of the motor vehicle is cleaned with water jetted from the side nozzles and the upper nozzles, thus enabling the entire outside surface of the motor vehicle to be automatically waxed.

In an arrangement where a blower for dewatering is mounted on the traveling frame, the blower can quickly remove the water remaining on the outer surface of the motor vehicle washed to carry out the compulsory drying of it. If the blower is coupled to a blowoff section with an air discharging opening, the blowoff section can uniformly supply the outside surface of the motor vehicle with the pressurized air from the blower.

Furthermore, in the case that the blowoff section is installed through the first rocking mechanism on the elevating frame, it is possible to change the discharging angles of the wax discharging nozzles and the upper nozzles integral with the blowoff section, so that it is possible to more surely perform a series of car washing processes including a cleaning process, a waxing process and a drying process. Still further, when guide rails are vertically disposed in the right and left hand sides of the traveling frame and guide rollers are provided in both the right and left hand sides of the elevating frame, the elevating frame hanging from the traveling frame

can stably shift up and down through the guide rails and the guide rollers.

A car washing apparatus according to a second aspect of this invention comprises, in addition to those in the first aspect, a nozzle elevating mechanism for moving the side nozzles up and down (or in the vertical direction) and a nozzle reciprocating mechanism for reciprocating or oscillating the upper nozzles in the right and left hand directions (or the transverse direction of the motor vehicle). In this case, the car washing apparatus can further comprises a second rocking mechanism for rocking the upper nozzles in the forward and backward directions (or in the longitudinal direction) of the motor vehicle.

With this arrangement, for reciprocating the upper nozzles, the upper nozzles may be fixed to a first movable plate having a elongated hole engaged with a pin attached to a chain which revolves or circulates within the elevating frame. Further, for elevating the side nozzles, the side nozzles may be fixedly secured onto a second movable plate having an elongated hole engaged with a pin attached to a chain which revolves within a leg portion. Preferably, the aforementioned side nozzles is fixed to the second movable plate through an adjusting part (or an adjusting member) which can adjust their fixing positions in the directions of approaching or separating

from the motor vehicle.

In the car washing apparatus according to the second aspect, the gate-like traveling frame incorporates, at its right and left sides, a pair of side nozzles which can reciprocate up and down and further incorporates, at its upper sides, upper nozzles which can oscillate in right and left hand directions. The traveling frame repeatedly reciprocates in the forward and backward directions of the motor vehicle accommodated therein while reciprocating the side nozzles and the upper nozzles up and down and in the right and left hand directions, respectively, so that cleaning liquid is discharged therefrom. This can minimize the amount of water used but cleans the entire surface of the motor vehicle. The vertical and horizontal reciprocation of the side nozzles and the upper nozzles can have the cleaning effect of the jetted liquid upon the motor vehicle over a wide range.

Furthermore, in the arrangement where the upper nozzles can rock in the forward and backward directions, the upper nozzles discharge the cleaning liquid downwardly while rocking to a proper angle, with the result that it is possible to certainly clean not only the top surface of the motor vehicle but also the front and rear surfaces thereof. In addition, since the upper nozzle can continue a rocking motion even while the traveling frame travels, the cleaning range of the

jettied liquid can substantially be widened to further enhance the cleaning effect.

In the case that the upper nozzles is attached through the first movable plate with the elongated hole to the traveling frame, when a drive pin protrusively provided on a driving chain is engaged with the elongated hole and the chain is driven to circulate in one direction, the upper nozzles can oscillate in the right and left hand directions. In this case, the chain is stretched horizontally at an upper portion of the traveling frame. In addition, the side nozzles have the same arrangement, and the chain for the respective side nozzles is stretched vertically at one side of the traveling frame.

Moreover, in the case that the side nozzles are arranged to approach and separate from the motor vehicle by means of the adjusting part, the side nozzles can be set to be at a constant distance from the side surface of the motor vehicle in accordance with the width of the motor vehicle placed inside the traveling frame.

In addition to those in the first aspect, a car washing apparatus according a third aspect further comprises a transverse position adjusting mechanism for transversely moving side nozzles and a leg portion side blowoff section in the direction of approaching or departing from a motor vehicle.

In this arrangement, it is desirable that an auxiliary

elevating mechanism is additionally provided in order to shift only the side nozzles up and down. Moreover, preferably an auxiliary moving mechanism is additionally provided in order to shift only the upper nozzles in the right and left hand directions. Still further, preferably a third rocking mechanism is additionally provided to rock or swing the upper nozzles and an elevating frame side blowoff section in the forward and backward directions of the motor vehicle. For the elevation of the side nozzles, they may be fixed to a third movable plate having an elongated hole which in turn, is engaged with a pin attached to a chain made to revolve within a guide frame provided along the leg portion side blowoff section.

The car washing apparatus according to the third aspect is equipped with the side nozzles and a blowoff case which can approach and separate from the motor vehicle in the right and left hand directions and further with the upper nozzles and a blowoff case which can approach and separate from the motor vehicle in the vertical directions. Accordingly, the car washing apparatus can reciprocate the traveling frame in the forward and backward directions (longitudinal direction) of the motor vehicle put therein and move the side nozzles and the upper nozzles in the right and left hand directions (or the lateral direction) and in the

vertical direction, respectively, to discharge water under a high pressure for cleaning the motor vehicle with an appropriate distance from the outside surface of the motor vehicle being kept. Besides, pressurized air can be discharged to dry the outside surface of the motor vehicle while the respective blowoff sections are maintained to be at an appropriate distance with respect to the outside surface thereof. The pressure applied to the water discharged from the side nozzles and the upper nozzles is preferable to be several tens atm (atmospheric pressure) to several hundreds atm. More preferably, it ranges from 70 to 200 atm.

When swinging the upper nozzles and the elevating frame side blowoff section is possible in the forward and backward directions, the upper nozzles can discharge water in the transverse direction by swinging by an proper angle to surely clean not only the top surface of the motor vehicle but also the front and rear surfaces thereof. Furthermore, the blowoff section can discharge the pressurized air in the transverse direction to dry the top surface, front surface and rear surface of the motor vehicle. Still further, since the upper nozzles and the blowoff section swing continuously in the forward and backward directions while the traveling frame travels, the substantial cleaning range of the jetted water and the substantial drying range of the strong wind can be widened,

thus exhibiting greater cleaning effect and greater drying effect.

If the side nozzles which can elevate are integrated through the guide frame into the horizontally movable blowoff section, the horizontal movements of the blowoff section can simultaneously move the side nozzles in the horizontal directions, so that the parts for moving the side nozzles and the blowoff section are usable in common to simplify the arrangement as a whole. In addition, if the upper nozzles and the blowoff section are incorporated through a common guide frame into the traveling frame, the guide frame can concurrently elevate the upper nozzles and the blowoff section in the vertical directions.

