A floor cleaning machine having two counter-rotating brushes in the forward end, a supply system for a cleaning solution, and a solution recovery mechanism with a squeegee device at the rearward end thereof. The squeegee device is connected to a single pivot means at a point intermediate the brushes and the squeegee device to provide both lateral and vertical angular movement.

Conventional floor cleaning machines for industrial use generally utilize two counter-rotating, power driven brushes at the forward end which are supplied with a cleaning solution from a tank on the machine, and a squeegee device mounted at the rear for recovering the dirty solution which is delivered to another tank on the machine. The squeegee device used on the conventional equipment is often ineffective in recovering all the used cleaning solution from the floor, frequently leaving streaks or puddles of solution, particularly in depressions in the floor and along the path of the machine where it was maneuvered into various turns and lateral positions. Floor irregularities, such as roughness and small protrusions, often permit the dirty solution to pass beneath the blades on the squeegee and form streaks or spots on the floor. Further, in the conventional machines, the squeegee is extended beyond the sides of the machine to give the squeegee sufficient breadth to recover the solution while the machine negotiates turns and other maneuvers. However, the protruding ends of the squeegee frequently bump or contact walls, posts, and other obstacles and cause damage thereto or the squeegee is itself damaged by the impact. It is therefore one of the principal objects of the present invention to provide a solution recovery device which will effectively adapt itself to slight or moderate floor depressions and protrusions and roughness and thereby give optimum performance under such adverse operating conditions, and which is so mounted on the machine that it will effectively follow the path of the floor surface cleaned by the brushes and will be readily deflected when bumped or sidewise as the machine is maneuvered along walls and around posts and other objects or obstacles.

Another object of the invention is to provide, in a floor cleaning machine having two counter-rotating brushes, an efficient solution recovery device which causes the solution to flow to the center part thereof and then laterally spaced ports where it is picked up and delivered to a tank on the machine, and which is provided with a scrubber or scraping device in the center thereof for removing any dirt left on the floor by the normal lateral spacing of the two brushes from one another.

Still another object of the invention is to provide a squeegee structure which applies a substantially uniform, yieldable pressure on the floor throughout its length and which will swing freely within a relatively wide horizontal arc to follow the path cleaned by the brushes, as the machine is maneuvered on the floor and to swing vertically to adapt to depressions and rises in the floor.

A further object is to provide a relatively simple, trouble-free solution recovery device for floor cleaning machines, which can be readily cleaned and serviced and which can effectively be used to recover either wet or dry floor cleaning compositions.

Additional objects and advantages of the invention will become apparent from the following description and accompanying drawings, wherein:

FIGURE 1 is a side elevational view of a floor cleaning machine showing a portion of the housing broken away for the purpose of better illustrating the mechanism associated with the present invention;

FIGURE 2 is a top plan view of the cleaning machine shown in FIGURE 1;

FIGURE 3 is an enlarged fragmentary side elevational view showing the mechanism involving the present invention;

FIGURE 4 is a horizontal fragmentary cross sectional view taken on line 4--4 of FIGURE 1;

FIGURE 5 is a top plan view of the solution recovery mechanism involving the present invention;

FIGURE 6 is an elevational view of the solution recovery mechanism shown in FIGURE 5;

FIGURE 7 is a bottom view of the solution recovery mechanism shown in FIGURE 5;

FIGURE 8 is a vertical cross sectional view through the mechanism shown in FIGURES 5, 6, and 7, the section being taken on line 8--8 of FIGURE 6; and

FIGURE 9 is an enlarged cross sectional view of a portion of the solution recovery mechanism, the section being taken on line 9--9 of FIGURE 3.

Referring more specifically to the drawings and to FIGURES 1 and 2 in particular, numeral 10 designates generally the present floor cleaning machine, and 12 the sweeping or scrubbing mechanism having a pair of rotating brushes 14 and 16 driven by an electric motor or other suitable power means enclosed in compartment 18 of body 20, the two brushes consisting of bristle portions 22, backing plate 24 and hub 26 through which the brushes are driven by a motor in compartment 20. As the two brushes are rotated, water flowing from a water supply system, including a tank in the upper part of body 20, is supplied to the brushes through conduits connected to hubs 26 in the respective brushes. The water on the rear of the brushes is distributed therein by centrifugal force and is used in the scrubbing operation as the machine is maneuvered over the floor. The two brushes are counter-rotating, and the water discharged through the brushes tends to collect in a stream trailing the space between the two brushes as the machine is moved generally forwardly over the area being cleaned. For the purpose of the present description, the two brushes and water supply system may be considered conventional, and hence the details thereof will not be described herein.

