

[54] **ESCALATOR CLEANING APPARATUS**

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Related U.S. Application Data

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[51] Int. Cl. **A47I 7/00**

[58] Field of Search **15/302, 308, 309, 320-322, 15/398**

[56] **References Cited**

UNITED STATES PATENTS

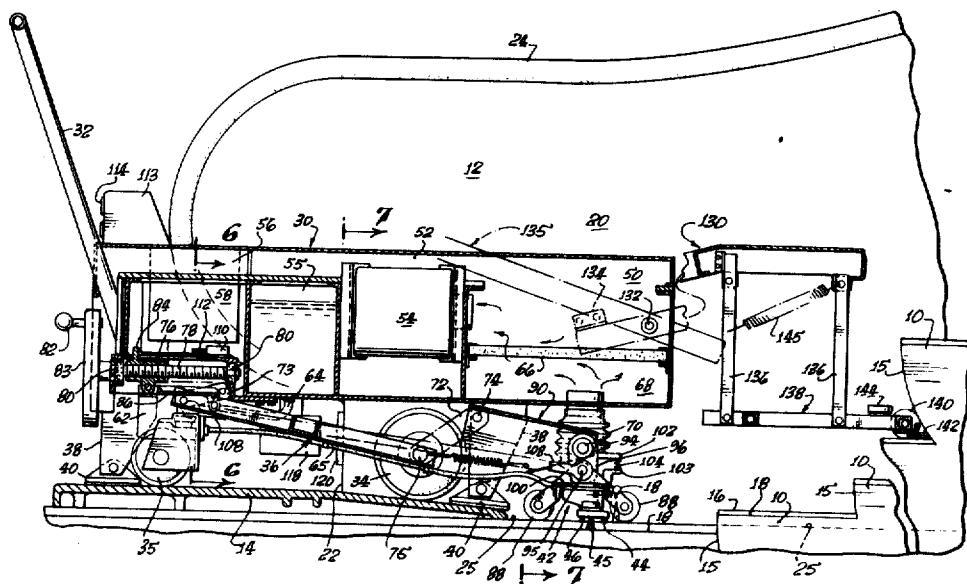
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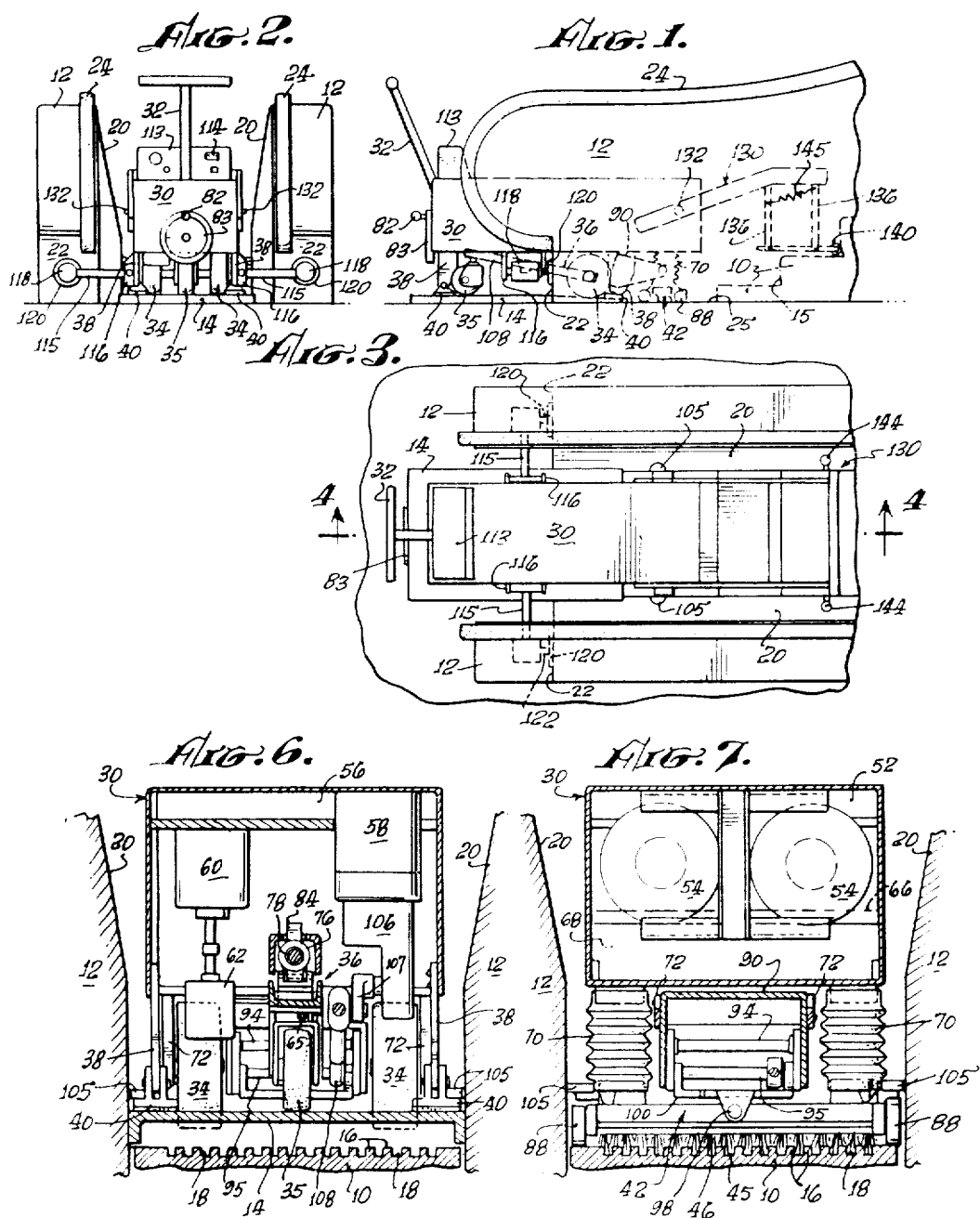
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[57] **ABSTRACT**