The object and features of the present invention will become more readily apparent from the following detailed description of the preferred embodiments taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front elevation view showing the entire arrangement of a car washing apparatus according to a first embodiment of the present invention;

Fig. 2 is an enlarged perspective view showing a principal portion of a crossbeam of a traveling frame;

Fig. 3 is a enlarged perspective view showing a leg portion of a traveling frame;

Fig. 4 is a perspective view showing a structure of an arm for supplying cleaning liquid and a liquid wax;

Fig. 5 is a perspective view showing a structure of an elevating frame section;

Fig. 6 is a cross-sectional view taken along a line X-X of Fig. 3;

Fig. 7 is a cross-sectional view taken along a line Y-Y of Fig. 1;

Fig. 8 is a flow diagram of a pipeline for cleaning liquid and a liquid wax;

Fig. 9 is a cross-sectional view taken along a line Z-Z of Fig. 5;

Fig. 10 is an illustration for describing an operation of the embodiment;

Fig. 11 is an illustration of a car washing apparatus according to a second embodiment of the present invention, corresponding to Fig. 1;

Fig. 12 is a perspective view showing principal portions of arrangements of a vertical frame and a side nozzle;

Fig. 13 is an enlarged side elevation view showing an adjusting mechanism for a size nozzle;

Fig. 14 is a perspective view showing a structure of

an elevating frame;

Fig. 15 is a perspective view showing a structure of an upper nozzle;

Fig. 16 is an X-direction illustration for describing a rocking operation of an upper nozzle;

Fig. 17 is an illustration of a car washing apparatus according to a third embodiment of the present invention, corresponding to Fig. 1;

Fig. 18 is a plan view corresponding to Fig. 17;

Fig. 19 is an exploded perspective view showing structures of a side blowoff case and a side nozzle;

Fig. 20 is an exploded perspective view showing a moving mechanism for an upper nozzle;

Fig. 21 is an illustration for explaining rocking operations of an upper nozzle and an upper blowoff case;

Figs. 22A, 22B are flow diagrams of pipelines for cleaning liquid and a liquid wax;

Fig. 23 is a perspective view showing an elevating mechanism for an upper cleaning agent nozzle;

Fig. 24 is a perspective view showing a drainage; and

Fig. 25 is a cross-sectional view showing a drainage purification construction.

DETAILED DESCRIPTION OF THE PREFERRED

EMBODIMENTS

The present invention will hereinbelow be described in detail with reference to embodiments illustrated. Figs. 1 to 10 shows a first embodiment of this invention. In Fig. 1, a car washing apparatus is shown as basically comprising a traveling frame 10 traveling on right and left hand traveling rails 10a, 10a in the forward and backward directions of a motor vehicle to be placed therein and an elevating frame 20 suspended from the traveling frame 10 to be movable up and down. The traveling rails 10a, 10a are located in parallel to each other within a building B, and car stops S, S are placed on a floor surface F of the building B in order to stop a motor vehicle C at a regular position.

The traveling frame 10 is, as shown in Fig. 2, constructed by combining crossbeams 11, 11 and vertical members 12a, 12b in an I-shaped configuration. The one vertical member 12a is larger in size than the other vertical member 12b. Further, traveling rollers 13, 13 are respectively fitted through truck brackets 13a, 13a onto lower surfaces of both end portions of each of the vertical members 12a, 12b, and guide rollers 14, 14 are respectively horizontally installed through bearing brackets 14a, 14a on both end portions of the vertical member 12a which are positioned outside the truck brackets 13a, 13a. The traveling

rollers 13, 13 can roll while being brought into contact with inner bottom surfaces of the traveling rails 10a, 10a, respectively, thus movably supporting the traveling frame 10. On the other hand, the guide rollers 14, 14 roll in a state with coming into contact with inner side surfaces of the traveling rail 10a, respectively, thus smoothing the traveling of the traveling frame 10.

Both end portions (start and end portion) of a chain 15 are respectively fixedly secured onto portions of the crossbeams 11, 11 close to the vertical member 12a, while the chain 15 is stretched between sprockets 16a, 16a situated at both end portions of the traveling rail 10a. The one sprocket 16a is fixedly secured onto a rotary shaft of a motor 16, whereas the other sprocket 16a is rotatably supported through a bracket (not shown) at a front end portion of the traveling rail 10a. The motor 16 is fixedly secured through a bracket (not shown) to a rear end portion of the traveling rail 10a. That is, if the motor 16 is driven in the forward and reverse directions, the traveling frame 10 can travel on the traveling rails 10a, 10a through the chain 15 in the forward and backward directions.

In Fig. 3, columns 17, 17 hang through brackets 11a, 11b from both end portions of the crossbeams 11, 11 of the traveling frame 10, and as shown in Fig. 4 a flexible arm 18 is

attached to an upper side wall of the one column 17. In this arm 18, connection between an upper arm section 18a and a lower arm section 18b is established through a pin 18bl, and an upper end portion of the upper arm section 18a is rotatably supported through a supporting plate 18c and a bracket 18d at an upper portion of the column 17, while a lower end portion of the lower arm section 18b is in connection to be allowed to swing with respect to a bracket 18e fixed on the floor surface F. Accordingly, when the traveling frame 10 travels on the traveling rails 10a, 10a in the forward and backward directions, the arm 18 can follow the traveling frame 10 in such a manner that the bending angle between the upper arm section 18a and the lower arm section 18b changes.

In Fig. 5, the elevating frame 20 is constructed by combining vertical leg members 21, 21 and a crossbeam 22 into a gate-like configuration. On upper and lower sides of a back surface of each of the vertical leg members 21, 21, there are provided guide rollers 23, 23 which protrude from the elevating frame 20 through brackets 23a, 23a in the right and left hand directions. In addition, both end portions of a chain 24 which revolves are fixedly secured to the upper side bracket 23a and the lower side bracket 23a, respectively.

In Fig. 3, a shaft 25 is rotatably placed through a bearing 25a on lower surfaces of the crossbeams 11, 11 of the

traveling frame 10. Further, the chain 24 is stretched between a sprocket 24a fixed to both end portions of the shaft 25 and a sprocket 24b located at a lower side of the column 17, where only one chain 24 is illustrated. The shaft 25 is attached through the bearing 25a and a bracket 25a1 to lower surfaces of the crossbeams 11, 11, and the sprocket 24b is rotatably supported through a bracket 24b2 on a shaft 24b1 provided to project from an end portion of the column 17. Furthermore, a motor 25b is attached through a bracket 25b1 to the lower surfaces of the crossbeams 11, 11, and the shaft 25 is coupled through a chain 25c to the motor 25b. Thus, the elevating frame 20 can move up and down through the chains 24, 24 when the motor 25b is driven in the forward and reverse (opposite) directions.

Each of the columns 17, 17 of the traveling frame 10 is equipped with a guide rail 23b in correspondence with the guide rollers 23, 23 disposed to protrude from the elevating frame 20 in the right and left hand directions. In Fig. 6, the guide rail 23b has a U-shaped cross section and is fixedly secured through upper, middle and lower brackets 23b1, 23b1 onto a front side of the column 17 to be placed along the column 17. An auxiliary roller 23c is provided in addition to the guide roller 23 and is combined with the guide roller 23 so that its rotating axis is perpendicular to the rotating axis of

the guide roller 23. The guide roller 23 and the auxiliary roller 23c roll while coming into contact with the inner wall of the guide rail 23b, thus smoothly guiding the elevating frame 20. In other words, the elevating frame 20 is stably movable up and down along the guide rails 23b, 23b.