The machine may be power-driven or pushed by the operator, and, in the machine shown in the drawing, the machine is supported by two main wheels 34 and 36 mounted on an axle 38 extending transversely beneath the body of the machine and connected thereto by several supports (not shown). Two casters 40 and 42 including wheels 44 and 46, respectively, support the rear end of the machine body and permit the machine to be maneuvered effectively over the area to be cleaned and along and around obstacles in the area. The two wheels 44 and 46 are connected to the body by bifurcated members 48 and pivot members 50 attached to the underside of body 20.

The water recovery mechanism designated by numeral 60 consists generally of a squeegee device 62 and a control device 64. The squeegee device, which is most clearly shown in FIGURES 5 through 8, consists of two front laterally spaced blades 66 and 68 and an intermediate blade 70 interposed between and spaced from blades 66 and 68. The front blades are supported by a housing 74.
and are secured to downwardly extending flanges on the housing by a plurality of bolts or rivets 76. A rear blade 78 spaced from front blades 66 and 68 is mounted on a downwardly extending flange on housing 74 and is secured thereto by a plurality of bolts or rivets 80. The outer ends of front blades 66 and 68 are provided with rearwardly extending flanges 82 and 84, respectively, which contact the forward edge of rear blade 78, thus restricting the ends of the space or chamber 86 between the front and rear squeegee blades, but providing an opening for air at each end for air traveling through the ends of blades 66 and 68. The blades are preferably made of rubber or plastic material and are sufficiently flexible that, as they move along the surface of the floor, they will conform readily to the irregularities and crevices to form a yieldable seal therewith. Thus, chamber 86 is substantially enclosed when the machine is in operation, with the exception of ports 88 and 90 at the inner ends of blades 66 and 68. The two ports thus formed constitute inlet openings for the dirty solution to enter space 86. The squeegee blades are pressed downwardly toward the surface of the floor with sufficient force to create a scraping action, which will not only effectively remove the water, but will also remove particles of dirt and other foreign matter tending to adhere to the floor, as well as any dry material which may be engaged by the squeegee device. Space or chamber 86 is connected to a water supply tank in body 20 by a flexible tube 94 secured to nipple 96 which in turn is connected to the space by an opening 98. The dirty solution collected in space 86 is drawn from said space through tube 94 to the solution recovery tank by a vacuum pump or other suitable pump mechanism disposed in the housing. A suitable solution tank and lift system is disclosed and claimed in co-pending application Ser. No. 650,312, filed on June 30, 1967, and hence will not be described in detail herein.

The squeegee device 62 is generally arcuate shaped and is connected to a single shaft 100 to a double swivel joint 102 pivotally secured to axle 38. The rear end of shaft 100 is rigidly connected to the squeegee device by pin 104 extending downwardly through fixture 105 and through a hole in the end of shaft 100. The joint 102 consists of a vertical bearing housing 106 rigidly secured to a bearing housing 108 mounted on shaft 38 and held in axial position therewith by sleeves 110 and 111 at opposite ends of housing 108. Housing 106 contains a vertical shaft 112 which rotates freely in the housing and which supports a sleeve 113 at its lower end for rotatably supporting shaft 100, the shaft being retained in the sleeve by pins 114 and 115. The joint 102 permits shaft 100 to rotate and to swing freely in both the horizontal and vertical directions, thus permitting the squeegee device 62 to tilt and to move freely laterally and vertically as it follows the path of the machine, and traverses depressions and rises and other irregularities in the floor.

With the device 64 mounted in the foregoing manner, the squeegee device 62 is capable of moving freely laterally in a generally arcuate direction and is readily deflected when a projecting end thereof contacts an object or obstacle or when the machine moves along the wall side-sweeping. Wheels 116 and 118 which are rotatably mounted on shafts 120 and 122, which in turn are mounted on the upper side of the outer ends of housing 74, roll when they contact an object such as a wall, thereby protecting the wall as the device moves along the floor closely thereto to remove the dirty solution. The wheels also facilitate effective deflection when the respective opposite contact the squeegee device. It is seen that the center of the arc of the squeegee device is on the axis of shaft 112, thus causing the device to move longitudinally in line with its own curvature when it is deflected to the right or left as the machine is maneuvered over the area being cleaned. This facilitates effective removal of the dirty solution, regardless of the various positions into which the machine is maneuvered during the cleaning operation.

The pressure of the squeegee blades on the floor is controlled by a mechanism indicated generally by numeral 130, consisting of a shaped rubber or resiliently mounted downwardly extending arms 134 and 136 mounted on vertical post 138 and having rollers 140 and 142 in the ends of arms 134 and 136, respectively. These rollers bear against a horizontally disposed plate 144 mounted on the rear of body 20. Post 138 consists of upper and lower telescopic sections 146 and 148, the upper section being rigidly attached to arms 134 and 136, and the lower section being mounted on shaft 100. A coil spring 150 disposed in post 138 and reacting against abutments in the sections thereof urges the rollers 140 and 142 firmly against plate 144 and urges the squeegee device firmly against the floor. The rollers traveling on the underside of plate 144 permit the squeegee device to swing freely laterally, and the telescopic sections and spring permit the squeegee device to adapt itself vertically to depressions and rises in the floor. Stop abutments 151 and 152 are provided at the ends of plate 144 to limit the lateral travel of squeegee device 60.