An apparatus mounted on wheels incorporating brush means and spray means to clean the flights of an operating escalator has guide means to engage the fixed balustrades of the escalator for accurate positioning of the apparatus and has means to immobilize the apparatus for a cleaning operation. In response to such immobilization, a self-aligning vacuum nozzle and brush carriage is lowered into operating position. A yieldingly extensible forward structure makes guiding contact with front surfaces of descending flights of steps to brush the front and top surfaces thereof.

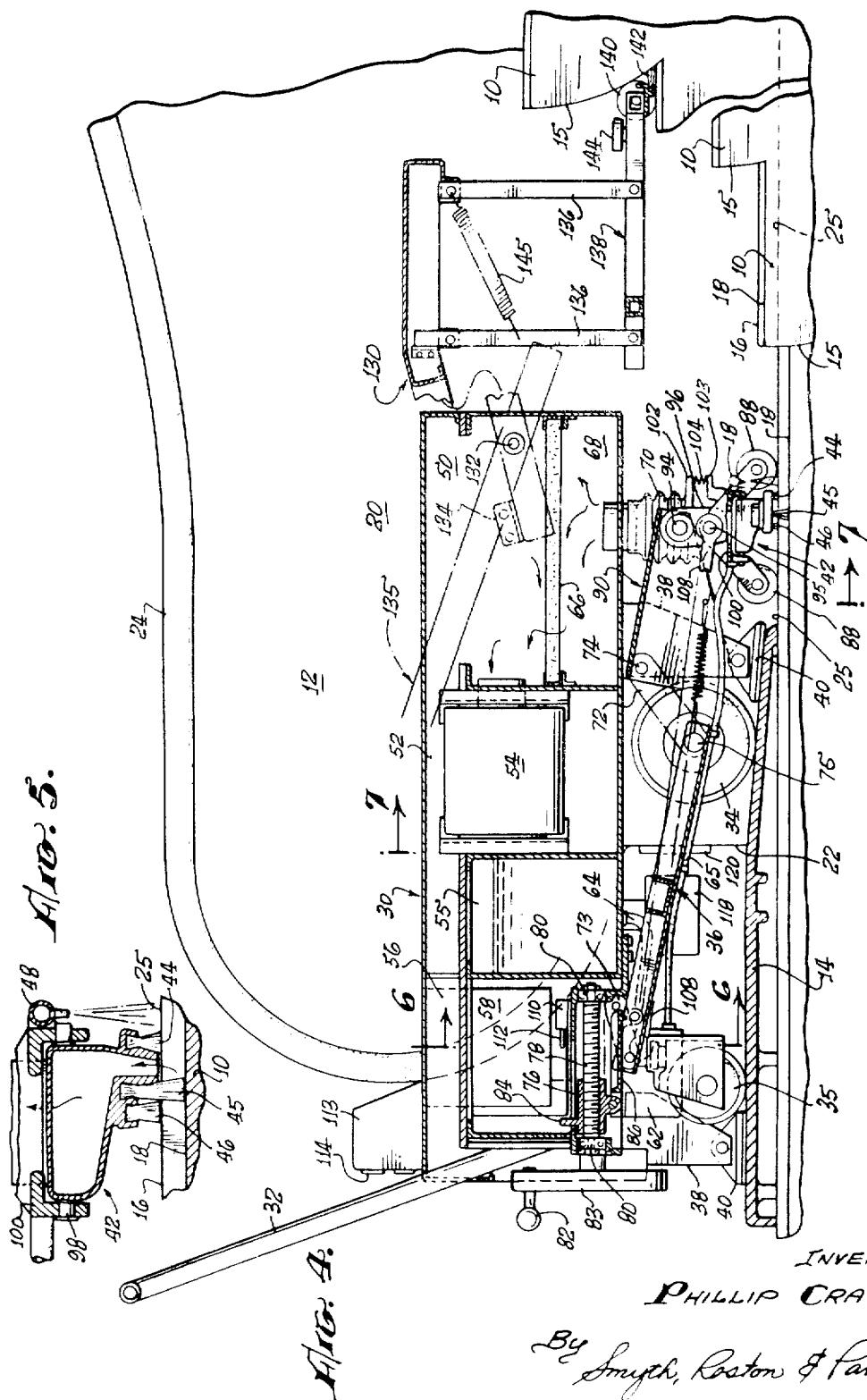
4 Claims, 11 Drawing Figures





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ESCALATOR CLEANING APPARATUS

CROSS-REFERENCES TO RELATED APPLICATIONS

This is a division of application Ser. No. 464,485, filed June 16, 1965 now U.S. Pat. No. 3,584,329.