Returning back to Fig. 1, right and left side blowers 31, 31 are mounted through bases or seats 31a, 31a on the traveling frame 10 so that their discharging openings are positioned downwardly, while the middle blower 31 is located through a base 31a thereon so that its discharging opening is positioned horizontally. The right and left side blowers 31, 31 are coupled through duct hoses 31b, 31b to blowoff cases 32, 32 serving as blowoff sections provided in opposed relation at right and left sides of the traveling frame 10 (see Figs. 3 and 7). Both the figures illustrate only one blowoff case 32. Each of the blowoff cases 32, 32 is of a vertically elongated box type, and has an opening, acting as an air introduction opening 32a, in its top surface. The inner side surface of the blowoff case 32 has a vertically oriented air blowoff opening 32b, and flow-arranging plates 32c, 32c are installed at both edge portions of the air blowoff opening 32b.

The blowoff case 32 is fixedly secured through brackets 32d, 32d, located at its upper and lower sides, onto a rear surface of the column 17 of the traveling frame 10. The

air introduction opening 32a is coupled with the duct hose 31b extending from the blower 31. The blowoff case 32 can uniformly discharge high-pressure air, supplied from the blower 31, through the blowoff opening 32b. The flow-arranging plates 32c, 32c prevent the air discharged from the blowoff opening 32b from being excessively scattered.

The middle blower 31 is coupled through the duct hose 31b to a blowoff case 33 mounted on the elevating frame 20 and acting as a blowoff section (Figs. 1 and 5). The blowoff case 33 has a horizontally elongated box-like configuration, and its top surface has an air introduction opening 33a. As well as the blowoff case 32, the blowoff case 33 has an blowoff opening 33b in its lower surface, and flow arranging plates 33c, 33c are located at both edge portions of the blowoff opening 33b. The blowoff case 33 is placed through brackets 33d, 33d and an oscillating mechanism 40 serving as a first rocking mechanism on the crossbeam 22 of the elevating frame 20. With this arrangement, the blowoff case 33 can uniformly discharge the pressurized air, supplied from the blower 31, through the blowoff opening 33b.

Water supply pipes 34, 34 and liquid wax supply pipes 35, 35 are installed at both right and left sides of the traveling frame 10 (see Figs. 1 and 8). In Fig. 1, only the

water supply pipes 34, 34 are illustrated. Further, a water supply pipe 36 and a liquid wax supply pipe 37 are mounted on the elevating frame 20 (see Figs. 5 and 8).

In Fig. 8, discharging nozzles 34a, 34a serving as side nozzles are inwardly fitted to each of the water supply pipes 34, 34, while discharging nozzles acting as upper nozzles are inwardly fitted to the water supply pipe 36 including both bent end portions. In addition, the water supply pipes 34, 36 and 34 are coupled through connecting pipes 34b, 34b and connecting hoses 34c, 34c to a pump P1, and the pump P1 is designed to supply water W within a container Y1 to the water supply pipes 34, 36 and 34 under pressure. Similarly, discharging nozzles 35a, 35a serving as wax discharging nozzles are inwardly fitted to each of the wax supply pipes 35, 35, whereas discharging nozzles 37a, 37a acting as wax discharging nozzles are inwardly fitted to the liquid wax supply pipe 37. In addition, these liquid wax supply pipes 35, 37 and 35 are coupled through connecting pipes 35b, 35b and connecting hoses 35c, 35c to a pump P2, and the pump P2 is engineered to supply a liquid wax WX within a container Y2 to the liquid wax supply pipes 35, 37, 35 under pressure.

The right and left side water supply pipes 34, 34 and the liquid wax supply pipes 35, 35 are respectively paired and fixed to the blowoff case 32 provided on the traveling frame

10 (see Figs. 1 and 7). The water supply pipes 34, 34 are fixed through U-shaped bolts 34f, 34f to brackets 34e, 34e fitted to upper and lower sides of the blowoff case 32. Further, the liquid wax supply pipe 35 are fixed through U-shaped bolts 35f, 35f to brackets 35e, 35e fitted to upper and lower sides of the blowoff case 32. Fig. 7 illustrates only the brackets 34e, 35e the U-shaped bolts 34f, 35f in the upper side of the blowoff case 32.

In Fig. 5, the water supply pipe 36 is fixed through brackets 36c, 36c and U-shaped bolts 36d, 36d to a side surface of the blowoff case 33 on the elevating frame 20 (see Fig. 9). Similarly, the liquid wax supply pipe 37 is fixed through brackets 37c, 37c and U-shaped bolts 37d, 37d to an inclined lower surface of the blowoff case 33. Further, the connecting hoses 34c, 35c for establishing connections from the water supply pipes 34, 36, 34 and the liquid wax supply pipes 35, 37, 35 to the pumps P1, P2 are fixed through brackets 18f, 18f and U-shaped bolts 18f1, 18f1, 18f2, 18f2 to the arm 18 (see Fig. 4).

The oscillating mechanism 40 provided on the blowoff case 33 is composed of a motor 41, a shaft 42, a bearing 43 and a bracket 44. The motor 41 includes a reduction gear and is fixed to a lower surface of the crossbeam 22 of the elevating frame 20, and its shaft is connected to the one

bracket 33d of the blowoff case 33. The bearing 43 is attached to the fixed bracket 44, suspended from the crossbeam 22, in opposed relation to the output shaft of the motor 41, and the short shaft 42 is rotatably attached to the bearing 43. Further, the short shaft 42 is in connected relation to the other bracket 33d of the blowoff case 33. Accordingly, the oscillating mechanism 40 rocks the blowoff case 33 in the forward and backward directions when the motor 41 is driven in the forward and reverse directions, with the result that the air discharging opening 33b of the blowoff case 33, the discharging nozzles 36a, 36a of the water supply pipe 36 and the discharging nozzles 37a, 37a of the liquid wax supply pipe 37 selectively take their discharging angles, i.e., the front-facing position as indicated by a solid line in Fig. 9, the downward position as indicated by a dashed line in Fig. 9, and the back-facing position as indicated by a two-dot chain line in Fig. 9.

A description will be made hereinbelow of an operation of the car washing apparatus thus constructed. First of all, the traveling frame 10 is retreated up to the rear marginal position while the elevating frame 20 is retreated up to the upper marginal position. In addition, the blowoff case 33, the water supply pipe 36 and the liquid wax supply pipe 37 are set up to the forwarding positions, respectively.

Secondly, a motor vehicle C are properly put in a building B so that its wheels come into contact with the car stops S, S (see Fig. 10). In response to a start switch (not shown), the motor 25b lowers the elevating frame 20, being at the upper marginal position, through chains 24, 24 and further moves the blowoff case 33, the water supply pipe 36 and the liquid wax supply pipe 37 to given positions corresponding to the height of the motor vehicle C to make them wait there (see a solid line and a dashed line in Fig. 10). At this motor, the motor 25b detects the height of the motor vehicle C through a sensor (not shown) and sets the blowoff case 33, the water supply pipe 36 and the liquid wax supply pipe 37 to their optimal positions by means of the elevating frame 20.