In the cleaning operation, the two counter-rotating brushes 14 and 16 are placed in operation and the water-detergent solution is delivered to the brushes which are maneuvered by the operator over the area being cleaned. As the brushes rotate and the machine is moved forwardly, the dirty solution accumulates in a stream trailing the space between the two brushes. As the squeegee device reaches the stream, the dirty water is deflected laterally by blades 66, 68 and/or 70 to ports 88 and 90 and is emulsified and sucked inwardly into space 86 where it is removed through pipe 92 to a collection tank in body 20. The two lateral blades 66 and 68, which are both arcuate and positioned with the outer ends forwardly of the inner ends, cause the dirty solution to flow inwardly to ports 88 and 90. The intermediate squeegee 70 normally trails directly behind the space between the two counter rotating brushes and thereby performs an effective scraping action on the floor for removing any foreign material left by the two brushes in the space therebetwixt. The dirty solution and foreign material pass outwardly laterally along the intermediate blade to ports 88 and 90 and are drawn therethrough into space 86. Any foreign material or dirty solution passing near the blades 66, 68, and 70 is caught in space 86 in front of blade 78, the latter blade performing the function of recovering any material remaining after the front blades have passed over the floor.

As the machine is maneuvered over the area being cleaned and is turned either to the right or the left, the squeegee device swings in the opposite direction relative to the body of the machine to follow effectively the path cleaned by the two brushes. Since the squeegee device is pivoted on the single pivoted arm 100, the device swings into an arcuate path in the lateral direction and effectively adapts itself to irregularities and to the contour of the floor. Sufficient pressure is applied by pressure mechanism 130 onto the squeegee device to cause the blades to press firmly on the floor and to adjust to depressions, rises, roughness and other irregularities in the floor. In the event either of the ends of the squeegee device engages an obstacle, the device is readily deflected laterally with little or no resistance to the obstacle, thereby preventing damage to the obstacle and/or to the cleaning machine.

While only one embodiment of the machine has been described in detail herein, various changes and modifications may be made without departing from the scope of the invention. I claim:

1. In a floor cleaning machine having a body, scrubbing means near the forward end, a system for supplying a cleaning solution to the scrubbing means, and a system
including a suction means for receiving used solution: a used solution recovery mechanism comprising a squeegee device extending laterally across the rear part of the machine at the bottom thereof, a unitary connecting member attached at one end to said device and at the other end to a single pivot means connected to the machine at a point between said scrubbing means and said squeegee device for both horizontal and vertical angular movement, a spring means positioned rearwardly of said single pivot means and reacting through said unitary connecting member for urging said squeegee device firmly onto the floor being cleaned, said spring means including a horizontal track means and a T-shaped structure resiliently connected to said unitary connecting member and having means engaging said track means for movement thereon, and a conduit means connecting said squeegee device with the system for used solution.

2. A solution recovery mechanism as defined in claim 1 in which said squeegee device includes a plurality of forwardly positioned squeegee blades and a rearwardly positioned squeegee blade, said blades forming a chamber therebetween, and a means connecting said chamber to said used solution conduit.

3. The solution recovery mechanism as defined in claim 2 in which said forwardly positioned blades include two laterally spaced blades and an intermediate blade, said laterally spaced blades being spaced from the ends of said intermediate blade forming ports for admission of used solution to said chamber.

4. A solution recovery mechanism as defined in claim 3 in which the two ends of the intermediate blade are positioned rearwardly from the center of the blade.

5. A solution recovery mechanism as defined in claim 4 in which said intermediate blade is arcuate in shape.

6. A solution recovery mechanism as defined in claim 5 in which said squeegee device is arcuate in shape with the ends thereof positioned forwardly relative to the center thereof.

7. A solution recovery mechanism as defined in claim 5 in which said squeegee device is arcuate in shape with the ends thereof positioned forwardly relative to the center thereof.

8. A solution recovery mechanism as defined in claim 6 in which the center of the arcuate configuration of the device is on said single pivot means.

9. A solution recovery mechanism as defined in claim 7 in which the center of the arcuate configuration of the device is on said single pivot means.

10. A solution recovery mechanism as defined in claim 1 in which said squeegee device extends beyond the sides of the body of the machine and is provided with a roller on each end for laterally deflecting the squeegee device in the event it engages an obstacle.

11. A solution recovery mechanism as defined in claim 9 in which said squeegee device extends beyond the sides of the body of the machine and is provided with a roller on each end for laterally deflecting the squeegee device in the event it engages an obstacle.

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