Oct. 11, 1966 J. M. LITTLE ETAL 3,277,511

ADJUSTABLE WIDTH FLOOR TREATING MACHINE

Filed April 15, 1964 9 Sheets-Sheet 1

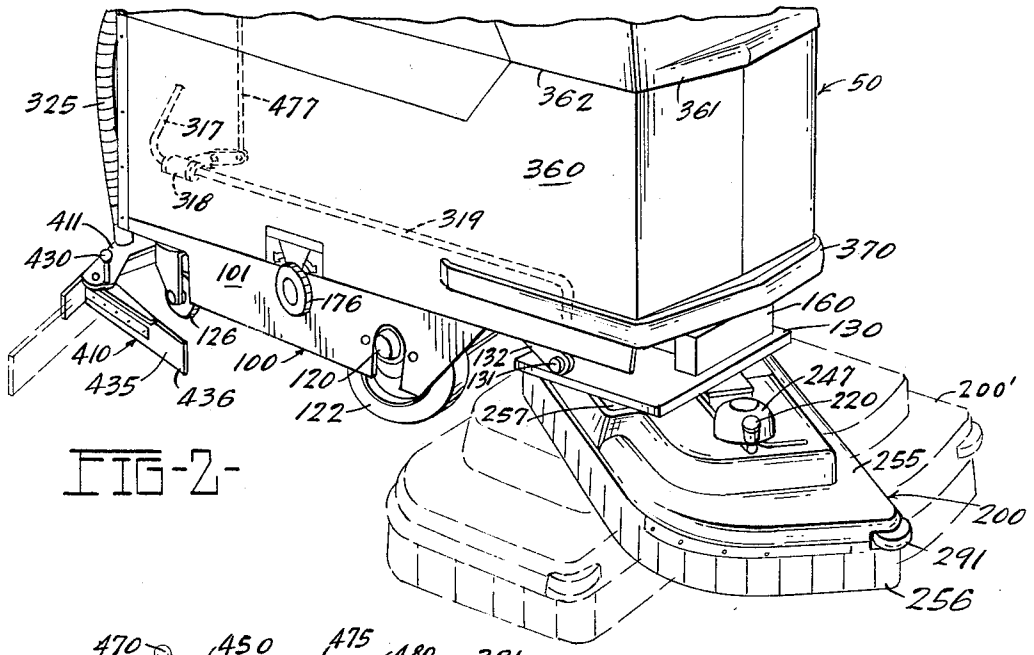



FIG-2-

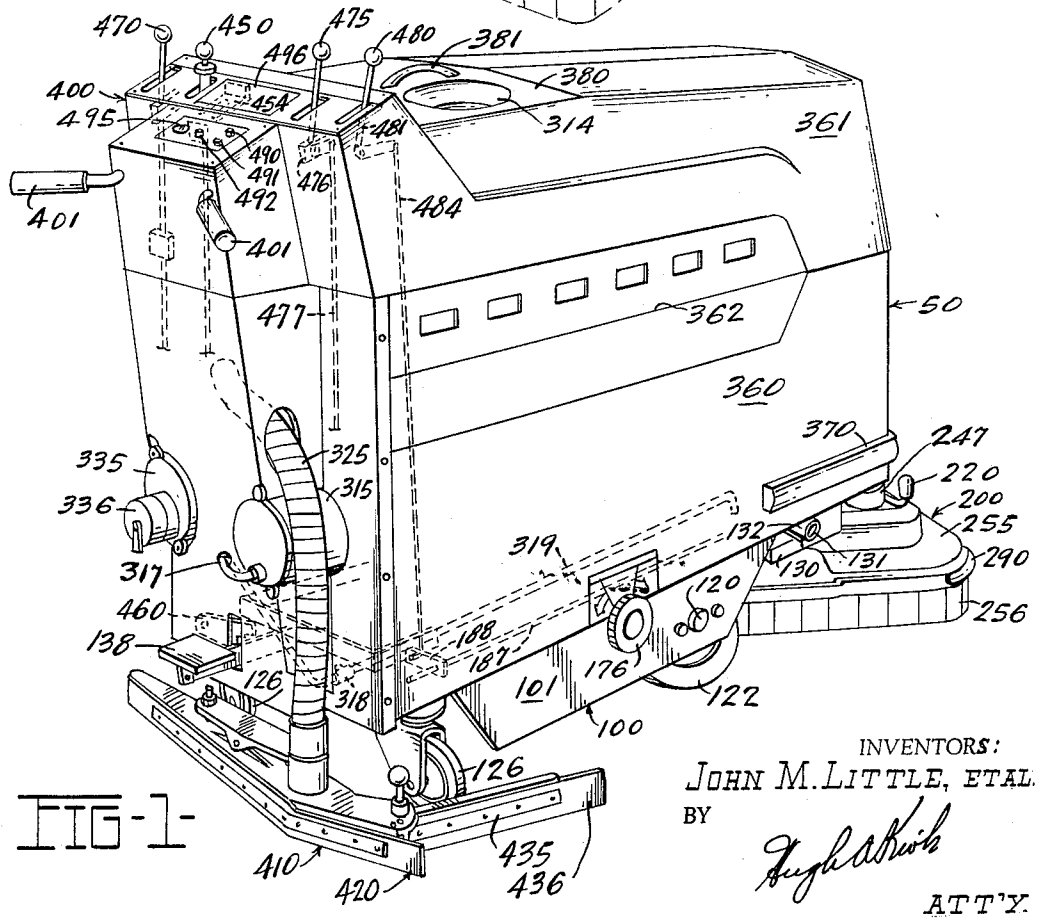



FIG-1-

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ADJUSTABLE WIDTH FLOOR TREATING MACHINE

Filed April 15, 1964 9 Sheets-Sheet 2

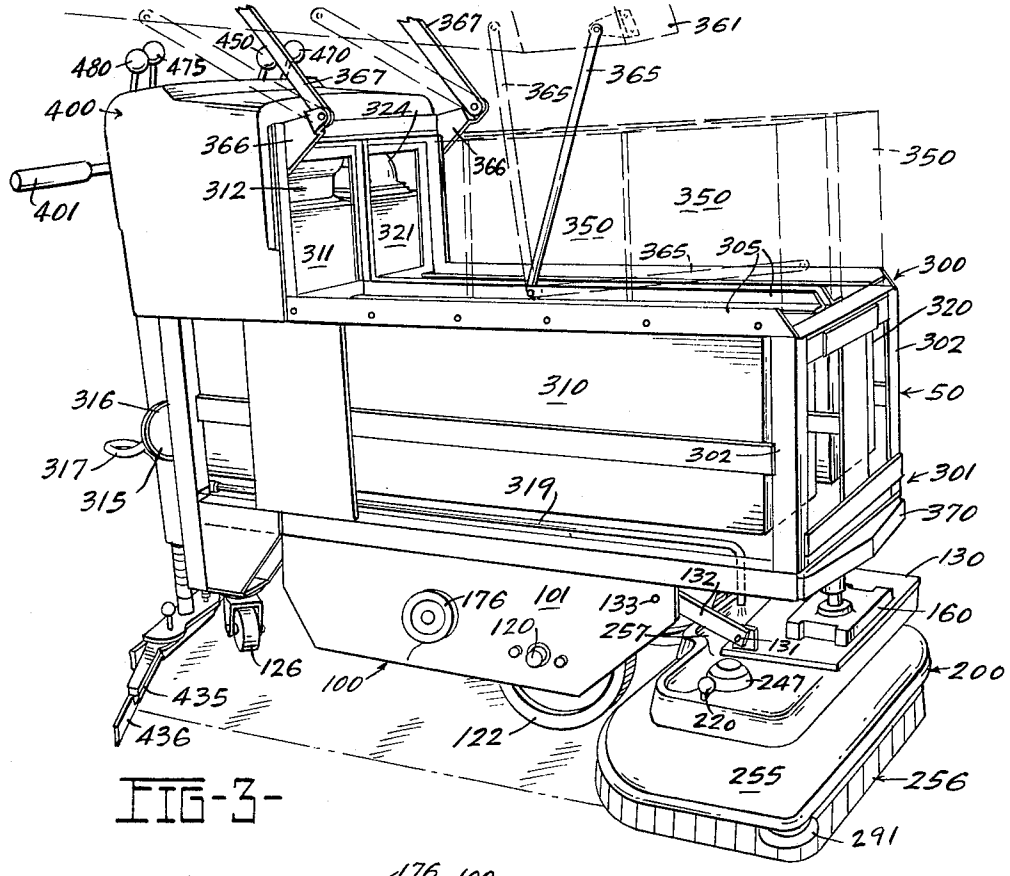



FIG-3-

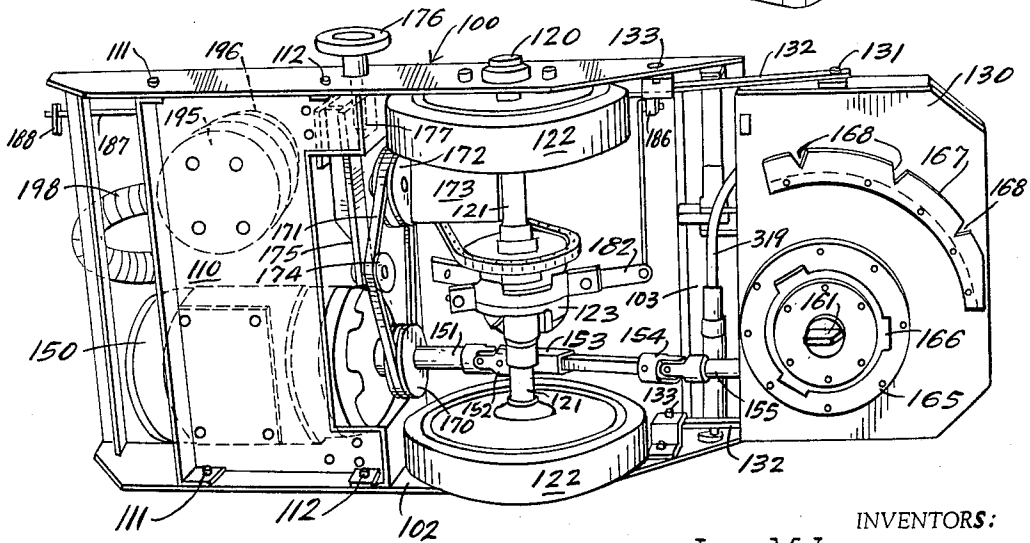



FIG-4-

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Oct. 11, 1966 J. M. LITTLE ETAL 3,277,511