Furthermore, the pump P1 starts to supply the water W within the container Y1 to the water supply pipes 34, 36 and 34 to discharge the water W from the discharging nozzles 34a, 34a, 36a, 36a. Subsequently, the motor 25b starts to lower the elevating frame 20 and lifts the elevating frame 20 to a predetermined position after it reaches the lower marginal position (a direction indicated by an arrow K1 in Fig. 10). With this operation, the rear surface of the motor vehicle C undergoes cleaning.

When the elevating frame 20 moves up and down, the oscillating mechanism 40 starts the motor 41 to set the

blowoff opening 32b of the blowoff case 33 and the discharging nozzles of the liquid wax supply pipe 37 and the water supply pipe 36 downwardly. Following this operation, the traveling frame 10 starts the motor 16 to travel the traveling rails 10a, 10a in the forward direction (a direction indicated by an arrow K2a in the same illustration). This operation can clean both the side surfaces and top surface of the motor vehicle C.

When the traveling frame 10 reaches its forward limit position, the blowoff case 33 and the discharging nozzles of the liquid wax supply pipe 37 and the water supply pipe 36 are set rearwardly through the oscillating mechanism 40.

Subsequently, the elevating frame 20 reciprocates up and down between the predetermined position and the lower marginal position (directions indicated by arrows K3 in the same illustration). This operation can clean the front surface of the motor vehicle C.

Thereafter, the blowoff opening of the blowoff case 33 and the discharging nozzles of the liquid wax supply pipe 37 and the water supply pipe 36 are again set downwardly through the oscillating mechanism 40, while the traveling frame 10 moves backwardly (a direction indicated by an arrow K2b in the same illustration) on the traveling rails 10a, 10a so that the respective discharging nozzles of the water supply

pipes 34, 36, 34 reclean the side surfaces and top surface of the motor vehicle C. When the traveling frame 10 reaches the backward marginal position, the pump P1 stops and the cleaning process for the motor vehicle C finishes. The blowoff case 33, the water supply pipe 36 and the liquid wax supply pipe 37 are returned to the forward positions through the oscillating mechanism.

Then, the pump P2 is started so that the wax WX within the container Y2 is supplied to the liquid wax supply pipes 35, 37; 35 to discharge it from the discharging nozzles 35a, 35a, 37a, 37a, and the elevating frame 20, the oscillating mechanism 40 and the traveling frame 10 are driven in the same order as in the cleaning process, thus waxing the rear surface, side surfaces and front surface of the motor vehicle C to complete the waxing process.

Following this waxing process, the blowers 31, 31 are started so that pressurized air is jetted from the air discharging openings 32b, 32b, 33b of the blowoff cases 32, 32, 33, while the elevating frame 20, the oscillating mechanism 40 and the traveling frame 10 are driven as well as in the cleaning process and the waxing process to remove waterdrops existing the entire surface of the motor vehicle C by the help of the pressurized air. Thus, the drying process after the washing comes to completion. After the completion

of the drying process, the elevating frame 20 is raised from the set position to the upper marginal position and all the operations revert to the initial condition.

In this invention, the number of the blowers 31, 31 to be mounted on the traveling frame 10 and the blowing capacity thereof can freely be selected as long as they can compulsorily dry the surface of the motor vehicle C. For example, if having a large capacity, it is sufficient even if only one blower is provided on the traveling frame 10. In this case, the air would be distributed to the respective blowoff cases 32, 32 and 33. Further, the water W to be fed from the pump P1 can be a solution containing a cleaning agent. Still further, instead of the installation in the building B, the traveling rails 10a, 10a can be installed on an appropriate base frame which can accept the motor vehicle C. Moreover, each of the water supply pipes 34, 34 can have a drain valve at its lower end portion to exhaust the water staying therein after the completion of the cleaning process. The liquid wax supply pipes 35, 35 can also have the same structure.

In addition, the order of the operation of the car washing apparatus can freely and selectively be taken through an operating switch (not shown). For example, both or one of the waxing process and the drying process can be omitted, and the water supply pipes 34, 34 and the liquid wax supply

pipes 35, 35 can have solenoid valves at their upper portions so that their operations stop when the elevating frame 20 moves up and down at the front and rear portions of the motor vehicle C. Further, the forward marginal position of the traveling frame 10 can be set in correspondence with the total length of the motor vehicle C in such a manner that the front end portion of the motor vehicle C is detected using an appropriate sensor.

Figs. 11 to 16 show a car washing apparatus according to a second embodiment of the present invention. As shown in Fig. 11, the car washing apparatus is composed of a traveling frame 110, a pair of side nozzles 121, 121 and an upper nozzle 131. The traveling frame 110 has a gate-like configuration which can accept a motor vehicle C. The traveling frame 110 is placed through a pair of right and left hand wheels 113, 113 on rails R, R laid on the ground to travel in the forward and backward directions. Each of the wheels 113, 113 is rotatably attached through a bracket 113a to a lower surface of the traveling frame 110. The one wheel 113 is connected through sprockets 113b, 113b and a chain 113c to a traveling motor 113d. Accordingly, the traveling frame 110 can reciprocate on the rails R, R in the forward and backward directions in such a way that the traveling motor 113d is rotatably driven in the forward and reverse directions.

A pair of vertical frames 111, 111 are incorporated into right and left hand portions of the traveling frame 110, and an elevating frame 112 is located horizontally at an upper portion thereof.

As shown in Fig. 12, each of the vertical frames 111, 111 comprises a pair of rail members 111a, 111a each having a T-shaped guide channel 111a1, and the upper and lower portions of the rail members 111a, 111a are connected to each other through connecting plates 111a2, 111a2, respectively. Fig. 12 illustrates only the upper end portion of the one vertical frame 111. Between the rail members 111a, 111a there is provided a chain 111c which revolves between sprockets 111b, 111b. However, the upper side sprocket 111b is fitted over a rotary shaft of a drive motor 111d and a driving pin 111c1 is protrusively downwardly provided on a portion of the chain 111c.

As shown in Fig. 13, the side nozzle is attached through a movable base 111e and brackets 111f, 111f to each of the vertical frames 111, 111 to be movable up and down. A horizontal elongated hole 111e1 is made in a central portion of the movable base 111e to engage with the driving pin 111c1, and rollers 111e2, 111e2 are provided on rear surface corners of the movable base 111e to travel within the guide channels 111a1, 111a1 as shown in Fig. 12. Further, a bracket 111f is

bent to make a L-shaped configuration and has elongated holes 111f1, 111f3 formed in its vertical and horizontal surfaces.

The bracket 111f is attached to the front surface of the movable base 111e in such a manner that set screws 111f2, 111f2 are set through the elongated hole 111f1 to a screw hole of the movable base 111e. Moreover, a bracket 111g is fixed through the elongated hole 111f3 and set screws 111f2, 111f2 of the bracket 111f onto a horizontal side surface of the bracket 111f.