This invention relates to an apparatus for use at a stationary platform or sill at one end of an escalator to clean the traveling steps of the escalator.

Such an apparatus must be mobile for movement from one escalator to another and yet must be capable of standing solid in an operating position on an escalator landing. It is further required that the apparatus incorporate brush means to sweep the moving steps of the escalator together with a vacuum system adjacent the brush means to pick up foreign particles that are dislodged by the brush means. In addition it is desirable to incorporate means to apply cleaning fluid such as water or a detergent mixture to the surfaces of the traveling steps to facilitate the loosening of foreign particles by the brush means.

Various problems have been encountered in attempts to provide a commercially acceptable apparatus for cleaning escalators. One problem which has not heretofore been met satisfactorily is to provide an efficient apparatus for this purpose that is of compact, simple construction suitable for mass production and capable of prolonged trouble-free service. Another heretofore unsolved problem is to provide an efficient apparatus to clean the forward riser surfaces of the traveling steps of an escalator. Still another problem is to provide an apparatus incorporating means to insure accurate positioning of the apparatus relative to the traveling steps of an escalator. A further troublesome problem is to lower a brush means into engagement with the longitudinal treads and intervening grooves of the traveling steps of an escalator without undue damage to the bristles of the brush means by bending of the bristles against the treads. A further problem is to provide simple and efficient means to position a transverse brush initially at the correct level relative to the traveling steps and at correct alignment with the plane of the steps and to maintain the correct position throughout the cleaning operation. A further problem is to adapt a transverse vacuum nozzle for efficient entrainment of the foreign particles in the longitudinal grooves of the traveling steps. A still further problem is to minimize the time required to prepare such an apparatus for operation when the apparatus is initially moved into position at an escalator.

As will be explained in detail the invention incorporates various features to meet these various problems. Broadly described, the preferred embodiment of the invention has a body in the form of an elongated tank having a series of chambers to serve the various purposes of providing a supply of cleaning liquid, providing a vacuum receiver and providing a housing to enclose working parts such as vacuum pump means, detergent pump means and motor means.

To process the forward riser surfaces of the traveling steps, the apparatus includes cleaning means which is urged forward towards the approaching steps by suitable spring means and is retracted by the approaching steps and the cleaning means automatically shifting from step to step to clean the steps in turn.

Accurate positioning of the apparatus relative to the traveling steps is provided by employing guide means for mechanical engagement with the fixed structure of the escalator.

Damage to the bristles of the brush means in the initial positioning of the brush means is avoided by lowering the brush means gradually into contact with the surface of the traveling steps and simultaneously reciprocating the brush means to work the bristles of the brush means gradually into the longitudinal grooves of the steps.

Quick and accurate positioning of the brush means relative to the upper surfaces of the traveling steps is accomplished by suspending the brush means with freedom for adjustment movement, by further providing the brush means with pilot wheels for contact with the traveling steps, and by progressively lowering the brush means to bring the pilot wheels into contact with the traveling steps.

Effective entrainment of foreign particles in the longitudinal grooves of the traveling steps by a vacuum nozzle is accomplished by using brush means to form, in effect, a continuation of the nozzle that extends into the grooves to cause the inflowing air to sweep through the grooves.

Lost time in getting into operation when the apparatus is initially positioned at an escalator is avoided by providing a single manually operable control for immobilizing the apparatus and by arranging for both the lowering of the brush means and the initiation of the cleaning operation to be carried out automatically in response to the immobilization of the apparatus.

The features and advantages of the invention may be understood from the following detailed description considered with the accompanying drawings.

In the drawings which are to be regarded as merely illustrative:

FIG. 1 is a side elevational view of an embodiment of the invention in operation at the bottom landing of an escalator;

FIG. 2 is an end elevational view of the apparatus in the same position;

FIG. 3 is a plan view of the apparatus in the same position;

FIG. 4 is an enlarged longitudinal section taken as indicated by the line 4—4 of FIG. 3;

FIG. 5 is an enlarged fragmentary sectional view showing a vacuum nozzle and associated brush means of the apparatus;

FIG. 6 is a transverse section taken along the line 6—6 of FIG. 4;

FIG. 7 is a transverse section taken along the line 7—7 of FIG. 4;

FIG. 8 is a view partly in section and partly in side elevation showing the vacuum nozzle elevated and the ground wheels lowered, parts of the apparatus being omitted for clarity of illustration;

FIG. 9 is a fragmentary perspective view showing one of the two guide means that is retractably mounted on the two opposite sides of the apparatus;

FIG. 10 is a side elevational view partly in section illustrating a second embodiment of the invention; and

FIG. 11 is a simplified side elevational view illustrating another embodiment of the invention.