ADJUSTABLE WIDTH FLOOR TREATING MACHINE

Filed April 15, 1964 9 Sheets-Sheet 3

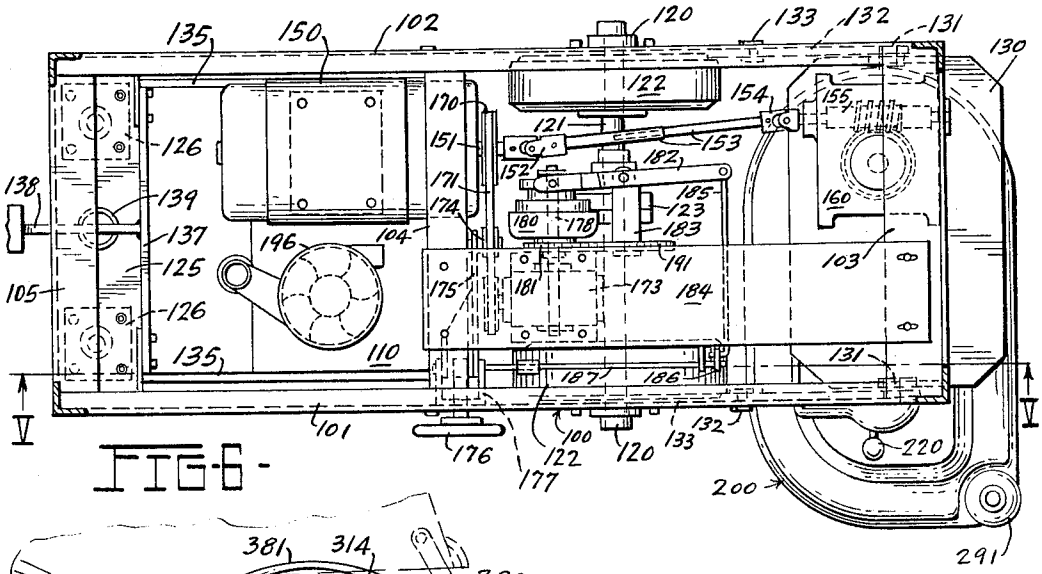


FIG-6-

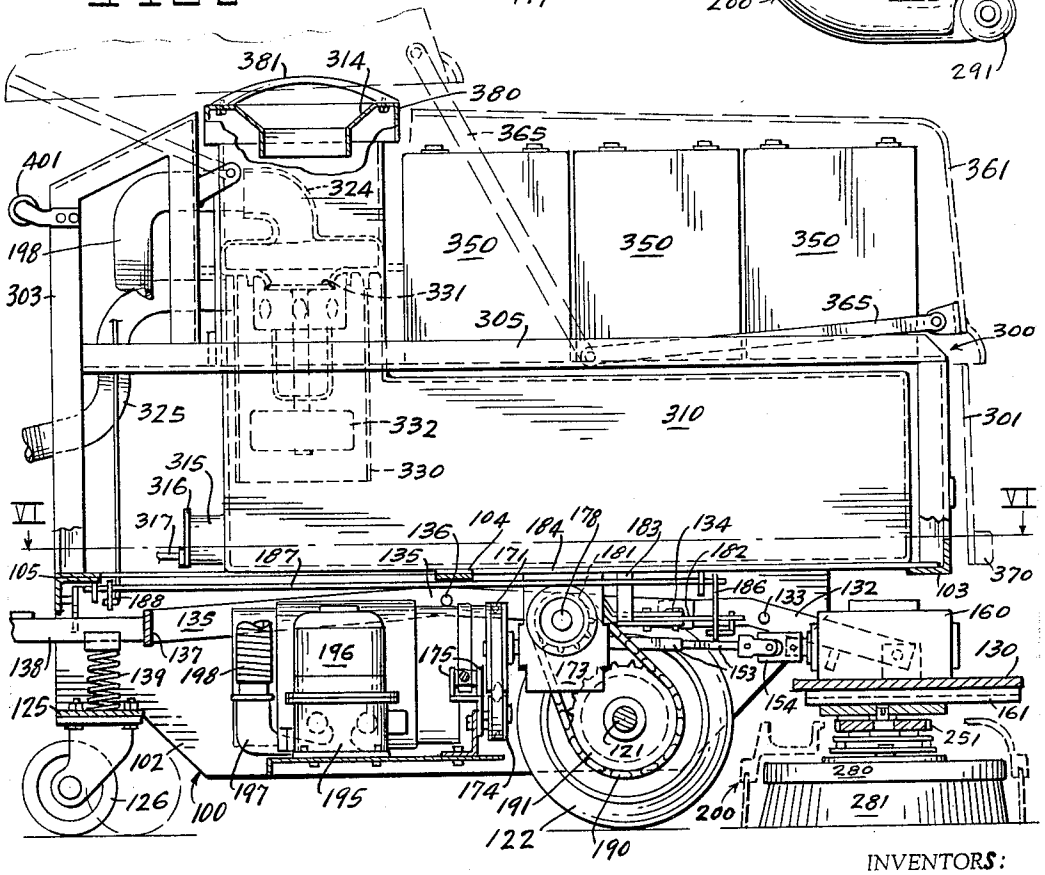


FIG-5-

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ADJUSTABLE WIDTH FLOOR TREATING MACHINE

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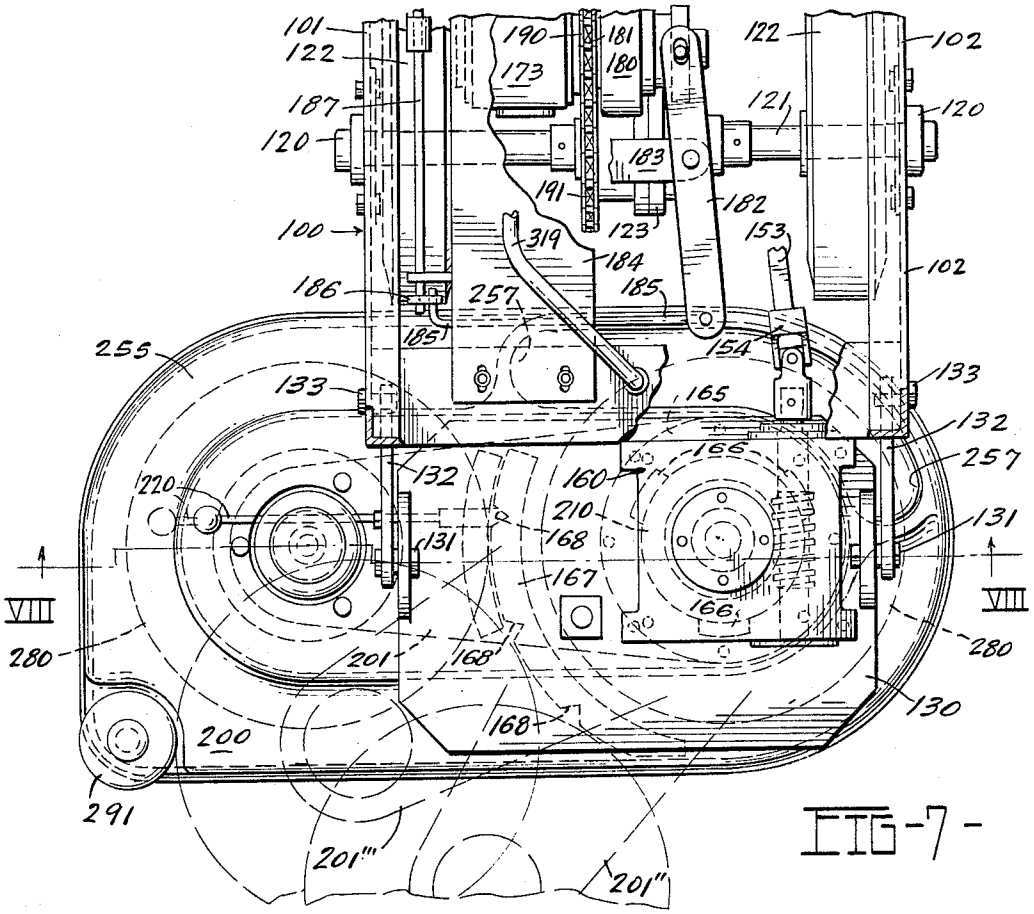



FIG-7-

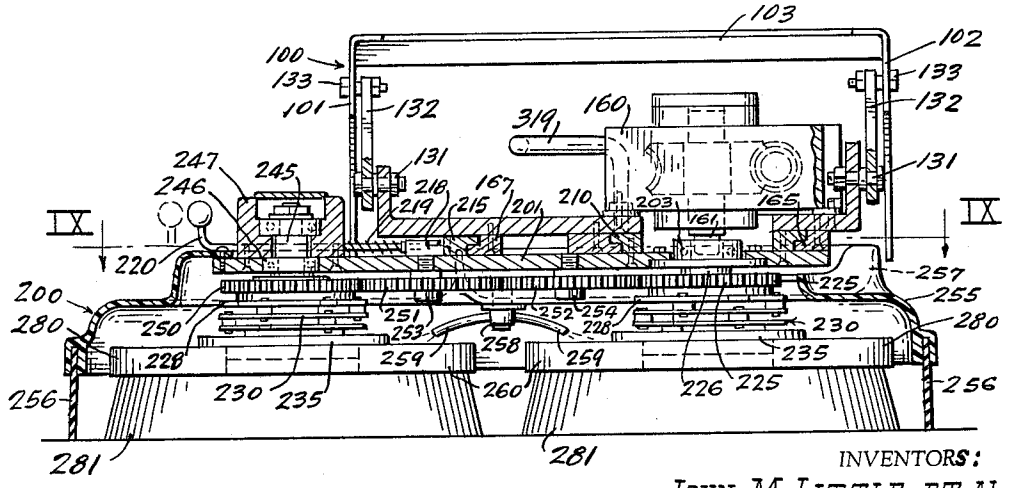



FIG-8-

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ADJUSTABLE WIDTH FLOOR TREATING MACHINE

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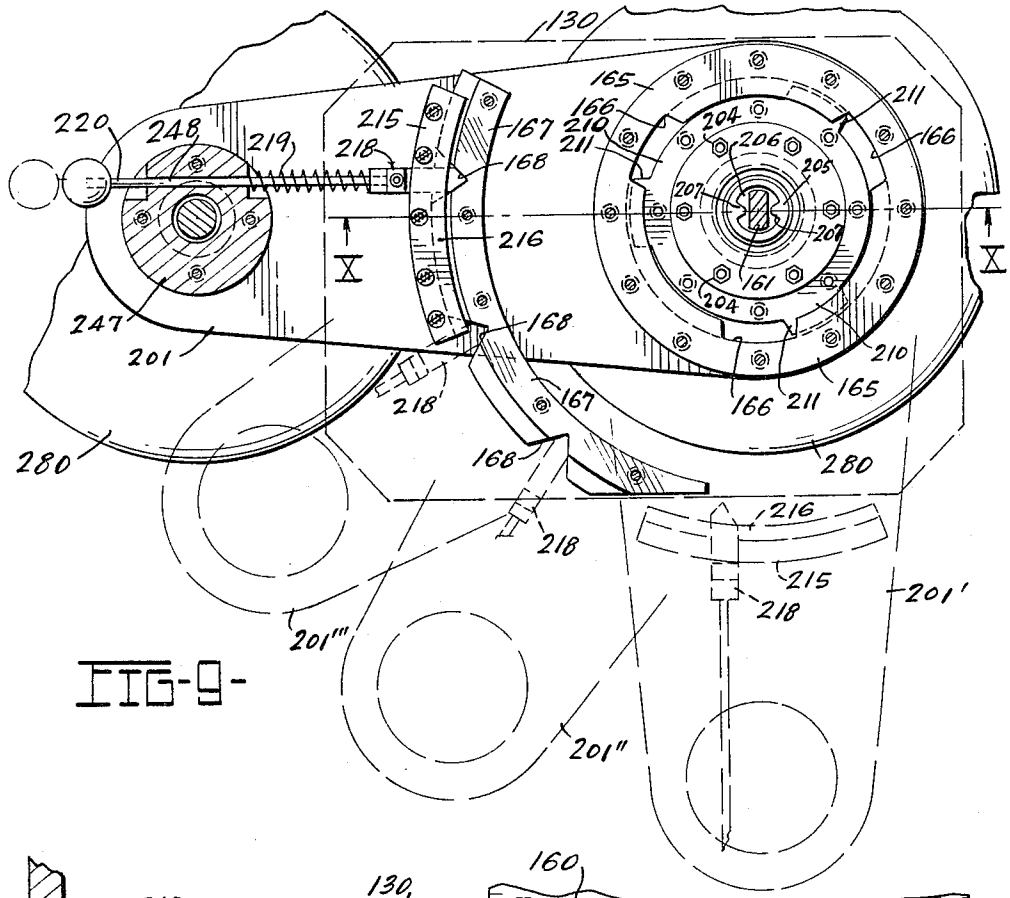