The side nozzle 121 is inwardly fixed through U-shaped bolts 111g1, 111g1 onto the bracket 111g. In addition, a sensor 122 is inwardly fixed onto the bracket 111g. Because of having the elongated hole 111f1, the bracket 111f is adjustable in the right and left hand directions with respect to the movable base 111e. Similarly, because of having the elongated hole 111f3, the bracket 111g is also adjustable in the right and left hand directions with respect to the bracket 111f. That is, the side nozzle 121 and the sensor 122 are movable in the right and left directions (directions indicated by arrows Ka in Fig. 13) with respect to the vertical frame 111. The aforementioned elongated hole-made bracket 111f and the set screws 111f2 can be considered as adjusting parts. The side nozzle 121 is coupled through a pipe 120 to a pump, not shown.

In Fig. 12, if the chain 111c is revolved in one direction with the drive motor 111d being driven, the driving pin 111c moves the movable base 111e (a second movable plate) in a state that it is in engagement with the elongated hole 111e1 of the movable base 111e, whereupon the side nozzle 121 is movable up and down (directions indicated by arrows K1 in Fig. 11). In this case, even if the chain 111c turning at the sprocket 111b moves in the other direction, since the driving pin 111c1 can move within the elongated hole 111e1 of the movable base 111e in the right and left hand direction, the movable base 111e does not rotate. For this reason, when the chain 111c is moves into the only one direction, the movable base 111e is movable up and down without changing its posture. The arrangement for the vertical movements of the movable base 111e can be considered as a nozzle elevating mechanism.

In Fig. 14, the elevating frame 112 is suspended through a pair of chains 115, 115 from an upper portion of the traveling frame 110 to be movable up and down. The chains 115, 115 respectively circulate between sprockets 115a, 115a incorporated into upper and lower portions of the traveling frame 110. The chains 115, 115 have fixing members 112a3, 112a3 at their portions. These fixing members 112a3, 112a3 are fixed onto upper and lower surfaces of the elevating frame

112. The upper side sprockets 115a, 115a are fixed to both end portions of a rotary shaft 115b which in turn, is connected through sprockets 115c, 115c and a chain 115e to an elevating motor 115f.

As shown in Fig. 15, two angular brackets 112h, 112h each having a roller 112h1 at its inner surface are vertically attached to each of both end portions of the elevating frame 112. In addition, guide rails corresponding to the rollers 112h1, 112h1 are placed at right and left hand sides of the elevating frame 112. The rollers 112h1, 112h1 of each of the brackets 112h, 112h are disposed to come into contact with three portions of each of the guide rails 114, 114 to surround the guide rail 114. Thus, the elevating frame 112 is movable up and down along the guide rails 114, 114 through the rotary shaft 115b and the chains 115, 115.

The elevating frame 112 is composed of rail members 112a, 112a each equipped with a T-shaped guide channel 112a1 as well as the vertical frames 111, 111. Ones of right and left hand end portions of the rail members 112a, 112a are connected through a pair of connecting plates 112a2, 112a2, respectively. Between the rail members 112a, 112a there is provided a chain 112c which circulates between sprockets 112b, 112b disposed in the right and left hand sides. The one sprocket 112b is connected to a drive motor 112d and a

driving pin 112c1 is protrusively fitted in a portion of the chain 112c. A movable base (first movable plate) 112e engaging with the driving pin 112c1, an auxiliary base 112f placed in parallel to the movable base 112e, and a connecting base 112g are in an integral construction. The connecting base 112g incorporates the upper nozzle 131, four sensors 132..., and a rocking motor 133. More specifically, the movable base 112e has a vertical elongated hole 112e1 engaged with the driving pin 112c1, and rollers 112e2, 112e2..., 112f1, 112f1.... are installed on the corners of the rear surfaces of the movable base 112e and the auxiliary base 112f to travel within the guide channels 112a1, 112a1 in the right and left hand directions.

The movable base 112e and the auxiliary 112f are connected to connecting pieces 112g1, 112g1 bent upwardly from the connecting base 112g, whereupon they are hung below the elevating frame 112. The connecting piece 112g1 attached to the movable base 112e has a notch portion 112g2 coincident with the elongated hole 112e1. In addition, the sensors 132, 132 are arranged in the forward and backward directions and obliquely downwardly attached through brackets 112g3, 112g3 to the right and left hand end portions of the connecting base 112g, and the rocking motor 133 is situated on the lower surface of the connecting base 112g

between the sensors 132. The upper nozzle 131 is downwardly attached through a joint 131a to the rotary shaft of the rocking motor 33, while the joint 131a is connected through a free joint 131b to a pipeline 130 which comes into connection with a pump, not shown. The pipeline 130 is fixed through a connector 130b and nuts 130a, 130a to penetrate the connecting base 112g.

The elevating frame 112 can oscillate the upper nozzle 131 in the right and left hand directions (directions indicated by arrows K3 in Fig. 11) through the driving pin 112c1 and the movable base 112e in such a way that the chain 112c is rotationally driven by the drive motor 112d in one direction. The aforementioned arrangement for the movements of the movable base 112e is considered as a nozzle reciprocating mechanism. In addition, the upper nozzle 131 can rock in the forward and backward directions (directions indicated by arrows K4 in Fig. 16) when the rocking motor 133 is driven in the forward and reverse directions. The rocking motor 133 restricts the rocking range of the upper nozzle 131 in the forward and backward directions by the detection of the rotational angle through a sensor, not shown, and a plate cam dog, not shown, (see a two-dot chain line in Fig. 16).

According to the car washing apparatus thus arranged,

after the motor vehicle C being washed is put between the rails R, R, it is possible to automatically clean the outside surface of the motor vehicle C. More specifically, when receiving the driving force from the traveling motor 113d, the traveling frame 110 reciprocates on the rails R, R over the total length of the motor vehicle C. At this time, the side nozzles 121, 121 being in opposed relation to each other goes up and down while jetting the cleaning liquid toward both the whole side surfaces of the motor vehicle C. On the other hand, the upper nozzle 131 reciprocates in the right and left hand directions and rocks in the forward and backward directions to jet the cleaning liquid toward the whole top surface of the motor vehicle C. Thus, the whole outside surface of the motor vehicle C can coincidentally be washed with the cleaning liquid from the side nozzles 121, 121 and the upper nozzle 131. The side nozzles 121, 121 and the upper nozzle 131 switch and jet the water, cleaning agent, wax and others in accordance with given traveling strokes while the traveling frame 110 reciprocates plural times, thus enhancing the cleaning effect. After the completion of the cleaning of the motor vehicle C, the motor vehicle C is moved to the outside to terminate the entire operation of the apparatus.

During operation, the sensors 122, 122 function to

prevent the side nozzles 121, 121 from excessively approaching the side surfaces of the motor vehicle C. That is, when the motor vehicle C is obliquely put between the rails R, R, the sensors 122, 122 stop the car washing apparatus before the side nozzles 121, 121 come into contact with the side surfaces of the motor vehicle C, thereby avoiding the damages to the outside surface of the motor vehicle C. The side nozzles 121, 121 can respectively be advanced and backed in the right and left hand directions along the elongated holes 111f1, 111f3 of the bracket 111f and further can be set to the optimal positions by the help of the set screws 111f2, 111f2,....