The drawings show how the invention is employed to clean a conventional escalator having a series of steps 10 that travel between two balustrades 12 from a stationary platform or sill (not shown) at the upper end of the escalator to a stationary platform or sill 14 at the bottom of the escalator. As best shown in FIG. 4, each of the steps 10 has a curved forward riser surface 15 and as best shown in FIGS. 6 and 7, the upper surfaces of the steps are formed in a well known manner with longitudinal treads or ribs 16 and intervening longitudinal grooves 18. The two balustrades 12, which constitute fixed structure of the escalator, have inside panels 20 and end panels 22 and each balustrade is equipped with the usual traveling hand rail 24 in the form of a continuous belt.

As indicated in FIGS. 1, 4 and 10, the steps 10 successively drop to a horizontal plane 25 and then travel along a horizontal path in the plane to and under the sill 14. The upper surfaces of approximately $1\frac{1}{2}$ steps are always exposed in the plane 25 as the steps approach the sill 14 and it is contemplated that the cleaning of the upper surfaces of the steps will be carried out by the apparatus in this zone of horizontal travel of the steps.

Referring to the first embodiment of the invention shown in FIGS. 1-9, the principal parts of the apparatus include: a body in the form of an elongated tank 30 of rectangular cross-sectional configuration; a handle 32 mounted on the rear end of the body to facilitate manually maneuvering the apparatus; a retractable wheel assembly comprising a pair of front wheels 34 and rear swiveled wheel or caster 35 mounted on a retractable wheel frame 36; suitable legs 38 extending rigidly downwardly from the body 30 and equipped with pivoted foot members 40 to support and immobilize the apparatus when the wheel assembly is retracted; a transverse vacuum nozzle, generally designated 42 equipped with three brushes 44, 45 and 46 (FIG. 5) and a spray manifold 48 mounted on the front

of the vacuum nozzle 42 equipped with a series of nozzles to spray cleaning liquid onto the traveling steps 10 in advance of the vacuum nozzle and the three brushes.

The tank which forms the body 30 of the apparatus is divided into a series of chambers including a forward chamber 50 which serves as a vacuum tank, an adjacent chamber 52 which houses a pair of motor-actuated pumps or blowers 54 for evacuating the vacuum tank, a chamber 55 which serves as a tank to hold a supply of water, and, finally a rear chamber 56 which houses a portion of the mechanism for actuating the wheel assembly and also houses a brush-actuating motor 58 (FIG. 6) and a motor 60 for driving a water pump 62. The water tank 55 is connected to the water pump 62 by a pipe 64 and the output side of the pump is connected to the spray manifold 48 by a hose 65.

As shown in FIG. 4, the interior of the vacuum tank 50 is spanned by a foamed plastic filter 66, the lower space 68 below the filter serving as a receiver for solid particles that are picked up by the vacuum nozzle 42. As best shown in FIG. 7 the vacuum nozzle 42 is connected to the lower space 68 in the vacuum tank 50 by means of two flexible corrugated ducts 70.

As shown in FIG. 8 the frame 36 of the wheel assembly is suspended from the underside of the body 30 by suitable link means comprising a pair of forward links 72 pivoted to the body 30 and a pair of shorter rearward links 73 pivoted on a crossbar 74, each link being pivotally connected at its lower end to the wheel frame. In the construction shown the two forward wheels 34 are journaled on a cross bar or axle 75 which is part of the wheel frame 36 and the lower ends of the forward links 72 are pivotally connected to this axle. FIG. 8 shows the wheel assembly extended downward to support the apparatus on the forward wheels 34 and the rearward dolly 35 and FIG. 4 shows the wheel assembly retracted upward to cause the apparatus to be supported on and immobilized by the rigid legs 38.

As shown in FIGS. 4 and 8, the mechanism for extending and retracting the wheel assembly includes a traveling nut 76 on a screw 78 that is journaled in two bearings 80. The screw 78 is housed in the rearward chamber 56 and is operated by a crank 82 on a handwheel 83 that is accessible at the rear end of the apparatus. The traveling nut 76 is provided with an upwardly extending finger 84. The traveling nut 76 is connected by an angular link 86 with the wheel frame 36 to move the wheel frame rearward to retract the wheels as shown in FIG. 4 and to move the wheel frame forward to extend the wheels as shown in FIG. 8.

A feature of the invention is that the vacuum nozzle 42 may be termed a carriage since it has two pairs of wheels 88 on its two opposite sides respectively to ride on the upper surfaces of the traveling steps as the traveling steps traverse the zone of horizontal travel in front of the stationary platform or sill 14. With the vacuum nozzle 42 given adequate freedom for movement this arrangement permits the vacuum nozzle to align itself automatically with the upper surfaces of the traveling steps with predetermined spacing from the surface of the traveling steps for correctly positioning the three brushes 44, 45 and 46 relative to the treads 16 and the longitudinal grooves 18 as indicated in FIG. 7.