FIG-9-

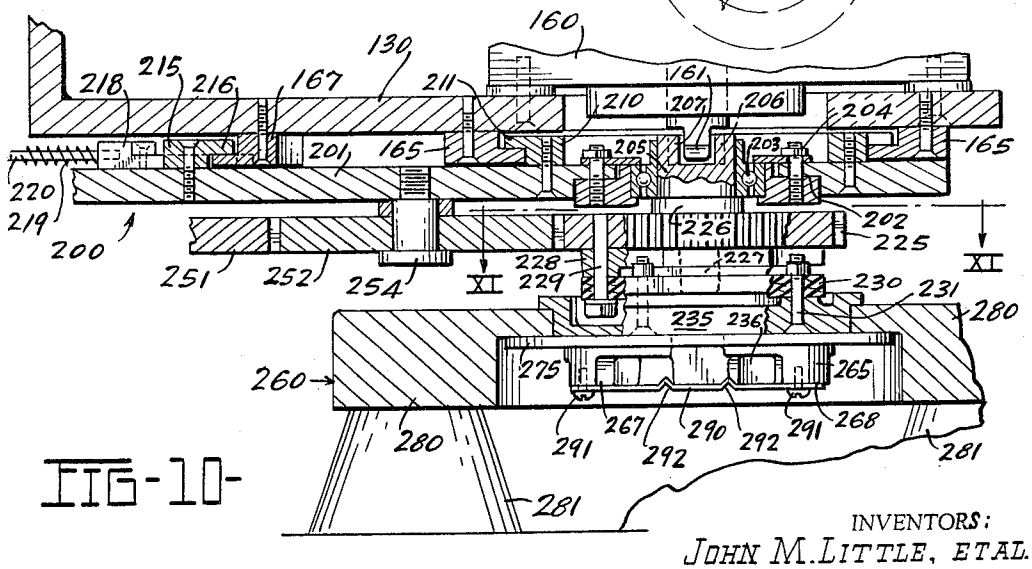



FIG-10-

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ADJUSTABLE WIDTH FLOOR TREATING MACHINE

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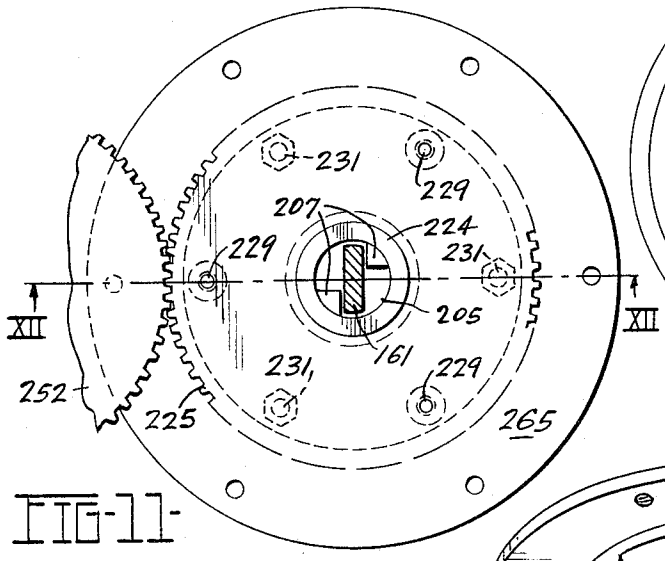



FIG-11-

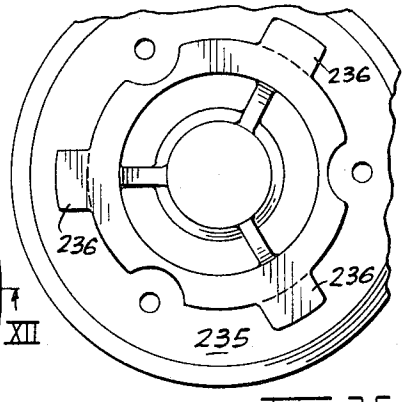



FIG-15-

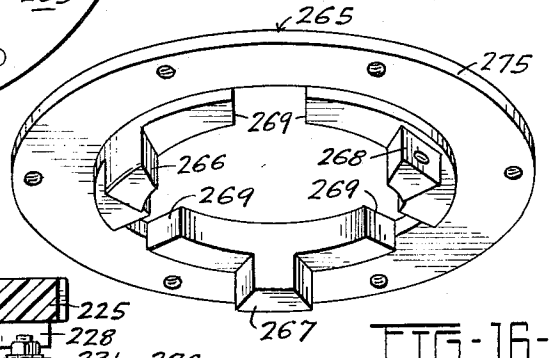



FIG-16-

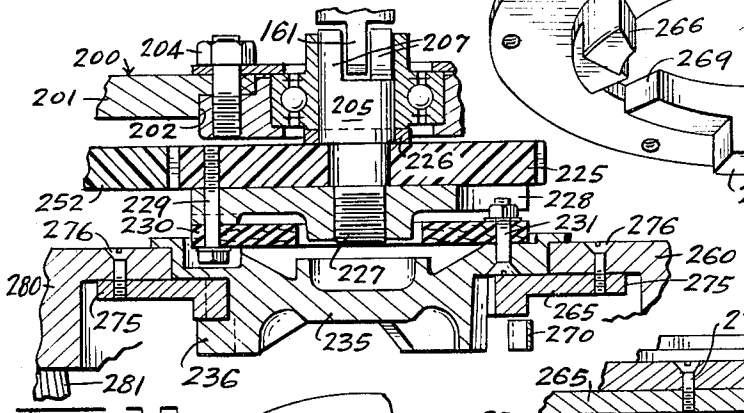



FIG-12-

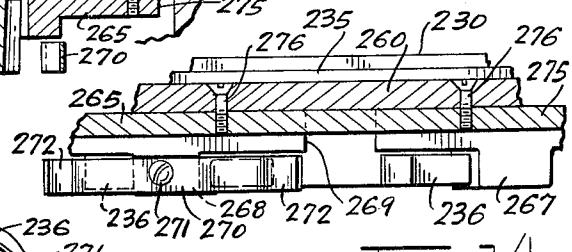



FIG-14-

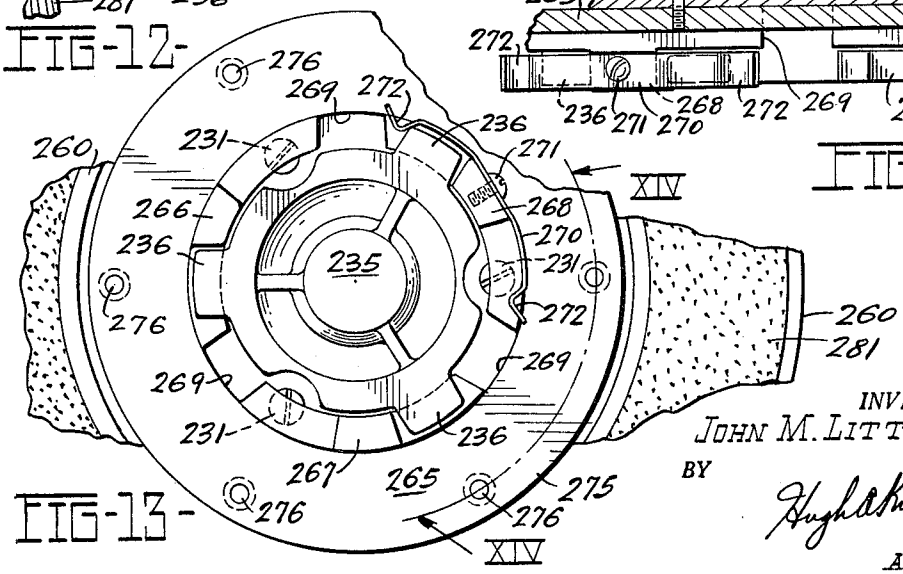



FIG-13-

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ADJUSTABLE WIDTH FLOOR TREATING MACHINE

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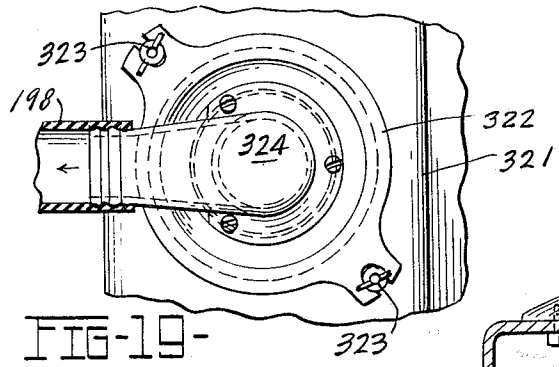



FIG-19-

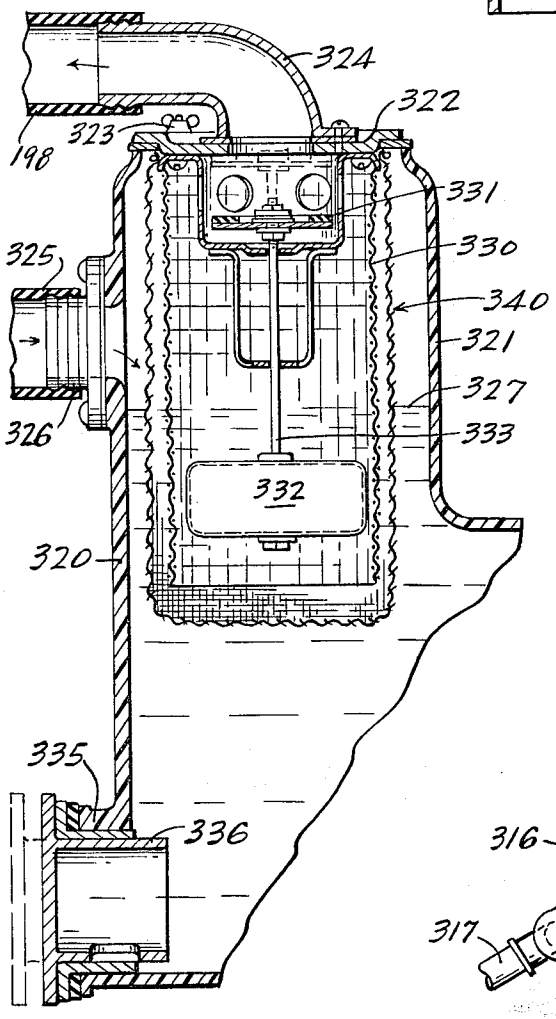



FIG-18-

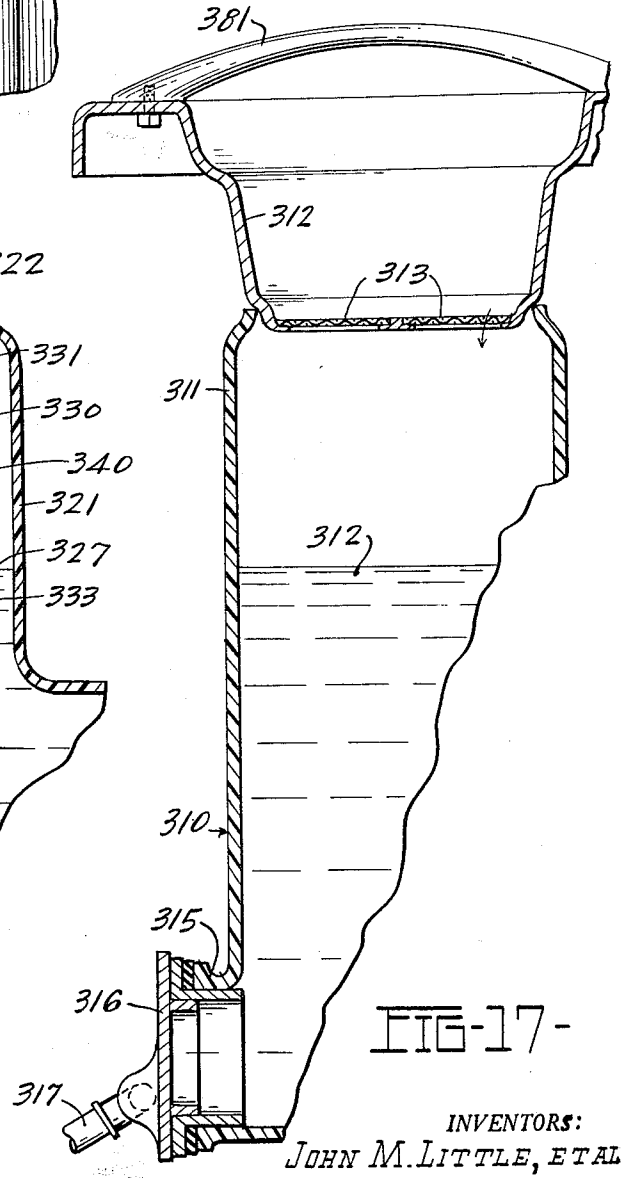



FIG-17-

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ADJUSTABLE WIDTH FLOOR TREATING MACHINE