On the other hand, the elevating motor 115f lowers the elevating frame 112 up to the lower limit position when the traveling frame 110 assumes the forward limit position corresponding to the front position of the motor vehicle C or takes the rearward limit position corresponding to the rear position thereof, whereupon the upper nozzle 131 can clean the front and rear surfaces of the motor vehicle C. In this case, the rocking motor 133 is shifted in the forward or backward direction. In addition, the elevating motor 115f can optimally control the heights of the elevating frame 112 and the upper nozzle 131 by means of a height sensor (not shown) for detecting the height of the motor vehicle C when the traveling frame 110 travels in the forward and backward

directions. The sensors 132...., always serve as safety switches for preventing the upper nozzle 131 from carelessly coming into contact with the motor vehicle C.

Figs. 17 to 25 show a car washing apparatus according to a third embodiment of the present invention. As shown in Fig. 17, the car washing apparatus is provided with a gate-like traveling frame 210, side nozzles 221, 221, upper nozzles 226, 226, side blowoff cases 231, 231, and an upper blowoff case 236. The side nozzles 221, 221 and the side blowoff cases 231, 231 are built in the right and left hand sides of the traveling frame 210, while the upper nozzles 226, 226 and the upper blowoff case 236 are incorporated into an upper portion of the traveling frame 210.

In Figs. 17 and 18, the traveling frame 210 is located to freely travel on rails R, R laid on the ground F through pairs of wheels 213, 213,... provided in the front and rear sides and in the right and left sides. In addition, the right and left hand rear wheels 213 are coupled through sprockets 213a, 213a and chains 213b, 213b to traveling motors 213c, 213c. Thus, the traveling frame 210 can reciprocate on the rails R, R in the forward and backward directions when the traveling motors 213c, 213c are synchronously driven in the forward and reverse directions.

In Fig. 19, the side nozzles 221, 221,... are disposed

in opposed relation to each other and incorporated into the traveling frame 210 through first guide frames 222, 222 placed on the side blowoff cases 231, 231. More specifically, the first guide frame 222 is constructed with an elongated member having a C-shaped configuration and extending vertically, and is attached onto a portion of a rear surface of the side blowoff case 231 which is close to the inside of the traveling frame 210. Projecting stripes 222a, 222a acting as guide rails are formed on the right and left hand side surfaces of the first guide frame 222. Further, a chain 222c circulates between sprockets 222b, 222b disposed at middle and lower portions of the first guide frame 222. A drive pin 222c1 is protrusively fitted in a portion of the chain 222c. The lower sprocket 222b is connected through pulleys 222d, 222e1 and a belt 222d1 to a drive motor 222e, and the belt 222d1 and the drive motor 222e are housed within a storage box 232 placed on the lower surface of the blowoff case 231.

The two side nozzles 221, 221 are fitted through a rectangular movable base 223 onto the first guide frame 222. A lower portion of the movable base 223 has a horizontal elongated hole 223a which can engage with the driving pin 222c1. At corner portions of the movable base 223 there are provided rollers 223b, 223b which roll along the first guide frame 222 in a state with being engaged with the projecting

stripes 222a, 222a. The side nozzles 221, 221 are disposed in parallel to the upper and lower sides of the movable base 223 and fixed inwardly. Thus, in the first guide frame 222, the drive motor 222e can circulate the chain 222c in one direction, so that the side nozzles 221, 221 are moved up and down (directions indicated by arrows K1 in Fig. 17) through the driving pin 222c and the movable base 223. The arrangement for moving the movable base 223 up and down is regarded as an auxiliary elevating mechanism. More specifically, the driving pin 222c1 comes into engagement with the elongated hole 223a of the movable base (third movable plate) 223 and can reciprocate within the elongated hole 223a in the right and left hand directions when moving up and down between the middle and lower portions of the first guide frame 222 by the chain 222c. Accordingly, even if the chain 222c revolves in one direction, the movable base 223 is movable up and down. At this time, the upper side nozzle 221 moves up and down within the range from the middle portion to upper portion of the first guide frame 222. On the other hand, the lower side nozzle 221 can move up and down within the range from the middle portion to lower portion of the first guide frame 222. That is, the side nozzles 221, 221 move by the upper and lower halves of the first guide frame 222, respectively, thereby covering the total length of the first

guide frame 222.

Each of the side blowoff cases 231, 231 has a vertically elongated box-like configuration, and its top surface has an air introduction opening 231a for connection to a blower 233 (see Figs. 18, 19). In addition, the inside surface of the side blowoff case 231 has a slit-like air discharging opening 231b extending vertically, and flow arranging plates 231c, 231c are installed on the respective edges of the air discharging opening 231b. Further, in Fig. 19, the side blowoff case 231 is made to be movable in the right and left hand directions through frames 233, 233 having rollers 233a, 233a. The rollers 233a, 233a are housed within channel members 232a, 232a attached to the lower surface of the storage box 232. The frames 233, 233 support the side blowoff case 231 through the rollers 233a, 233a.

The lower surface of the storage box 232 is provided with a rack 232b which meshes with a pinion 234a. A shaft 234 of the pinion 234a is coupled through sprockets 234b, 234b and a chain 234c to a drive motor 235. Thus, when the drive motor 235 is driven in the forward and reverse directions, the side blowoff case 231, together with the side nozzles 221, 221, can move in the right and left hand directions (directions indicated by arrows K2 in Fig. 17) along the frames 233, 233 by means of the pinion 234a and the rack

232b. The rack 232b and the pinion 234a serve as a transverse position adjusting mechanism. That is, since the side nozzles 221, 221 are installed on the side blowoff case 31 which is movable to be adjusted in terms of its position in the right and left hand directions, the moving distances of the side nozzles 221, 221 in the right and left hand directions are adjustable with respect to the traveling frame 210 and further the side nozzles 221, 221 are movable up and down.

On the other hand, as shown in Fig. 20, the upper nozzles 226, 226 and the blowoff case 236 are attached to a second guide frame 227 used in common thereto and incorporated into the traveling frame 210 to be movable up and down. Projecting stripes 227a, 227a functioning as guide rails are vertically installed on the second guide frame 227, and a chain 227c revolves between sprockets 227b, 227b disposed at a middle portion and one end portion of the guide frame 227. A driving pin 227c is protrusively fitted in a portion of the chain 227c, while the one sprocket 227b is connected through pulleys 227d, 227e1 and a belt 227d1 to a drive motor 227e.

The pair of right and left hand upper nozzles 226, 226 are installed through a transversely extending movable base 228 onto the rear surface of the second guide frame 227. In the drive motor 227e side of the movable base 228 there is

formed a vertical elongated hole 228a which can engage with the driving pin 227c1, and at the corners thereof there are provided rollers 228b, 228b which engage with projecting stripes 227a, 227a and roll along the second guide frame 227. In addition, the upper nozzles 226, 226 are downwardly fixed through a pipeline 226a onto the rear surface of the movable base 228.