The vacuum nozzle 42 is mounted on a pivoted yoke 90 which is capable of gravitational movement downward and the carriage is suspended from the pivoted yoke with the required freedom for movement relative thereto. In the construction shown, the yoke 90 is a metal plate bent to the configuration of an inverted U as may be seen in FIG. 7 with the yoke pivoted on the previously mentioned cross bar 74, which cross bar extends between the two forward rigid legs 38. As may be seen in FIG. 4 the pivoted yoke 90 is triangular as viewed in side elevation and in effect constitutes a bellcrank having a forwardly extending arm on which the vacuum nozzle is mounted, the rear edge of the yoke constituting a downwardly extending arm in the path of movement of the wheel frame 36.

When the wheel frame 36 is retracted as shown in FIG. 4, the yoke 90 is free for pivotal movement to permit the vacuum nozzle 42 to gravitate downward into rolling contact with the upper surfaces of the traveling steps 10. On the other hand, when the wheel frame 36 is shifted rearward to its extended position as shown in FIG. 8 for making the apparatus mobile, the axle 75 of the wheel frame 36 pushes against the rear edge of the pivoted yoke 90 to lift the vacuum nozzle 42 to an elevated position.

The means for mounting the vacuum nozzle 42 on the forward arm of the pivoted yoke 90 includes an upper cross bar 94 that spans the yoke and a lower cross bar 95 that is suspended from the upper cross bar by a pair of links 96. As best shown in FIG. 5 the nozzle 42 is provided with a pair of trunnions 98 on a central longitudinal axis for pivotally suspending the vacuum nozzle from a transverse bracket 100 and as shown in FIG. 7 the bracket 100 is in turn pivotally mounted on the lower cross bar 95 for freedom for adjustment about the axis thereof. Preferably, as best shown in FIG. 8, each of the two links 96 is formed with a forwardly extending finger 102 to cooperate with a flange 103 of the bracket 100 to limit the relative movement between the bracket and the links. When the vacuum nozzle 42 is raised above floor level by the pivoted yoke 90, a coil spring 104 acting in tension between the vacuum nozzle and the finger 102 tilts the vacuum nozzle upward until the finger touches the flange 103 as shown in FIG. 8. Consequently the rear wheels of the vacuum nozzle touch first when the vacuum nozzle is lowered to floor level.

Preferably the vacuum nozzle 42 is further provided with guide rollers or wheels 105 on its opposite sides respectively. These guide rollers 105 cooperate with the inside panels 20 of the balustrades 12 to keep the front end of the apparatus aligned with the escalator.

It is apparent that the vacuum nozzle 42 is in effect attached to the yoke 90 by a universal joint and that the two links 96 additionally permit arcuate movement of the vacuum nozzle relative to the yoke so that the three brushes 44, 45 and 46 may be reciprocated over a short arcuate range longitudinally of the traveling steps. For the purpose of causing such reciprocation, when desired, the previously mentioned brush-actuating motor 58 in the rearward chamber 56 is operatively connected through a gear box 106 (FIG. 6) with a crank 107 and the crank, in turn, is operatively connected by a connecting rod 108 with the lower cross bar 95 of the suspension for the vacuum nozzle.

As heretofore explained, retraction of the wheel assembly to immobilize the apparatus automatically frees the pivoted yoke 90 to lower the vacuum nozzle 42 onto the horizontally traveling escalator steps. In the preferred practice of the invention the immobilization of the apparatus by the retraction of the wheel assembly also automatically energizes the motor-driven vacuum pumps 54 and the motor 58 for reciprocating the vacuum nozzle carriage 42. For this purpose, as shown in FIGS. 4 and 8, a suitable switch 110 with an operating plunger 112 is positioned in the path of movement of the finger 84 of the traveling nut 76. When the wheel assembly is extended downward to make the apparatus mobile, the finger 84 is in operating contact with the switch 110 to deenergize the various motors. On the other hand, when the wheel assembly is retracted to immobilize the apparatus, the finger 84 moves away from the switch 110 to close the various motor circuits.

Preferably, the apparatus is provided with a rearward control panel 113 with convenient switches (not shown) for controlling the various motors independently of the switch 110 whenever desired. The control panel also provides a timer 114 which carries out a predetermined operating cycle as will be explained.

A feature of the invention is the provision of two guide arms 115 (FIGS. 1 and 2) on the opposite sides respectively of the apparatus for cooperation with the fixed end panels 22 of the two balustrades 12 to facilitate correctly aligning the apparatus longitudinally with the direction of travel of the

escalator steps. As shown in FIG. 9 each guide arm 115 is pivotally mounted on a bracket 116 and fixedly carries a forwardly directed cylinder 118 on its outer end. A pad 120 for abutment against the corresponding end panel 22 is mounted on a shank 122 that screw threadly extends into the cylinder 118 and is provided with a suitable lock nut 124. By virtue of this arrangement, the two pads 120 may be accurately adjusted for correct alignment of the apparatus when the two pads are in firm abutment against the fixed end panels 22. When the apparatus is not in use, each of the guide arms 115 may be swung upward out of the way to a dotted position shown in FIG. 9 and the guide arm may be releasably secured in this upright position by a suitable latch member 125.