Filed April 15, 1964 9 Sheets-Sheet 8

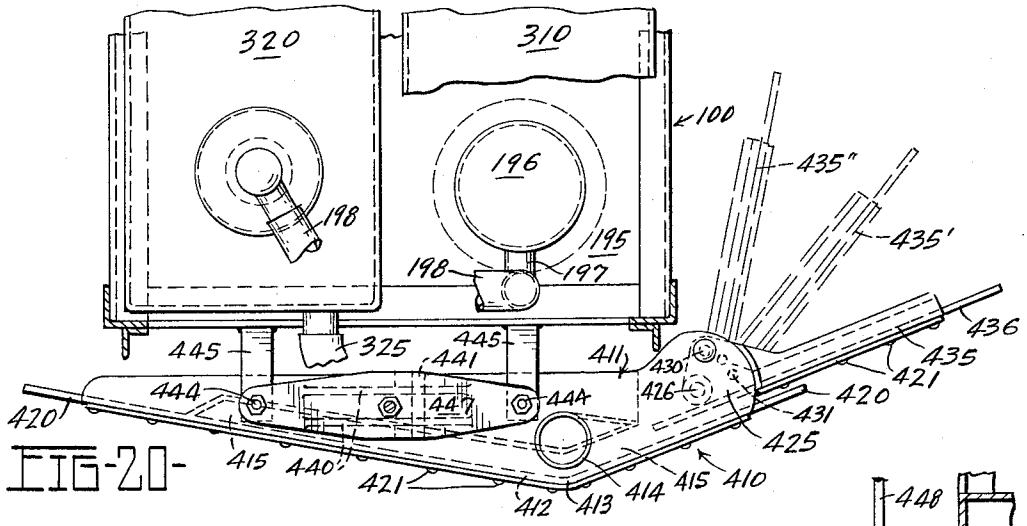



FIG-20-

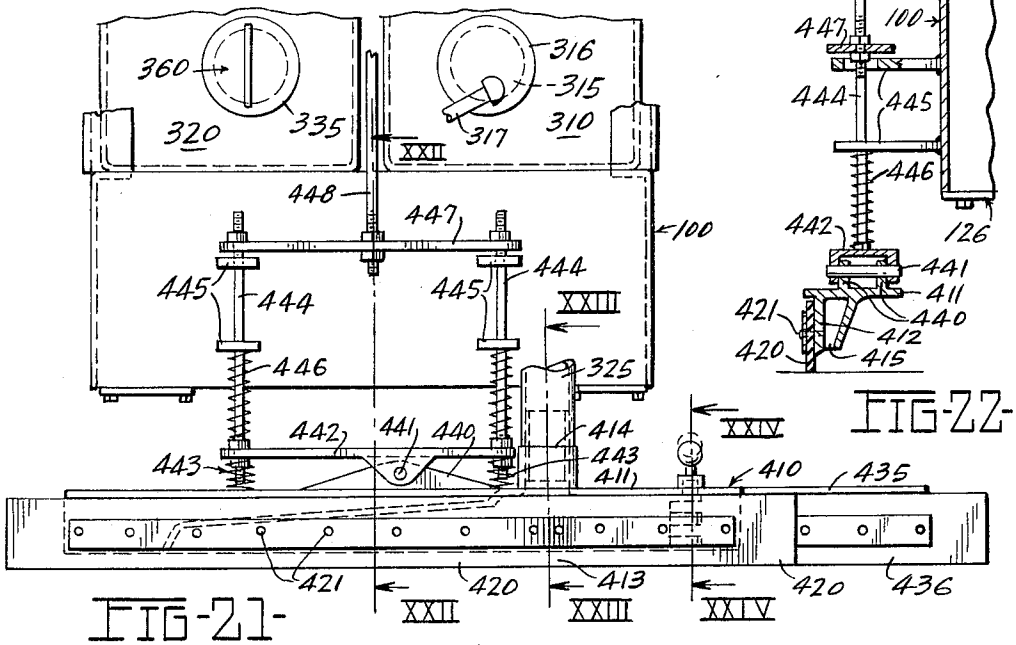



FIG-21-




FIG-22-

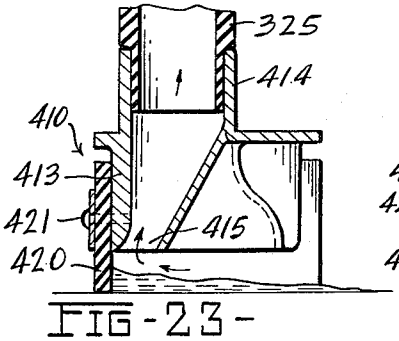



FIG-23-

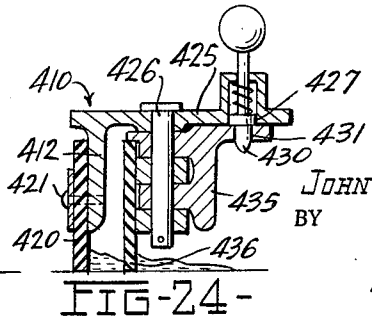



FIG-24-

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ADJUSTABLE WIDTH FLOOR TREATING MACHINE

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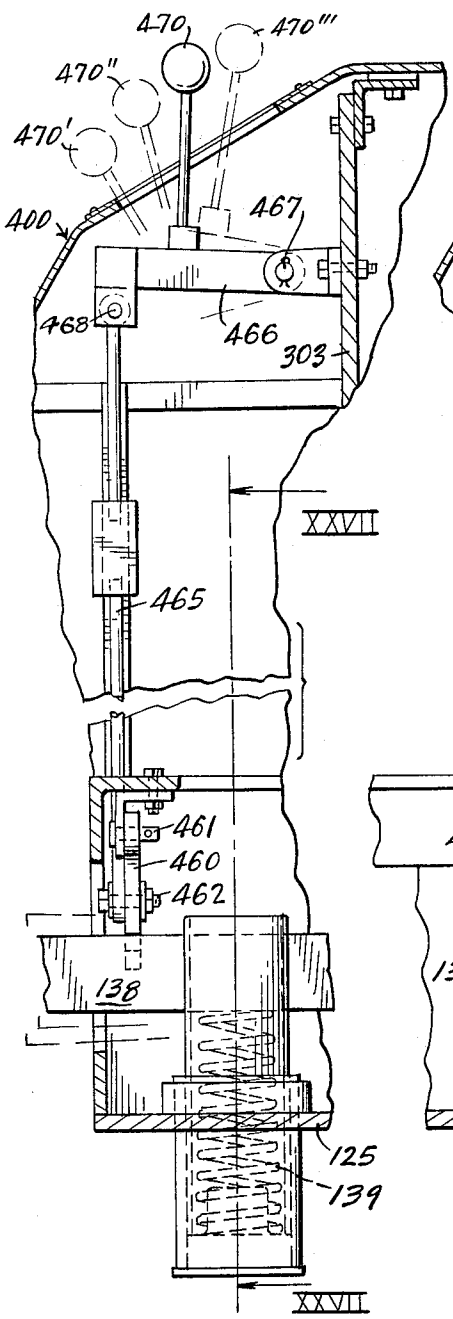



FIG-26-

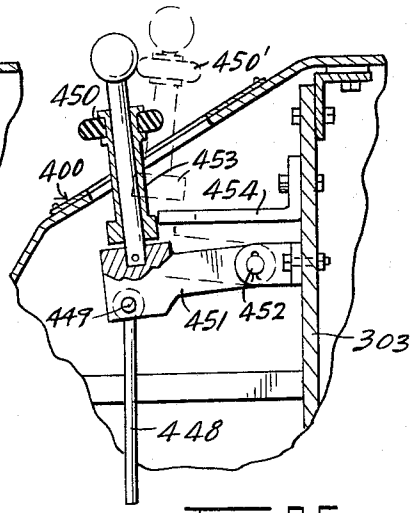



FIG-25-

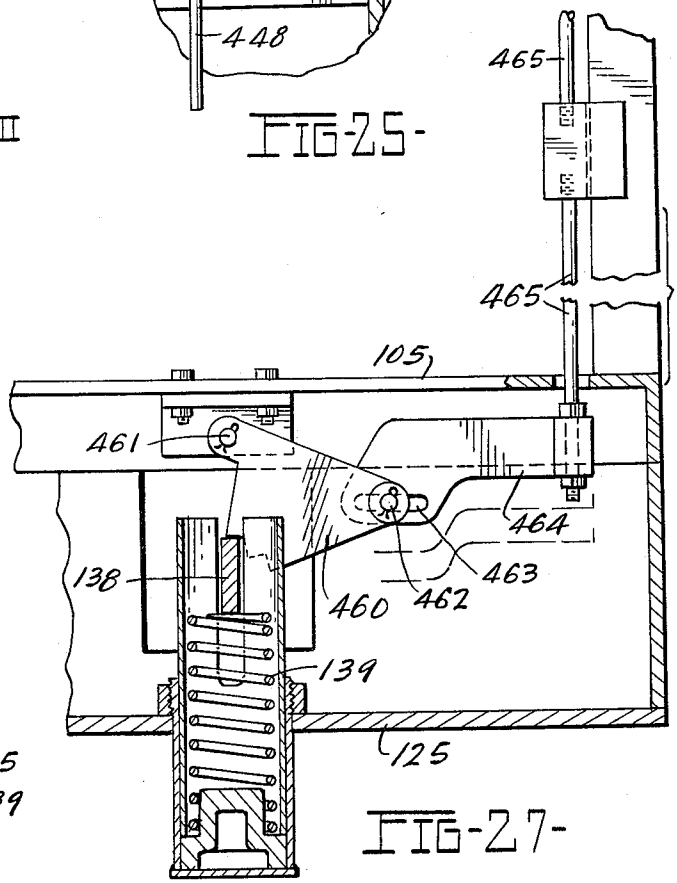



FIG-27-

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United States Patent Office 3,277,511 Patented Oct. 11, 1966



3,277,511

# ADJUSTABLE WIDTH FLOOR TREATING MACHINE

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Filed Apr. 15, 1964, Ser. No. 360,019
39 Claims. (Cl. 15—320)

This invention relates to a floor maintenance machine having an adjustable width swath. More particularly, it deals with a machine for scrubbing, polishing, washing, cleaning, mopping, and/or finishing floors in which the width of the swath of the floor treating head on the machine may be adjusted relative to the path of the machine to take variable width swaths along the path of movement of the machine. For example, this width may be varied from twenty to twenty-six inches, so that the machine may be used both for treating narrow aisles of floor as well as wide halls with fewer passes over the floor necessary for their complete cleaning than would be possible with a single width machine that was also narrow enough to clean the narrow aisles.