Accordingly, in the second guide frame 227, the upper nozzles 226, 226 can reciprocate in the right and left hand directions (directions indicated by arrows K3 in Fig. 17) through the driving pin 227c1 and the movable base 228 when the drive motor 227c is started to revolve the chain 227c in one direction. However, the upper nozzles 226, 226 respectively move with respect to the right half and left half of the second guide frame 227 to cover the total length of the second guide frame 227. The aforementioned mechanism for movement of the movable base 228 serves as an auxiliary moving mechanism.

The upper blowoff case 236 has a transversely extending box-like configuration whose cross section shows an inverse triangle and is attached to the front surface of the second guide frame 227. Air introduction openings 236b, 236b are made through introduction sections 236a, 236a in the top surface of the upper blowoff case 236, and the air

introduction openings 236b, 236b communicate with blowers 237, 237 (see Fig. 18). Further, as well as the side blowoff case 231, a slit-like air discharging opening 236c is made in the lower surface of the upper blowoff case 236.

Accordingly, the pressurized air from the blowers 237, 237 can simultaneously be discharged downwardly.

The second guide frame 227 is suspended from an upper portion of the traveling frame 210 through chains 229, 229, connected to box-like elevating members 224, 224 disposed at both sides thereof, to be movable up and down. Shafts 227f, 227f are protrusively fitted in brackets 227f1, 227f1 extending from both end portions of the second guide frame 227 (see Fig. 20), and these shafts 227f, 227f are rotatably supported by the elevating members 224, 224, which makes the second guide frame 227 rotatable. The one shaft 227f is coupled through sprockets 227f2, 227f2 and a chain 227f3 to a rocking motor 227g which in turn, is housed within the elevating member 224. The transmission mechanism from the bracket 227f1 to the rocking motor 227g acts as a third rocking mechanism.

Thus, as shown in Fig. 21, when the rocking motor 227g is driven in the forward and reverse directions, the upper nozzles 226, 226 and the upper blowoff case 236 can simultaneously be rocked in the forward and backward

directions (directions indicated by arrows K4a, K4b in the same illustration). The rocking motor 227g restricts the rocking range of the upper nozzles 226, 226 and the upper blowoff case 236 in such a manner that its rotational angle is detected through a sensor (not shown) and a plate cam-like dog (member). Therefore, the upper nozzles 226, 226 and the upper blowoff case 236 can rock in the downward, rearward and forward directions (see a solid line, a dashed line, and a two-dot chain line in the same illustration).

In Fig. 17, the chains 229, 229 are respectively made to circulate between sprockets 229a, 229a installed on upper and lower sides, and the start and end portions of the chain 229 are respectively fixed to upper and lower surfaces of the elevating member 224. The upper side sprockets 229a, 229a are fixed to both end portions of the rotary shaft 229b, with the rotary shaft 229b being connected through sprockets 229c, 229c and a chain 229d to an elevating motor 229e.

On the other hand, each of the elevating members 224 is, at its outside surface, equipped with rollers 224a, 224a disposed in the forward and backward directions and a roller 224b disposed in the right and left hand directions. A guide rail 225 is provided in correspondence with rollers 224a, 224a, 224b in the vicinity of the outside of each of the elevating members 224, 224. The rollers 224a, 224a, 224b are made to

roll while coming into contact with the inner surface of the guide rail 225. Thus, when the elevating motor 229e is driven in the forward and reverse directions, the second guide frame 227 can be moved vertically along the guide rails 225, 225 by means of the chains 229, 229, so that the upper nozzles 226, 226 and the upper blowoff case 236 move up and down (directions indicated by arrows K5 in Fig. 17).

In the right and left sides of the traveling frame 210, there are disposed side cleaning agent nozzles 241, 241,... for discharging a cleaning agent and wax nozzles 251, 251,... for discharging a liquid wax (see Figs. 18 and 22). Further, wax nozzles 251, 251,... are located on an upper portion of the traveling frame 210. Side nozzles 241, 241 are inwardly placed in the right and left sides of a pipeline 241a assembled to have a gate-like configuration (see Fig. 22A). On the other hand, the wax nozzles 251, 251,... are inwardly placed on an upper portion of a pipeline 251a and further inwardly located on right and left hand sides thereof (see Fig. 22B).

Moreover, as shown in Fig. 23, upper cleaning agent nozzles 246, 246 vertically adjustable are incorporated in an upper portion of the traveling frame 210. The upper cleaning agent nozzles 246, 246 are downwardly fitted in pipelines 246a, 246a separated in parallel and in the forward and backward directions, and the pipelines 246a, 246a are fixedly

secured onto the front surface of the elevating frame 247. Both end portions of the elevating frame 247 are equipped with brackets 247a which in turn, are provided with rollers 247a1, 247a1. In addition, the elevating frame 247 is suspended through chains 248, 248 from an upper portion of the traveling frame 210 to be movable up and down. Each of the chains 248, 248 is made to circulate between sprockets 248a, 248a built in upper and lower portions of the traveling frame 210, and its start and end portions are fixed to an upper surface of an auxiliary bracket 247b and a lower surface of an auxiliary bracket 247b, respectively.

The upper sprockets 248a, 248a are fixed to both end portions of a rotary shaft 248b, respectively, and the rotary shaft 248b is directly coupled to an elevating motor 248c. Further, guide rails 249, 249 are provided in both sides of the elevating frame 247 in correspondence with the rollers 247a1, 247a1. The rollers 247a1, 247a1,... are made to avoid disconnection, for that they roll in a state with being interposed between the two guide rails 249, 249. Accordingly, when the elevating motor 248c is driven in the forward and reverse directions, the elevating frame 247 moves up and down, whereupon the upper cleaning agent nozzles 246, 246,... can move vertically (directions indicated by arrows K6 in the same illustration).

The car washing apparatus thus arranged can clean, wax and dry the entire outside surface of the motor vehicle C correctly put between the rails R, R for washing. More specifically, the traveling frame 210 reciprocates several times on the rails R, R by means of the traveling motors 213c, 213c. At this time, the side nozzles 221, 221,... move up and down and concurrently jet water under a high pressure toward both the sides of the motor vehicle C, whereas the upper nozzles 226, 226 reciprocate in the right and left hand directions and rock in the forward and backward directions while coincidentally jetting water under a high pressure toward the whole top surface of the motor vehicle C. Further, the side cleaning agent nozzles 241, 241,... discharge a cleaning agent toward both the sides of the motor vehicle C, whereas the upper cleaning agent nozzles 246, 246,... discharge the cleaning agent the entire top surface of the motor vehicle C. Thus, the entire outside surface of the motor vehicle C can coincidentally undergo the cleaning with the high-pressure water jets from the side nozzles 221, 221 and the upper nozzles 226, 226,... and further with the cleaning agent from the side cleaning agent nozzles 241, 241 and the upper cleaning agent nozzles 246, 246,....

Subsequently, the entire outside surface of the motor vehicle C is further cleaned with the water discharged from

the side nozzles 221, 221,... and the upper nozzles 226, 226,... in order to remove the cleaning agent attached, and the liquid wax is discharged from the wax nozzles 251, 251,... with the result that the entire outside surface of the motor vehicle C is waxed, finally completing the cleaning and waxing processes.