As shown in FIG. 4, the mechanism for cleaning the forward riser surfaces 15 of the escalator steps 10 includes a forward cantilever frame 130 which is pivotally mounted on trunnions 132 on opposite sides of the body 30 and is normally extended forward with the rear end of the frame in abutment with the undersides of fixed steps 134. When the mechanism is not in use the cantilever frame 130 may be swung upwardly and rearwardly out of the way to an idle position indicated by the broken lines 135, the cantilever frame then resting on the upper sides of the fixed steps 134.

Suspended from the cantilever frame 130 by four links 136 is a lower movable frame 138 which carries a plurality of spaced narrow pilot rollers 140 for contact with the forward riser surfaces 15 and also carries brush means 142 to sweep the riser surfaces upwardly as the riser surfaces descend. Preferably the lower movable frame 138 is also provided with guide rollers 144 on its opposite sides for contact respectively with the two opposite inner panels 20 of the two balustrades 12 to keep the lower frame in correct alignment with the traveling escalator steps.

It is apparent that the lower movable frame 138 by virtue of the four links 136 is capable of reciprocation along a fixed arcuate path that is generally horizontal in direction. A pair of tension springs 145 on opposite sides of the cantilever frame 130 act between the cantilever frame and the rearward links 136 to urge the lower movable frame 138 forward towards the approaching steps.

The manner in which the apparatus functions for its purpose may be readily understood from the foregoing description. With the wheel assembly extended as shown in FIG. 8 to make the apparatus mobile on the wheels 34 and caster 35, and with the cantilever frame 130 swung forward from its idle position to its operating position, the apparatus may be maneuvered by the handle 32 onto a lower sill or stationary platform at the bottom of an escalator that is to be cleaned. To facilitate correct longitudinal alignment of the apparatus with the direction of travel of the escalator steps, the two guide arms 115 are swung downward to their outwardly extending effective positions for firm abutment against the fixed end panels 22 of the two balustrades 12. With the two guide pads 120 in firm abutment against the fixed end panels 22 of the two balustrades, the rearward crank 82 is manually rotated to retract the wheel assembly and thus immobilize the apparatus on the downwardly extending rigid legs 38.

Initial rotation of the crank 82 causes the switch 110 to close and thereby energize the two vacuum pumps 54 and the motor 58 that reciprocates the vacuum nozzle 42. As the wheel assembly progressively retracts, the pivoted yoke 90 is progressively released to lower the carriage 87 into rolling contact with the horizontally traveling escalator steps. The spring 105 in keeping the elevated vacuum nozzle tilted to its limit prevents oscillation of the vacuum nozzle relative to the links 96 and consequently the vacuum nozzle and the links are reciprocated as a unit by the motor 58.

The importance of keeping the vacuum nozzle 42 tilted and at the same time reciprocating the vacuum nozzle as it descends into operating position may be understood when it is considered that lowering the three brushes 44, 45 and 46 without the tilt and without reciprocation causes the bristles of the brushes to be bent by contact with the longitudinal threads

16 of the traveling steps, whereas reciprocation of the tilted brushes causes the bristles to work their way into the longitudinal grooves 18 without damage to the bristles. Once the vacuum nozzle is lowered into operating position, the reciprocation continues to facilitate loosening of foreign matter by the brushes. The range of reciprocation may, for example, be approximately 1 inch.

As an escalator step 10 advances against the pilot rollers 140 of the movable frame 138 in opposition to the force exerted by the two springs 145, the brush means 142 on the movable frame sweeps the forward riser surface 15 of the escalator step upward and thus displaces dirt and foreign particles from the riser face onto the upper surface of the traveling step. When the traveling step descends below the level of the pilot rollers 140, the two springs 145 shift the movable frame 138 forward to bring the pilot rollers 140 into contact with the forward riser surfaces 15 of the next succeeding escalator step 10. Thus the movable frame 138 is reciprocated automatically by the successive advancing steps.

With the dirt and foreign material swept upward onto the upper surfaces of the traveling steps, the traveling steps enter the zone of horizontal travel under the vacuum nozzle 42. The forward brush 44 sweeps the upper surfaces of the longitudinal treads 16 and tends to displace the dirt and foreign material into the longitudinal grooves 18. Any residual material which fails to be displaced into the grooves will encounter the third brush 46 which also sweeps the upper surfaces of the treads. The dirt and foreign material that is displaced into the longitudinal grooves 18 encounters the second brush 45 and at that time is directly under the vacuum nozzle 42 to be entrained thereby and delivered to the vacuum tank 50 through the two corrugated flexible ducts 70.