Accordingly, it is an object of this invention to produce a simple, sturdy, neat, powerful, economic, efficient, effective, quiet and easily serviced floor maintenance machine having an adjustable width swath.

Another object is to provide such a machine which puts down a measured or metered amount of cleaning solution, scrubs the floor upon which the solution is placed, and then picks up the dirty solution to leave the floor clean and dry.

Another object is to provide such a machine which is adaptable for dry buffing and/or suction cleaning of a floor, as well as wet scrubbing and cleaning of a floor.

Another object of this invention is to produce such a machine composed of four separate easily serviced units, namely: (I) a power and chassis unit, (II) a removable scrubbing head, (III) a battery and tank assembly, and (IV) a control panel; each of which units may be separately removed from the machine and serviced.

Another object is to produce such a machine wherein the driving motors are easily accessible in its power unit, and may be readily replaced with a minimum of connecting and disconnecting of leads and shafts thereto.

Another object is to produce such a machine having an elongated, angularly adjustable, low, retractable, easily removable, and relatively light weight (i.e. about 35 pounds) floor contacting or scrubbing head having a pair of easily replaceable rotating brushes therein.

Another object is to provide such a floor scrubbing head for this machine which: does not require lubrication and therefore avoids any possible oil leaks; is free from problems caused by water or solution in its gearing; and fits under low channels, along counters, and in the corners.

Another object is to provide such a floor treating machine with a projecting scrubbing head which enables the machine to avoid obstacles hanging on walls, and to provide a head which will snap back out of its projecting position into a more protected position to avoid collision damage to the head and/or so that the resilient bumper on the machine chassis or body will receive any shock.

Another object is to provide such a machine which has not only adjustable swath width scrubbing head but also a correspondingly adjustable width swath and retractable squeegee, as well as an adjustable pressure means for the scrubbing brushes in said head.

Another object is to provide such a machine wherein the floor rotating and contacting means or brushes are



mounted to float on their axes so as to follow any irregularities in the contour of the floor.

Another object is to provide such a machine which is self-powered, such as by batteries, is versatile, is able to make short radius turns, and will run for a relatively long time (i.e. 4 to 9 hours) or clean many square feet of floor (i.e. 100,000–225,000 square feet) without having to be serviced or its batteries re-charged.

Still another object is to provide such a machine which is adaptable to be driven by either four or six batteries which may easily be installed or removed, and are readily accessible for re-charging without removal from the machine.

A further object is to provide such a machine with infinitely variable speed control, variable means for the flow of cleaning liquid to the floor scrubbing head, and translucent liquid tanks so the amount of liquid therein can readily be viewed, which tanks are of such a configuration to have narrow neck portions that avoid sloshing.

Still a further object is to provide such a machine containing liquid tanks which are readily removable, and which are easily filled from the top of the machine through a filter, and easily drained while in the machine.

Generally speaking, the floor maintenance machine of this invention comprises four essential and separate assemblies or parts, namely: (I) A power and pump assembly or vehicle chassis part having a pair of centrally located wheels therein which preferably may be driven by the power unit located in said assembly. (II) An elongated scrubbing head removably attached and angularly adjustable with respect to the power and pump assembly or vehicle chassis; the angular adjustability of said head providing different width swaths for the scrubbing head as it is moved along a path. (III) A battery and tank assembly on a frame mounted on the chassis part above the power and pump assembly, which frame supports a pair of translucent L-shaped tanks, one for clean liquid to be supplied for the scrubbing, and the other for dirty liquid collected after the scrubbing. The rectangular space bordered on two sides by the L-shaped tanks contains two or more electric batteries for powering the driving mechanism in the power and pump assembly. (IV) A control panel is mounted on the rear of the battery and tank assembly or frame for easy access by the operator of the machine, which panel is provided with levers and switches for controlling the operation of the machine.

Specifically, the power and pump assembly or vehicle chassis part (I) comprises a pair of driving wheels located relatively centrally of the device so as to provide a narrow turning radius for the machine, which wheels may be driven through a manually adjustable infinitely variable speed mechanism, a reduction gear mechanism and a clutch. At one end of the chassis is provided a platform vertically adjustable by means of a lever and spring, and to which platform a flexible and/or telescopic drive shaft and gearing is connected from the driving motor for driving the floor scrubbing head. A suction fan or pump, which may be driven by a separate motor, may be mounted on the same plate as the driving motor, which plate may be releasably pivotally mounted for easy access to the motors and pump without dismantling the whole power and pump assembly.

The elongated scrubbing head (II) is removably attached to the underside of the vertically adjustable platform mounted on the power and pump assembly or vehicle chassis part, such as by means of a bayonet type joint around a vertically pivotal axis. This head also is angularly adjustable about this vertically pivotal axis so as to vary the angularity of the elongated head relative to the path of the vehicle to produce the different width

swaths. In the elongated head may be provided at least two rotating brushes or floor contacting means, which may be driven by plastic gears, one of which gears is mounted axially of the vertically pivotal axis and driven therethrough. The head is also easily removable in order that the machine may be readily moved up and down inclines without interference of the scrubbing head which is suspended under the vehicle chassis assembly. This removability also facilitates replacement of the removable brushes therein. These removable brushes preferably are driven through flexible couplings so that they will follow any irregularity in the contour in the floors being scrubbed or treated. In the top of the scrubbing head is provided a trough into which a spout from the clean liquid tank may provide cleaning liquid to both brushes regardless of the angular or vertical position of the head. Since a spring pressed detent maintains the angular projecting position of the scrubbing head, a bump on the forwardly and/or outwardly projecting head which has more force than the spring pressure on the detent will cause the head to move or rotate under the front end of the vehicle frame, so that the bumper on the vehicle will absorb the major portion of the shock and the scrubbing head will not be damaged.

Above or on the vehicle chassis or power and pump assembly, there is provided a frame (III) into which may be slid two parallel L-shaped tanks, in the angle of which tanks are located supports for two to six batteries, depending upon whether a 24 or 36 volt motor is employed. Around the whole tank and battery assembly may be provided a housing having a cantilever mounted cover or hood, which can be readily raised for access to the batteries. The inlets to the two L-shaped tanks are at their tops outside the housing, and may include filters, with a float valve in the dirty tank to prevent contamination of the suction pump. The outlets of the tanks are in or near their bottoms for easy draining. If desired, the suction fan or pump, and/or a removable filter bag may be placed at or around the dirty tank's inlet so that the machine may be employed as a dry vacuum cleaning machine.

The control panel (IV) which is provided at the rear of the machine adjacent the guiding handles thereof, is also provided with several levers, one of which vertically retracts and extends a squeegee following the scrubbing head and vehicle driving wheels to wipe any liquid and streaks from the floor. The width of the squeegee may be varied in accordance with the angularity or width of the swath of the scrubbing head. On the control panel there are also provided switches for starting the motors for driving the unit and the rotary scrubbing brushes and for the vacuum or suction pump, a lever to vary the flow of liquid from the clean tank onto the scrubbing brushes, a lock for adjusting the pressure of the scrubbing head against the floor after it has been set by a foot pedal, a lever for engaging and releasing the clutch between the driving motor and the vehicle, and handles for guiding the machine. The control panel also may contain a plaque stating the directions for operating the machine and in what sequence to operate the levers and switches.

The above mentioned and other features and objects of the invention and the manner of attaining them will become more apparent and the invention itself will be understood best by reference to the following description of embodiments of the invention taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of the right side and rear of a machine according to this invention, with the head and squeegee in its narrowest swath adjusted position and showing the levers on the control panel at the rear of the machine;

FIG. 2 is a perspective view of the lower half of the right side and front of the machine shown in FIG. 1, with other of the angular positions of the head and squeegee being shown in dashed lines;



FIG. 3 is another perspective view as shown in FIG. 2, but of the whole machine with its housing removed and its hood raised and mostly broken away, and the head and squeegee in their widest swath positions;

FIG. 4 is a perspective view of the under side of the machine shown in FIG. 1 with the scrubbing head and squeegee removed, showing primarily the power, pump and wheel driving mechanisms;

FIG. 5 is a slightly enlarged longitudinal vertical sectional view of the unhoused machine shown in FIG. 3 as though it were taken along line V—V of FIG. 6, showing the chassis and power unit, the scrubbing unit, and the tank and battery assembly and its supporting frame;

FIG. 6 is a plan view of the chassis and power unit taken along line VI—VI of FIG. 5;

FIG. 7 is an enlarged plan view of the forward end of the power and driving unit shown in FIG. 6 with parts broken away and different angular positions of the driving head being shown in dashed lines;

FIG. 8 is a vertical sectional view taken along line VIII—VIII of FIG. 7 showing two brushes in the scrubbing head;

FIG. 9 is a further enlarged plan view of the platform at the front end of the power unit as shown in FIG. 7, showing the detent means for angularly adjusting and removing the scrubbing head from said platform and chassis of the machine; various angular positions of the head being shown in dashed lines;

FIG. 10 is a still further enlarged vertical sectional view taken along line X—X of FIG. 9 with parts broken away and showing the connection for suspending the scrubbing head from the underside of the vertically movable platform;

FIG. 11 is an enlarged sectional view taken along line XI—XI of FIG. 10 with parts broken away and showing the gears for driving the rotating brushes;

FIG. 12 is a vertical section similar to FIG. 10 but taken along line XII—XII of FIG. 11 with parts broken away and showing the removable pivotal connection of the scrubbing head to the platform, the driving means and floating mounting for the brushes, and the removable connection for the scrubbing brushes;

FIG. 13 is the bottom view of FIG. 12 showing the bayonet connection between the brush driving means and the brush plate, and the leaf spring means for holding them together;

FIG. 14 is flattened out arcuate side view taken along arcuate line XIV—XIV in FIG. 13 showing part of the leaf spring means for releasably maintaining the brush plate connected with its driving means;

FIG. 15 is a bottom view, with parts broken away, of the brush driving means as seen looking from the bottom of FIG. 12 with the brush removed, showing the flanges for bayonet connection with the notched plate shown in perspective in FIG. 16;

FIG. 16 is a perspective view of only the brush mounting plate, showing its bayonet connection slots or notches for cooperation with the flanged brush driving means shown in FIG. 15;

FIG. 17 is an enlarged vertical section of the rear end of the L-shaped clean liquid tank, showing its top inlet and lower side drain outlet;

FIG. 18 is an enlarged vertical sectional view of the rear end of the L-shaped dirty liquid tank showing its inlet, suction outlet, float valve, removable filter, and drain outlet;

FIG. 19 is a top plan view of FIG. 18 showing how the filter can be removed;

FIG. 20 is an enlarged plan view of the rear end of the machine shown in FIG. 1, with parts broken away, showing the retractable and adjustable squeegee in its widest swath position, and its different adjustable width swath positions in dashed lines;

FIG. 21 is a rear view of the lower portion of the machine shown in FIG. 20, with parts broken away, showing the squeegee and its mounting means;

FIG. 22 is a vertical sectional view taken along line XXII—XXII of FIG. 21 showing the squeegee mounting means;

FIG. 23 is an enlarged sectional view taken along line XXIII—XXIII of FIG. 21 showing the suction nozzle;

FIG. 24 is an enlarged sectional view taken along line XXIV—XXIV of FIG. 21, showing the adjustable pivot and locking pin for varying the swath width of the squeegee;

FIG. 25 is an enlarged vertical section through the control panel with parts broken away, showing the lever and its latching mechanism for retracting and extending the squeegee;

FIG. 26 is an enlarged vertical section through another part of the control panel with parts broken away, showing the locking mechanism for the pedal operated lever for adjusting the vertical height of the scrubbing head against the action of a spring; and

FIG. 27 is a vertical section taken along line XXVII—XXVII of FIG. 26.