Secondly, using the blowers 233, 233, 237, 237, the pressurized air is discharged from the side blowoff cases 231, 231 and the upper blowoff case 236 in order to remove the excessive water from the entire outside surface of the motor vehicle C, thereby completing the drying process after the washing. After the completion of the drying process, the motor vehicle C is brought out from the apparatus, before the whole operation of the apparatus comes to an end.

The side nozzles 221, 221 and the side blowoff cases 231, 231 can move in the right and left hand directions through the rack 232b and the pinion 234a and, hence, can be set to take the optimal positions with respect to both the sides of the motor vehicle C. On the other hand, the elevating motor 229e lowers the second guide frame 227 to the lower limit position when the traveling frame 210 reaches the forward and rearward limit positions corresponding to the front and rear of the motor vehicle C, whereupon the upper nozzles 226, 226 and the upper blowoff case 236 can clean and dry the front and rear surfaces of the motor vehicle C.

At this time, the rocking motor 227g shifts the upper nozzles 226, 226 and the upper blowoff case 236 in the forward or backward direction so that they take opposed relation to the front or rear surface of the motor vehicle C.

On the other hand, when first traveling in the forward direction over the total length of the motor vehicle, the traveling frame 210 can use a height sensor (not shown) to obtain the data on the height of the motor vehicle C and then store the obtained data in a control unit (not shown). Accordingly, when the traveling frame 210 afterwards travels in the forward and backward directions, the elevating motors 229e, 248c can move the second guide frame 227 and the elevating frame 247 on the basis of the stored height data to optimally control the heights of the upper nozzles 226, 226, the upper blowoff case 236 and the upper cleaning agent nozzles 246, 246.

It is also appropriate that, as shown in Figs. 24 and 25, a draining channel F1 is made in the ground F supporting the rails R, R and a precipitator F2 is constructed at one end portion of the channel F1 and made to communicate through a protrusively tank 260 with a reservoir F3. The protrusively tank 260 is equipped with a container 261, a cover 262, a filter 263 and partitions 264, 264. The container 261 has, in its one side wall, an inflow passage 261a coupled to the

precipitator F2, and further has, in the other side wall, an L-shaped outflow pipe 261b. One opening of the outflow passage 261b turns downwardly within the container 261. On the other hand, the partitions 264, 264 are located to divide the space within the container 261 in a direction from the inflow passage 261a to the outflow passage 261b, and a gap is defined between each of the partitions 264, 264 and the bottom surface of the container 261. Further, the filter 263 is placed through supporting sections 261c, 264a in the inflow passage 261a side of the container 261. On the bottom surface of the container 261 there are planted baffle plates 265, 265 which establish a bypass in the outflow passage 261b side of each of the partitions 264, 264.

With this construction, the filter 263 within the protrusively tank 260 removes impurities contained in the drain coming through the inflow passage 261a from the precipitator F2, while the partitions 264, 264 and baffle plates 265, 265 remove fine suspended components containing oils, so that the drain is purified and discharged as treated water from the outflow passage 261b to the reservoir F3. That is, the reservoir F3 stores the purified and treated water which in turn, is again used for cleaning the motor vehicle C.

It should be understood that while the invention has been illustrated with respect to several specific embodiments

thereof, these embodiments should be considered as illustrative rather than limiting. Various modifications and additions may be made and will be apparent to those skilled in the art without departing from the spirit and scope of the present invention. Accordingly, the invention should not be limited by the foregoing description but rather should be defined only by the following claims.

**WHAT IS CLAIMED IS:****1. A car washing apparatus comprising:**

a traveling frame having a gate-like configuration for traveling in the forward and backward directions of a motor vehicle to be placed therein;

side nozzles opposingly disposed at leg portions of said traveling frame for discharging cleaning liquid toward said motor vehicle;

an elevating frame attached to said traveling frame to be movable up and down for adjusting a height thereof in accordance with a height of said motor vehicle; and

an upper nozzle installed on said elevating frame for discharging the cleaning liquid toward said motor vehicle.

2. A car washing apparatus as defined in claim 1,
further comprising blowoff sections provided on a leg portion of said traveling frame and said elevating frame for arranging and discharging air flow supplied.

3. A car washing apparatus as defined in claim 2,
further comprising a blower mounted on said traveling frame for supplying air to said blowoff section.

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4. A car washing apparatus as defined in any one of claims 1 to 3, further comprising wax discharging nozzles provided on a leg portion of said traveling frame and said elevating frame for discharging liquid wax toward said motor vehicle.

5. A car washing apparatus as defined in claim 4, wherein said upper nozzle and said wax discharging nozzles are fixed to said elevation frame side blowoff section, and said blowoff section is attached through a first rocking mechanism to said elevating frame.

6. A car washing apparatus as defined in any one of claims 1 to 5, further comprising guide rails provided along said leg portions of said traveling frame and guide rollers installed on both right and left end portions of said elevating frame to engage with said guide rails.

7. A car washing apparatus as defined in claim 1, further comprising:

a nozzle elevating mechanism for moving said side nozzles in the vertical direction; and

a nozzle reciprocating mechanism for reciprocating said upper nozzle in the lateral direction of said motor vehicle.

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8. A car washing apparatus as defined in claim 7, further comprising a second rocking mechanism for rocking said upper nozzle in the forward and backward directions of said motor vehicle.

9. A car washing apparatus as defined in claim 7 or 8, wherein said upper nozzle is fixedly attached to a first movable plate having an elongated hole, and said elongated hole is engaged with a pin attached to a chain which revolves within said elevating frame.

10. A car washing apparatus as defined in any one of claims 7 to 9, wherein said side nozzle is fixedly secured to a second movable plate having an elongated hole, and said elongated hole is engaged with a pin fitted in a chain which revolves within said leg portion.

11. A car washing apparatus as defined in any one of claims 7 to 10, wherein said side nozzle is fixed through an adjusting member to said second movable plate for adjusting a relative fixed position of said side nozzle with respect to said motor vehicle in the lateral direction of said motor vehicle.

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12. A car washing apparatus as defined in claim 2, further comprising a transverse position adjusting mechanism for transversely moving said side nozzle and said blowoff section on the leg portion side in the lateral direction of said motor vehicle.

13. A car washing apparatus as defined in claim 12, further comprising an auxiliary elevating mechanism for moving said side nozzle with respect to said leg portion.

14. A car washing apparatus as defined in claim 12 or 13, further comprising an auxiliary moving mechanism for moving said upper nozzle with respect to said elevating frame in the lateral direction of said motor vehicle.

15. A car washing apparatus as defined in any one of claims 12 to 14, further comprising a third rocking mechanism for rocking said upper nozzle and said blowoff section on the elevating frame side in the forward and backward directions of said motor vehicle.

16. A car washing apparatus as defined in any one of claims 12 to 15, wherein said side nozzle is fixedly secured to a third movable plate having an elongated hole, and said

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elongated hole is engaged with a pin attached to a chain which revolves within a guide frame provided along said leg portion side blowoff section.

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