The function of the rearward brush 46 is not only to sweep the upper surfaces of the treads 16 but also to close the gaps in the brush 45 which are caused by the brush 45 straddling the various treads 16. Thus the brush 46 in cooperation with the brush 45 forms an air seal between the vacuum nozzle 42 and the traveling steps rearward of the vacuum nozzle. The function of the forward brush 44 is not only to sweep the upper surfaces of the treads 16 but also to confine the inflow of air to the longitudinal grooves 18. Thus the three brushes 44, 45 and 46 serve in effect as an extension of the vacuum nozzle 42, which extension conforms to the cross-sectional configuration of the treads and grooves and concentrates the inflowing air into high velocity streams in the individual grooves 18. Water as well as dirt and material is delivered to the lower space 68 of the vacuum tank but in actual practice the water evaporates instead of accumulating in the vacuum tank.

In the preferred practice of the invention, the closing of the switch 110 when the vacuum nozzle is lowered to start a cleaning operation, causes the timer 114 to carry out the following operation sequence. First a dry brushing operation is carried out long enough to loosen and remove the bulk of dirt and foreign material. Then automatically the water pump 62 is operated to spray water for a period of time to loosen and remove additional material. Then the water pump is stopped and scrubbing with vacuum action is continued for a predetermined time to remove all moisture from the traveling surfaces.

At the end of a cleaning operation the forward cantilever frame 130 is swung upward and rearward to its idle position and the crank 82 is operated manually to extend the wheel assembly downward to take the weight of the apparatus off of the fixed legs 38. Initial retraction of the traveling nut 76 opens the switch 110 to energize the various motors and the progressive downward extension of the wheel assembly results in corresponding progressive elevation of the pivoted yoke 90 to lift vacuum nozzle 42 sufficiently to avoid interference with movement of the apparatus to a new location. The lateral guide arms 115 are then swung upward and latched in their idle positions to be out of the way as the apparatus travels to a new location.

THE SECOND EMBODIMENT SHOWN IN FIG. 10

The apparatus shown in FIG. 10 has a body, generally designated 150, in the form of an elongated tank that is divided into various chambers including a forward chamber 152 equipped with a filter 154 to serve as a vacuum tank and an intermediate chamber 155 which serves as a water supply tank. Suitable vacuum pump means 156 driven by suitable motor means 158 is mounted externally on the forward end of the body 150. The body 150 is provided with the usual handle 160 and is provided with the usual rigid downwardly extending legs 162 to support and immobilize the apparatus.

The apparatus is provided with a retractable wheel assembly which may be lowered to make the apparatus mobile. The wheel assembly includes a pair of forward wheels 164 and a rearward caster 165, all of which are mounted on a wheel frame 166 that is suspended by a pair of forward links 168 and a pair of rearward links 170. A traveling nut 172 on an upright screw 174 is operatively connected to the wheel frame 166 by a suitable link 175 and the screw is provided with an external crank 176 for manual operation.

A motor driven water pump 178 supplies water from the water tank 155 to two four-way valves 180 and 182 and a spray-control valve 184. The spray-control valve 184 supplies water to a venturi fitting 185 that is connected by a short pipe 186 with a detergent tank 188. The water mixed with detergent is delivered by a pipe 190 to a spray manifold 192 on the front end of the apparatus and is further delivered by a forward hose 194 to a spray manifold 195 for cleaning the forward riser surfaces 15 of the traveling escalator steps.

In the same general manner as heretofore described, a vacuum nozzle 196 equipped with suitable brush means 198 is connected to the vacuum tank 152 by a pair of corrugated flexible ducts 200. The vacuum nozzle 196 is provided with suitable wheel means 202 and is pivotally suspended from a pivoted yoke 204. The pivoted yoke 204 functions in the previously described manner as a bellcrank for abutment by the wheel frame 166 to lift the carriage 101 when the wheel assembly is lowered.

A forward brush 205 with relative stiff bristles is mounted on a transverse frame 206 that is pivotally mounted on a cross rod 208. To reciprocate the forward brush 205, the transverse frame 206 is connected by a connecting rod 210 to a rearward crank 212, the crank being actuated by a motor 214 through a gear box 215.

Preferably the cross rod 208 may be raised and lowered by remote control for adjusting the level of the forward brush 205 relative to the surfaces of the horizontally traveling steps. For this purpose the cross rod 208 is carried by one arm of a bellcrank means 216 and the second arm of the bellcrank means is connected to a piston rod 218 that extends from a hydraulic cylinder 220. With the hydraulic cylinder 220 connected to the previously mentioned four-way valve 182 by a pair of pipes 222 it is apparent that the four-way valve 182 may be manipulated to adjust the elevation of the forward brush 205.

For the purpose of cleaning the forward riser surfaces of the traveling escalator steps 15, an upper forwardly extending cantilever frame 224 is slidably mounted on a fixed frame 225 for longitudinal adjustment. Preferably the longitudinal adjustment is accomplished by hydraulic means under remote control and for this purpose the cantilever frame 224 is connected to a piston rod 226 that extends from a hydraulic cylinder 228. With the hydraulic cylinder 228 connected to the previously mentioned four-way valve 180 by a pair of pipes 230, the four-way valve may be manipulated for forward and rearward adjustment of the cantilever frame 224.