In order to clarify the following detailed description of the machine **50** of this invention as disclosed in the drawings, said description is divided into sections according to the following outline:

I. Chassis, power, and pump assembly (FIGS. 4, 5, 6 and 7):
   - A. Chassis.
   - B. Motors.

II. Scrubbing head (FIGS. 2, 3, 5 and 7 through 16):
   - A. Angular adjustment and connection of the scrubbing head (FIGS. 7, 8 and 9).
   - B. Floating rotating brush driving means (FIGS. 11 and 12).
   - C. Housing and trough (FIGS. 2, 3, 7 and 8).
   - D. Removal brushes (FIGS. 13 through 16).

III. Tank and battery assembly (FIGS. 1, 3, 5, 17, 18 and 19):
   - A. Frame (FIGS. 3 and 5).
   - B. Clean liquid tank (FIGS. 3, 5 and 17).
   - C. Dirty liquid tank (FIGS. 3, 5, 18 and 19).
   - D. Batteries (FIGS. 3 and 5).
   - E. Housing and hood (FIGS. 1, 2, 3 and 5).

IV. Control panel (FIGS. 1, 2, 3 and 20 through 27):
   - A. Guiding handles.
   - B. Retractable and adjustable squeegee (FIGS. 1, 2, 3 and 20 through 25).
   - C. Latch for brush pressure platform (FIGS. 26 and 27).
   - D. Clutch and liquid flow lever (FIGS. 1 through 8).
   - E. Switches (FIG. 1).

Furthermore, the four major parts I, II, III and IV according to the foregoing outline have reference characters given to their respective elements in the hundreds corresponding thereto. Thus all of the chassis, power and pump assembly parts have reference characters between 100 and 199; all of the elements of the scrubbing head have reference characters between 200 and 299; all of the elements in the tank and battery assembly have reference characters between 300 and 399; and all of the elements in the control panel have reference characters between 400 and 499.

## I. CHASSIS, POWER AND PUMP ASSEMBLY

### *A. Chassis*

Referring first to FIGS. 1 through 8 inclusive, the vehicle chassis or base **100** upon which the machine **50** of this invention is constructed and in which is incorporated the motors and their moving and driving parts, comprises in the specific example disclosed, a substantially rectangular frame having parallel side members **101** and **102** spaced by front, center and rear cross-members **103**, **104**, **105**, respectively (see FIGS. 5 and 6).

Connected between the lower edges of the side panels **101** and **102** is mounted a motor mounting plate **110** which may be fastened by ears or flanges at its corners, such as by axially aligned pairs of bolts **111** and **112** (see FIG. 4) so that by loosening one pair of bolts the plate may be pivoted around the axis of the other pair of bolts for outwardly swinging the motors mounted on the plate without completely removing the plate, for quick and easy repair and/or replacement of these motors when required.

Also between the side members **101** and **102** about centrally of the machine as a whole, and slightly forward of the center of the chassis **100**, there are mounted bearings **120** for the main support and driven shafts **121** to which the two wheels **122** are keyed. If desired, the adjacent ends of the shafts **121** may be attached through a differential mechanism **123** and/or an over-riding clutch mounted in the hubs of the wheels **122**.

Below the cross-member **105** between the rear end of the plates **101** and **102** there may be provided an additional plate or member **125** (see FIGS. 5 and 6) to the under side of which may be attached, such as by bolts, a pair of casters **126** to stabilize the machine and prevent its rocking about the axles **121**. These free wheeling casters **126**, which follow the motion of the machine, also permit the sharp turning of the machine about one or the other of the driving wheels **122** as directed by the operator of the machine.

Forward of the chassis **100** is suspended a vertically mounted platform **130** which may have a pair of supporting pivots **131** on opposite sides thereof, which pivots **131** are connected to a pair of levers **132** pivoted at **133** to the upper forward end of the side members **101** and **102**, respectively, of the chassis **100**. The opposite ends of these levers **132**, on the other side of the pivot **133** from the plate connecting pivots **131**, are connected to a second pair of levers **135**, which may be pivoted to the upper central portion of the side members **101** and **102** at **136**, and may be connected together at their rear ends by a cross-member **137** from the central portion of which extends a foot pedal **138**, so that downward pressure on the foot pedal **138** will cause downward movement of the platform **130** to increase the pressure on the floor of the scrubbing brushes in the scrubbing head which is mounted under the plate **130** as will be described later. The adjacent ends of the levers **132** and **135** are connected to a pivot and slot connection **134** for transferring their respective arcuate movements about the pivots **133** and **136**, respectively. In order to counter-balance the weight of the platform **130** and the head **200** attached thereto, there is provided a strong compression spring **139** (see FIG. 5 and also FIGS. 26 and 27) between the pedal **138** and the cross-member **125** at the rear of the chassis **100**.

### I.—*B. Motors*

Referring to FIGS. 4, 5 and 6 there is shown mounted on the motor supporting plate a main electric, preferably direct current, driving motor **150** having a driving shaft **151** projecting from at least one end thereof, to the end of which shaft **151** may be keyed a flexible shaft which may comprise a universal joint **152** attached to square telescoping shaft sections **153** at the opposite end of which is another universal joint **154** connected to shaft **155** extending from a worm gear reduction box **160** mounted on the platform **130**. The flexible shaft **153** and universal joints **152** and **154**, which joints may be jacketed in flexible boots, permit positive drive of the gear box **160** regardless of the vertical position of the platform **130** to which it is attached. Extending vertically from the bottom of the box **160** and through an aperture in the plate **130** is a releasable rotating brush driving connection comprising a bevelled edge rotating key or pin **161** (see FIGS. 4, 9, 10 and 12) concentrically of which is mounted a bayonet type ring **165** with notches **166** to which the scrubbing head **200** (described below) is removably at-

tached (see also FIGS. 7, 8, 9 and 10). Also mounted on the under side of the plate **130** is an arcuate member **167** with "V" notches **168** therein, concentric of the axis of the shaft **161** and the bayonet ring **165**, for the angular adjustment of the head **200** as will be described in Section II.—A. below.

Also mounted on the motor shaft **151** may be a pulley **170** which may be connected by means of a flexible belt **171** to a variable diameter spreadable plate pulley **172** driving a gear reduction device **173**. The speed is varied in this specific variable speed mechanism by changing the diameter of contact of the belt **171** with pulley **172** by axially moving the conical sides of the pulley **172** by varying the tension in the belt **171** through an idler pulley **174** (see FIG. 4) mounted on a lever arm **175**, which idler **174** may be manually controlled by a rotatable knob **176** extending through the side member **101** of the chassis to move the lever **175** through a screw or other type of mechanical arrangement in box **177** mounted on the inside of the member **101**.

Horizontally from the side of the speed reduction box **173** is shown herein a shaft **178** (see FIG. 6) upon which is mounted a clutch **180** which releases and engages sprocket gear **181** with the shaft **178** by operation of the clutch control lever **182** pivoted to supporting bracket **183** which may be connected to the supporting plate **184** connected between transverse chassis members **103** and **104**. The speed reduction device or box **173** also may be mounted on this plate **184**. The operation of the lever **182** may be connected by link **185**, lever **186**, rod **187** (see FIGS. 5 and 6) to the rear end of the chassis **100** for connection with a manual lever **480** on the control panel as will be described later in Section IV.—D. below. The control rod **187** has a lever **188** at its rearward end and may be journalled in bearings attached near the upper edge of the side member **101**.

Around the sprocket wheel **181** may be fed a sprocket chain **190** which drives sprocket wheel **191** attached to the differential **123** on the shafts **121** between said wheels **122**.

There also may be mounted on the plate **110** a suction or vacuum pump **195** which may be driven, either by the motor **150** or the separate motor **196** shown. If this pump or fan is mounted on this plate **110**, the suction intake **197** therefor may be connected by flexible duct **198** to the suction inlet **324** of the dirty liquid tank **320** as will be described later in Section III.—B.

## II. SCRUBBING HEAD

### *A. Angular adjustment and connection of scrubbing head*

Referring now to FIGS. 2, 3, and 7 through 16, there is shown attached to the under side of the platform **130**, a scrubbing head **200** which is both removable and angularly adjustable with respect to said platform **130** and the vehicle **100** or machine **50** of this invention. In FIGS. 9 and 10, and specifically FIG. 9, the angular adjustment of the head and its removal from the platform **130** is illustrated in the combination of connections mounted on the top of the supporting plate **201** of the elongated scrubbing head **200**. Near one end of this plate **201**, in this embodiment, is provided an aperture **202** (see FIGS. 10 and 12) into which may be clamped a roller bearing **203**, such as by means of bolts **204**. This bearing **203** journals a stub shaft **205** having a socket **206** in its upper end with diametrically opposite ridges **207**, between which the key or pin **161** of the driving mechanism **160** may easily be inserted, so that the shaft **205** is positively driven through the mechanisms previously described by the motor **150**.

Concentric with the aperture **202**, in the plate **201** is attached an anchoring ring **210** having three equally spaced outwardly projecting ears **211** which only axially fit into the notches **166** in the ring **165** attached to the bottom of the platform **130** when the whole scrubbing head assembly is in its directly forward position **201'** shown in dashed lines in FIG. 9. In this position the arcuate member **215**, which has overhanging flange **216** that engages above the flange on the arcuate member **167** mounted under the platform **130**, is beyond the end of and free from the arcuate member **167** so it may be easily vertically or axially dropped or removed from or attached to the platform **130** or machine **50**. Radially outwardly from the arcuate member **215** and sliding in a slot provided in member **215** is a radially movable detent **218** which is normally urged into the notches **168** by a spring **219** around its manually operating rod **220**. Thus by pulling outwardly on the rod **220** the detent **218** is removed from one of its notches **168**, so that the head **200** may be angularly moved around the arc **167** to fit in other detents **168** in other angular positions **201''** and **201'''** as shown in dashed lines in FIG. 9. Thus as the vehicle or machine **50** is moved longitudinally of the position **201'**, different and lesser width swaths or paths are scrubbed by the head **200** in each of the different angular positions, **201**, **201'''**, and **201''**, respectively.

The easy removal of the scrubbing head **200**, not only enables easy replacement of the floor treating means or brushes **260** described later, but also permits the machine to be pushed up steep ramps which could be prevented solely by the forward extending scrubbing head **200**.

### *II.—B. Floating rotating brush driving means*

Keyed to the lower part of the stub shaft **205**, which portion of the shaft may be of reduced diameter, is a plastic spur gear **225** which may be spaced from the bearing **203** by a washer **226** (see FIG. 12). Below the gear **225**, the shaft **205** may be threaded at **227** for attachment of a clamping disc **228** threaded thereon and fixed to the spur gear **225** by means of three equally spaced bolts **229**, which also may attach below the disc **228** a flexible annulus or ring **230**, which ring **230** in turn supports by three additionally equally spaced bolts **231**, a brush connecting means or disc **235**, having three lower outwardly projecting ears **236** (see FIG. 15) to which the removable brushes or floor treating means **260** are connected. The flexible ring **230** thus permits the floor treating means **260** to wobble as it is rotated so as to follow any irregularities in the contour of the floor, thus the ring **230** forms a universal type joint between the driving shaft **205** and the brush or rotating floor treating means **260**.

According to the embodiment of this invention illustrated herein, there are provided two of these floor treating means or rotating brushes **260** in the head **200** mounted under the plate **201**, the other one of which is mounted on a stub shaft **245** (see FIG. 8) extending through a second aperture **246** in plate **201**, and mounted in bearing **247** on the top of said plate. Through the support of this bearing **247** may be provided a transverse hole **248** for guiding the pull rod **220** of the detent **218**. Similarly as for stub shaft **205**, the stub shaft **245** has attached thereto a plastic spur gear **250** which is geared through two additional intermediate plastic idler gears **251** and **252** along a line connecting the axes of the two shafts **205** and **245**, mounted to rotate freely on correspondingly fixed stub shafts **253** and **254**, respectively, which may be screwed into the plate **201**. Since these gears **225**, **250**, **251** and **252** are all of the same size and are all of plastic, no lubrication for them is required and they are not affected by any solution or water which may be splashed on them during the scrubbing operation of the machine. Furthermore, since they do not require any lubrication, no oil leaks or spots will be dropped from them upon the floor. The lower end of the shaft **245** is similarly provided with a universal joint comprising a disc **228**, connecting means **235**, and an intermediate flexible ring **230**, as previously described for the shaft **205**, so that a similar rotating treating means or scrubbing brush **260** may be readily removably mounted

thereon. This second floor treating means or brush **260** is correspondingly positively driven by the driving mechanism from gear box **160** on top of the platform **130** through means of the plastic gears **225, 252, 251** and **250** in sequence, and also is driven in the opposite direction to the brush **260** mounted axially below the shaft **205.**

### II.—*C. Housing and trough*

Over the top of the head **200** and extending out around over the edges of the brushes **260** may be a reinforced fiber glass plastic cover or housing **255,** having a peripheral skirt **256** of flexible material surrounding the edges of the rotating treating means or brushes **260** to prevent splash therefrom. Provided in the top of the housing **255** is a trough **257** which extends arcuately partly around the axis of the shaft **205** and then longitudinally of the head **200** a little over half the length of its rear side so as to connect with a central downwardly extending drain or duct **258** shown in FIG. 8, from which two spouts **259** extend towards and over each of the brushes **260.** This trough **257** may be filled with a cleaning solution or liquid from a controlled outlet duct **319** from the clean tank **310** as will be described below in Section III.—B. By locating the outlet of this duct **310** sufficiently above the arc portion of the trough **257,** the head **200** may be raised and lowered with the platform **130** and rotated with respect thereto without requiring a flexible hose to connect with the head **200,** which would have to be disconnected each time the head **200** was removed. Furthermore since the duct **319** discharges into the arcuate portion of the trough **257,** it can continuously supply liquid to the duct **258** and nozzles **259** regardless of the angular position of the head **200.**

As shown in FIGS. 1, 2, 3 and 7 the outer foremost corner of the housing **255** of the scrubbing head may be provided with a bumper **290** as shown in FIG. 1 and/or a contact roller **291** as shown in FIGS. 2, 3 and 7. Thus when the extending brush head **200** is bumped too hard against a wall, the detent **218** will release from its notch **168** against the action of spring **219,** and permit the head **200** to move rearwardly underneath the forward end of the machine, so that a bumper **370** on or mounted on the front end thereof will absorb the shock of any collision and prevent damage to the head **200.**

### II.—*D. Removable brushes*

Referring now more specifically to FIGS. 12 through 16, each of the rotating floor treating means or brushes **260** is provided with a connecting plate member **265** shown in perspective in FIG. 16, which is annular in shape and has projecting below it three stops or lugs **266, 267** and **268.** Spaced 60° from each of these lugs are notches **269** through which the flanges **236** on the driving plate **235** axially fit for easy removing and attaching and/or replacing of the brushes **260.** When the brushes **260** are attached, they are rotated until its flanges **236** contact the lugs **266, 267** and **268,** respectively. One of the lugs **268** herein may be of slightly lesser width and have attached thereto a brush maintaining leaf spring **270,** such as by means of a screw **271** threaded into the lug **267,** which spring **270** may have bent ends **272** for snapping in and retaining the other side of the one flange **236** adjacent the lug **268.** Thus a positive rotating force is necessary in order to release the brush from its driving means **235,** and the spring **270** maintains it in connection with the driving means **235** for all normal operations of the machine and the brushes. Attached to the outwardly extending flange **275** of the connecting plate **265,** such as by means of screws **276,** may be the body portion **280** of the brush which holds the floor treating means, such as the brush bristles **281** shown in FIGS. 8 and 10.

Instead of the leaf spring **270** shown in FIGS. 12, 13 and 14, there may be provided an arcuate or ring type spring **290** as shown in FIG. 10 attached to the ends of the lugs **266, 267** and **268,** such as by means of screws **291,** which spring **290** has upwardly extending ridges **292** for maintaining the lugs **236** adjacent the lugs **266, 267** and **268** of the driving means **235.**

## III. TANK AND BATTERY ASSEMBLY

### *A. Frame*

Referring first to FIGS. 3 and 5 there is shown tank and battery assembly frame **300** comprising a bottom rectangular frame **301** which extends out beyond the rectangular top of the chassis **100** formed by the side members **101** and **102.** The frame **300** is provided with corner upright members **302** at its forward end, and upright members **303** at its rearward end which herein extend about twice as high as the forward members **302** and are connected to the top of the forward members **302** through two pairs of horizontal angles or slide rails **305.** Between the rectangular frame **301** and the rails **305** there is provided a longitudinal space into which the longer side of a pair of similar L-shaped tanks **310** and **320,** may be slid from the rear of the machine. These tanks **310** and **320** are preferably made of translucent reinforced plastic, such as high impact polystyrene. The rear ends of these tanks **310** and **320** are more clearly shown in FIGS. 17 and 18, respectively.

### III.—*B. Clean liquid tank*

The tank **310** is herein the clean liquid tank, which should be filled with liquid up into its upper L-shaped end **311** as shown by liquid level **312** in FIG. 17, so as to reduce sloshing of the liquid in the tank. The inlet for this tank **310** is provided in the top of this L-shaped portion **311,** such as by a funnel member **312,** which may have a screen or filter **313** in its bottom. This funnel member **312** fits up under the top outer housing portion **314** shown in FIG. 5 so that the tank **310** may be filled with liquid from the outside and top of the machine **50.**

In the rear side of the tank **310** at its bottom is provided an outwardly projecting neck portion **315** into which is located a plug **316** which may be removed for draining and/or cleaning the tank **310.** Into the end of this plug **316** is provided an outlet duct **317** which extends to valve **318** (see FIGS. 1 and 2) and thence to duct **319** to discharge into the trough **257** as shown in FIG. 8 of the head **200** for supplying liquid cleaning solution to the treating or brushing members **260** as described above in Section II.—C.

### III.—*C. Dirty liquid tank*

The other or dirty liquid tank **320,** of similar shape and construction to tank **310,** has on its upper L-shaped section **321** as shown in FIGS. 18 and 19, a removable cover **322** which may be fastened by thumb screws **323.** This cover **322** may contain an L-shaped suction inlet duct **324** connected to the flexible hose **198** to the suction pump **195.** However, the suction pump or fan and its separate motor may be mounted in this cover **322** instead and thereby eliminate the necessity of the hose **198,** without departing from the scope of this invention. Thus this tank is maintained under vacuum or reduced pressure so that it will suck up dirty liquid from the floor as it is collected by the squeegee **410** to be described later in Section IV.—B. To this squeegee **410** is connected a flexible suction duct **325** from a dirty fluid inlet connection **326,** located also in the upper section **321** of this tank **320** above the normal liquid level **327** therein. Depending from the cover **322** there may be provided a cylindrical filter screen **330** inside of which may be mounted a suction cut-off valve **331** controlled by a float **332** suspended from the valve by a rod **333** (see FIG. 18). Thus if the liquid in the dirty tank comes above a certain level so that it might be drawn into the pump **195,** the float **332** will be raised by the liquid level to close the valve **331** against the suction inlet **324** to prevent contamination of the pump **195** by the dirty liquid. This stops the drawing up of liquid from

the floor so the operator will know the dirty tank **320** is full and should be drained.

Similarly as for tank **310**, tank **320** has an outwardly projecting portion **335** from the rear of the tank near its bottom, into which may be provided a pull-out type plug or drain valve **336**, as shown in FIG. 18, for the ready draining of the dirty liquid from the tank **320** outside the rear of the machine **50** into any container, sump or sewer.

If the machine is to be used as a dry vacuum cleaning machine, the filter screen **330** around the liquid level cut-off valve **331** may be surrounded with a fabric or other vacuum type air filter sack or bag **340**, as shown in FIG. 18, and when the drain valve plug **336** is closed, dirt sucked in by the vacuum pump **195** will accumulate in the bottom of the tank **320** and around the outside of the filter screen **330**. When the tank **320** becomes full of dirt, it may be cleaned out by loosening of the thumb screw **323** to remove the filter sack **340** from the top of the tank, and the bottom of the tank may be cleaned out by completely removing the drain plug valve **336**.

### III.—*D. Batteries*

Referring back to FIGS. 3 and 5, there are shown located in the angle portion of the L-shaped tanks **310** and **320**, along and supported by the pairs of rails **305**, electric accumulators or batteries **350**, for which there is sufficient room for as many as six. These batteries supply power for the motors **150** and **196** and are connected through electrical switches mounted in the control panel **400** which will be described later in Section IV.—E.

### III.—*E. Housing and hood*

Over the top of the tank and battery assembly frame **300** there may be provided a smooth and decorative housing **360** as shown in FIGS. 1 and 2, the upper forward portion of which may be removable therefrom as a hood or cover **361**, which separates from the lower part of the housing along the line **362** shown in FIG. 1. The forward end of the hood **361** may be pivoted to the center rails **305** by a lever **365** as shown in FIGS. 3 and 5, and the center of the hood may be pivoted near the upper end of the rear frame portion **303**, such as to members **366**, by a pair of side levers **367**, in such a manner that when the hood **361** is raised it will be moved rearwardly over the upper rear portion of the assembly **300** to expose the top of all the batteries **350** for easy access, removal, replacement and/or servicing. If desired, the instructions for connecting of the batteries **350** may be provided on a flag (not shown) that is connected to the forward lever **365** and is easily visible when the hood **361** is in its raised position. The upper portion of the housing **360** may be provided with a removable plate **380** (see FIGS. 1 and 5) which contains the funnel shaped member **314** and which may also have a handle **381** for the removal of this plate for easy access to the thumb screws **323** for removal of the filter bag **340** in the dirty liquid tank **320**, without having to remove the rear panel and slide out the L-shaped tank **320** from the rear end of the machine **50**.

## IV. CONTROL PANEL

### *A. Guiding handles*

Referring first again to FIGS. 1, 3 and 5, there is shown attached to the rear upright frame members **303** at their upper end a control panel **400** and extending further rearwardly and outwardly therefrom a pair of operator steering and guiding handles **401** which may be rigidly attached to the frame members **303**.

### IV.—*B. Retractable and adjustable squeegee*

Referring now to FIGS. 1, 2, 3 and 20 through 25, there are shown details of the adjustable and retractable squeegee **410** which comprises a transverse member **411** (see FIGS. 20 and 21) having a rearwardly depending flange **412** extending at an obtuse angle from its apex **413** which is offset from the center of the machine. Above this apex **413** is provided the outlet for the suction nozzle **414** (see FIG. 23) having an elongated opening **415** which extends along most of the forward side of the flange **412**. The outlet **414** is connected by means of flexible duct **325** extending to the suction inlet of the dirty tank **320**. Depending from the rearward side of the flange **412** is a flexible squeegee or floor wiping strip **420**, such as of rubber, which is releasably or replaceably attached to said flange **412**, such as by means of rivets or screws **421**. At the shorter end of the member **411** from its obtuse angle apex **413**, may be provided an arcuate portion **425** having a pivot **426** at its center, and a radially spaced hole **427** through which is mounted a spring urged detent or pin **430** manually retractable by a handle into a series of holes **431** located in an arc equally radially spaced from the pivot **426** in a pivoted extension **435** of the squeegee **411**. This extension **435** has attached thereto a similar flexible strip or squeegee wiper **436** to that of the squeegee strip **420**. This extension **435** is adapted to be set by detent **430** into dash-lined position **435'** and **435''** as shown in FIG. 10 which correspond to the different width of the swaths provided by the angular adjustment of the scrubbing head **200** as shown in FIG. 9.

Centrally of the member **411** there may be provided a pair of parallel upstanding flanges **440** (see FIG. 21) between which may be provided a pivot pin **441** which is connected to a rocker plate **442** urged in a position parallel to the member **411** by a pair of springs **443** between the top of the member **411** and the ends of the plate **442**. Connected to the ends of this rocker plate **442** is a pair of vertical connecting rods **444** each of which may extend through a pair of apertured guiding flanges **445** mounted on a cover plate attached to the rear of the chassis **100**. The rocker plate **442** is maintained in equilibrium between the lower apertured flanges **445** by means of an additional pair of springs **446**. The upper ends of this pair of guide rods **444** may be connected to a cross-member **447**, to the center of which is connected a pull rod **448** to an operating lever **450** shown in FIG. 25 extending from the top of the control panel **400**, or, if desired, the pull rod **448** may be extended downwardly and connected directly to the rocker plate **442**, eliminating the necessity for the cross-member **447**.

The handle **450** is connected to a lever **451** which may be pivoted at either one of its ends, such as at **452**, to a bracket attached to the rear frame upright member **303**, and at its other end **449** to the pull rod **448**. This handle **450** herein is shown to have a locking sleeve **453** slidable there along which cooperates with a forked member **454**, also mounted on the frame member **303**. Thus when the handle **450** is pulled rearwardly so that the sleeve **453** may be raised as shown in the dashed lines in position **450'** in FIG. 25, the lever and handle **450** can then rock forwardly and be straddled by the fork **454** with the sleeve **453** resting on the top of the fork to maintain the squeegee **410** in its raised position spaced from the floor. On the other hand when the squeegee **420** is to be lowered, the handle **450** is placed in its full line position shown in FIG. 25, and it is maintained there by abutment of the ends of the fork **454** against the lower end of the sleeve **453**. The springs **446** and **443** at the lower end of the squeegee supporting means, through the pivot **441** connected to the squeegee mounting member **411**, permit the squeegee **410** to rock to compensate for any irregularities in the floor over which it and the machine travels.

### IV.—*C. Latch for brush pressure platform*

As previously described the rear foot lever or pedal **138**, acting against the spring **139** mounted on the plate **125** as described in Section I.—A. above, may be retained in any of ts pressure setting positions by means of the different teeth on the pivoted locking cam **460** shown in FIGS. 26 and 27. This cam **460** may be fixedly pivoted at **461** to the rear cross-member **105** of the chassis **100** and operated through pivoted connection **462** in the slot

463 provided in arm 464 connected to the end of rod 465 which extends to lever 466 of the manual lever 470 on the control panel 400. This lever 466 may be pivoted at either one of its ends, such as at 467, to a bracket on the member 303 and, at its other end 468 to rod 465. Thus as foot pressure is applied to the pedal or foot lever 138, it may be locked in position by the adjustment of the handle 470 into one of the dotted line positions 470', 470'' and 470''' as shown in FIG. 26, thus maintaining different vertical distances of the head 200 from the front end of the machine to apply different pressures of the floor treating equipment to the floor over which the machine travels.

IV.—*D. Clutch and liquid flow levers*

Another manual lever 475 on the control panel 400 (see FIGS. 1, 2 and 5) may be pivoted to a lever 476 mounted to the frame member 303, and connected by means of a push and pull rod 477 to operate the valve 318 which controls the amount of liquid that can flow from the clean tank onto the brushes through the ducts 317 and 319, trough 257, duct 258, and nozzles 259.

Still another manual lever 480 is located on the control panel 400 which also may be connected through a pivoted lever 481 to pull rod 484 which connects to lever 188 for operating the clutch 180. This control extends through shaft 187, lever 186, rod 185, and lever 182 to engage and disengage the drive for the wheels 122 for the movement of the machine 50 over the floor.

IV.—*E. The switches*

As shown in FIG. 1, the control panel 400 is also provided with one or more electrical switches 490, 491 and 492, which may be employed, respectively, for turning on the motors 150, 196 and re-setting the circuit breaker for the electric power from the batteries 350.

The control panel also may, if desired, contain a battery generator indicator dial 495, as well as a plate 496 which contains instructions as to the operation of the device and sequence in which to operate the manual levers and switches; all in plain and easy view of the operator of the vehicle who guides the machine 50 by holding onto the guiding handles 401 adjacent to the control panel 400.

While there is described above the principles of this invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of this invention.

What is claimed is:

1. A floor treatment machine comprising:
(1) a wheeled vehicle,
(2) an angularly adjustable elongated floor treating head mounted on said vehicle,
(3) at least two rotating floor treating means mounted along said head,
(4) means on said vehicle for driving said rotating treating means, and
(5) a pivotal connection between said head and said vehicle comprising:
(a) key and socket means for connecting said driving means to said rotating and treating means, and
(b) arcuate means coaxial with and around said key and socket means for angularly adjusting and supporting said head relative to the path of movement of said vehicle for varying the width of the swath made by said treating head as said vehicle is moved along a path.

2. A machine according to claim 1 wherein said wheeled vehicle comprises a pair of wheels relatively centrally located of said vehicle, whereby turns of relatively short radius of said vehicle can be made.

3. A machine according to claim 1 wherein said head is mounted beneath one end of said vehicle and is angularly projectable beyond the borders of said vehicle.

4. A machine according to claim 1 wherein said vehicle includes a platform mounted forwardly of said wheels, and means for adjusting said platform vertically with respect to said vehicle.

5. A machine according to claim 1 wherein said floor treating means includes means for flexibly mounting said rotating treating means whereby they follow the irregularities of the floor.

6. A machine according to claim 1 wherein said floor treating means include means for separately removing them from said head.

7. A machine according to claim 1 including plastic gears for driving said rotating treating means.

8. A machine according to claim 1 wherein said means for rotating said treating means includes electric batteries and an electric motor driven thereby.

9. A machine according to claim 8 wherein said motor means is mounted on a plate pivotally mounted to said vehicle.

10. A floor treating machine according to claim 1 wherein said vehicle includes a vertically movable platform attached thereto for mounting said head, and wherein said means for rotating said scrubbers includes a flexible shaft connection to said platform.

11. A machine according to claim 10 wherein said flexible connection includes a telescopic shaft.

12. A machine according to claim 1 including means on said vehicle connected to said head for adjusting the pressure of said head on said floor.

13. A machine according to claim 12 including locking means on said vehicle for locking said head in its adjusted position relative to said vehicle and said floor.

14. A machine according to claim 1 wherein said vehicle includes
(a) a platform pivotally connected thereto,
(b) means on said vehicle for adjusting said platform vertically with respect to said floor and said vehicle,
(c) resilient means for applying downward pressure on said platform connected to said adjustment means,
(d) means associated with said arcuate means for removably attaching said head to said platform, said pivotal connection for angularly adjusting said head being between said platform and said head.

15. A machine according to claim 1 wherein said wheeled vehicle comprises a vehicle driving wheel, and wherein said driving means for rotating said treating means includes means for driving said driving wheel.

16. A machine according to claim 15 wherein said driving means comprises a motor means and a clutch means between said driving wheel and said motor means.

17. A machine according to claim 16 wherein said driving means includes means for reducing the speed of said motor means.

18. A machine according to claim 1 wherein said pivotal connection includes spring pressed detent means for angularly adjusting said head from said vehicle.

19. A machine according to claim 1 wherein said socket in said pivotal connection has two inwardly tapered ridges and said key is bevelled and is engageable with said ridges.

20. A machine according to claim 1 including an adjustable width floor squeegee mounted on said vehicle.

21. A machine according to claim 20 wherein said vehicle includes means for retracting said squeegee vertically relative to the floor.

22. A machine according to claim 1 including means for applying liquid to said treating means regardless of the angular position of said head.

23. A machine according to claim 22 wherein said liquid applying means comprises a trough in said head extending along said head and arcuate of said pivotal connection thereof.

24. A machine according to claim 1 including tank means mounted on said vehicle for supplying liquid to said treating means.

25. A machine according to claim 24 wherein said tank means are made of translucent material.

26. A machine according to claim 24 wherein said tank means comprises a pair of L-shaped tanks having openings at the tops thereof for introducing liquid thereinto, and at their bottoms for draining liquid therefrom.

27. A machine according to claim 26 including a suction means, means for attaching said suction means to one of said two tanks and a float valve in said one tank adjacent said suction connection thereto.

28. A machine according to claim 24 including a squeegee mounted on said vehicle, and wherein said suction tank includes an intake duct extending to the forward side of said squeegee.

29. A machine according to claim 24 including means for varying the flow of liquid from said tank means.

30. A machine according to claim 1 wherein said arcuate means includes means for separating said head from said vehicle.

31. A floor treating machine comprising:

(1) a power unit comprising
  (a) a base frame,
  (b) two supporting wheels mounted between the ends of said frame,
  (c) a driving means,
  (d) a platform connected to said unit movable vertically relative to said unit, and
  (e) a flexible driving connection between said driving means and said platform;

(2) a removable floor treating head comprising:
  (a) at least two rotating floor treating means,
  (b) an arcuate means pivotally connecting said head to said platform for angularly adjusting and supporting said head relative to said platform, and
  (c) a separable socket means axial of said arcuate means for connecting said driving means to said treating means;

(3) an upper frame mounted on said unit comprising:
  (a) electric power source for said driving means, and
  (b) a hinged cover for said power source; and

(4) a control assembly connected on said upper frame comprising:



  (a) levers and switches for controlling said driving means, and the position of said platform relative to said unit, and
  (b) handles for guiding said machine.

32. A machine according to claim 31 wherein said power unit includes variable speed control means connected between said driving means and said flexible driven connection to said platform.

33. A machine according to claim 31 wherein said power unit includes a vacuum pump and power means for driving said pump.

34. A machine according to claim 31 wherein said arcuate means includes spring actuated detent means for adjusting the angularity of said head with respect to said platform.

35. A machine according to claim 31 including a squeegee means attached to said machine.

36. A machine according to claim 35 including lever means on said control panel for retracting said squeegee means.

37. A machine according to claim 31 wherein said upper frame includes a pair of L-shaped tanks, and said power source comprise batteries located in the angle of said tanks.

38. A machine according to claim 37 including a suction means attached to one of said tanks, a squeegee means mounted on said frame following said treating means, and means for connecting said one tank to the forward side of said squeegee means.

39. A machine according to claim 38 wherein said control panel includes means for varying the flow of liquid from the other of said tanks to said floor treating head.


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