A movable auxiliary frame 232 is slidably mounted on the front end of the cantilever frame 224 for reciprocation relative thereto along a generally horizontal path and is continuously urged forward by compression spring means 233. The movable auxiliary frame 232 has an upper forward extension 234 that carries a plurality of spaced forward pilot rollers 235

and the auxiliary frame has an additional lower forward extension 236 which carries a suitable brush means 238. It is apparent that the pilot rollers 235 will reciprocate by rolling contact with the successive steps and will guide the auxiliary frame 232 to cause the brush means 238 to sweep the forward riser surfaces 15 of the successive traveling steps. The spray manifold 195 is positioned to spray the detergent and water mixture onto the riser surfaces in advance of the brush means 238 and the second spray manifold 192 sprays the surfaces of the steps in advance of the stiff brush 205.

It is apparent that the second embodiment of the invention functions in the same general manner as the first embodiment and in addition sprays the forward riser surfaces of the approaching steps. The advantage of having the pilot rollers 235 in contact with one riser surface while the brush means 238 operates on another riser surface is that no pilot roller means is required close to the brush means.

THE THIRD EMBODIMENT OF THE INVENTION SHOWN IN FIG. 11

The apparatus shown in FIG. 11 has the usual body 240 in the form of an elongated tank with a handle 242 at the rear end of the tank and with a forward cantilever frame 130 carrying a previously described arrangement for cleaning the forward riser surfaces of the approaching steps. A pair of forward wheels 244 are journaled on an axle 245 which rigidly extends between two downwardly extending rigid legs 246. A swivel caster 248 is carried by a rearward column 250 that extends retractably downward from the rear end of the body 240. Adjacent the caster 248 a pair of rearward legs 252 extend rigidly downward from the body and are provided with pivoted foot pieces 254. The caster 248 may be retracted upwardly to immobilize the apparatus by lowering the apparatus onto the two legs 252. For this purpose a manually operable crank 255 on the rear end of the apparatus is connected to a gear box 256 inside the body for the purpose of raising and lowering the column 250 that carries the caster wheel 248.

In the previously described manner a transverse vacuum nozzle 42a is part of a carriage 87a provided with wheels 88a and is suspended from a pivoted yoke 90a with freedom for adjustment movement relative to the yoke. The yoke 90a is in the form of a lever having a rearwardly extending arm 258 which is forked at its end to extend under a cross pin 260 that is carried by the column 250.

When the caster 248 is elevated to immobilize the apparatus on the two legs 252, the yoke 90a is free to permit the carriage 87a to gravitate downward onto the surface of the horizontally traveling steps. When the crank 255 is operated to extend the swivel caster 248 downward to make the apparatus mobile, the cross pin 260 carried by the column 250 depresses the arm 258 thereby to rock the yoke 90a for elevating the carriage 87a.

The apparatus shown in FIG. 11 operates in the same general manner as heretofore described but differs in that the forward wheels 244 are not retractable and serve to support the forward end of the apparatus on the horizontally traveling escalator steps as the steps approach the sill or stationary platform 14.

My description in specific detail of the selected embodiments of the invention will suggest various changes, substitutions and other departures from my disclosure within the spirit and scope of the appended claims.

I claim:

1. In an apparatus of the character described for cleaning the longitudinal treads and intervening grooves of the moving steps of an escalator as the steps travel relative to a landing at one end of the escalator, the combination of:

a vacuum system including a vacuum nozzle positioned transversely of the apparatus to pick up foreign particles from the moving steps, said nozzle having a transverse front wall and a transverse rear wall spaced therefrom;

brush means depending from the front wall of the nozzle to the upper surface of the longitudinal treads without extending substantially into the intervening grooves; and brush means depending from the rear wall to the top surface of the treads and also extending into the grooves to span the grooves,

whereby air flowing into the nozzle is divided into a plurality of streams corresponding to the longitudinal grooves of the moving steps, said streams extending under the forward brush means into the grooves.

2. A combination as set forth in claim 1 which includes means to spray the moving steps forward of the nozzle.

3. A combination as set forth in claim 1 in which the brush means that depends from the rear wall of the nozzle comprises a first brush with relatively long bristles to extend into the grooves of the moving steps whereby the longitudinal treads of the moving steps form gaps in the bristles; and

a second brush contiguous to the first brush to close the gaps in the bristles in the first brush.

4. In an apparatus of the character described for cleaning

the moving steps of an escalator as the steps travel relative to a landing at one end of the escalator, the combination of:

brush means to sweep the upper surfaces of the approaching steps;

a chamber to hold cleaning liquid;

a spray head forward of the brush means to spray the upper surfaces of the approaching steps;

passage means from the chamber to the spray head to deliver the cleaning liquid thereto;

power actuated pump means to pump the liquid from the chamber through the passage means thereby to place the liquid in the passage means under pressure;

support means for the brush means, said support means being movable up and down for adjustment of the level of the brush means;

hydraulic means in communication with said passage means for raising and lowering the support means to raise and lower the brush; and

control valve means for said hydraulic means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,678,533 Dated July 25, 1972

Inventor(s) Phillip Cravits

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Date of issue now reads -- July 25, 9172

Correct date of issue to -- July 25, 1972

Signed and sealed this 6th day of February 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents