March 15, 1932. W. S. FINNELL 1,849,663

VACUUM FLOOR MOPPER

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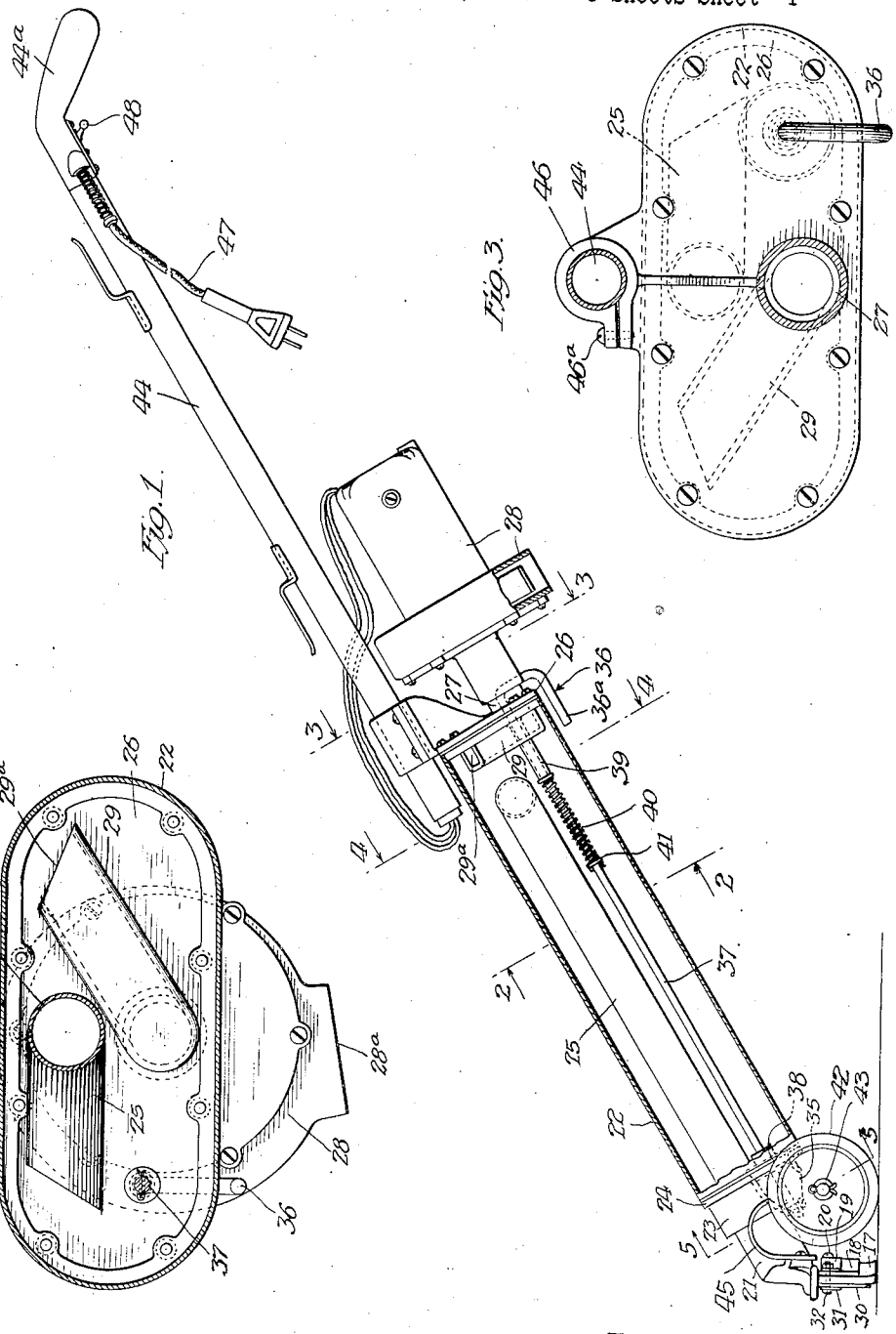

Fig. 1.

Fig. 3.

Fig. 2.

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Fig. 4.

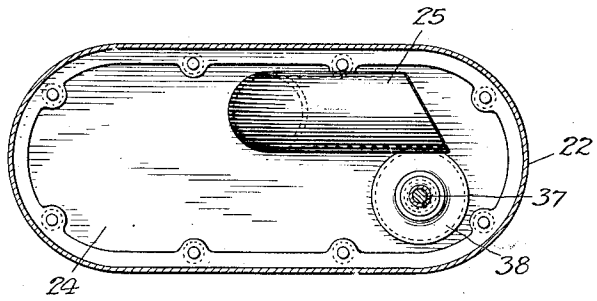

Fig. 5.

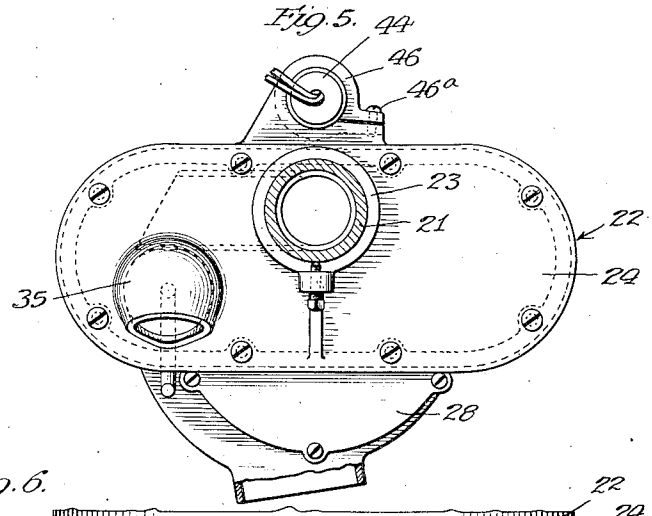

Fig. 6.

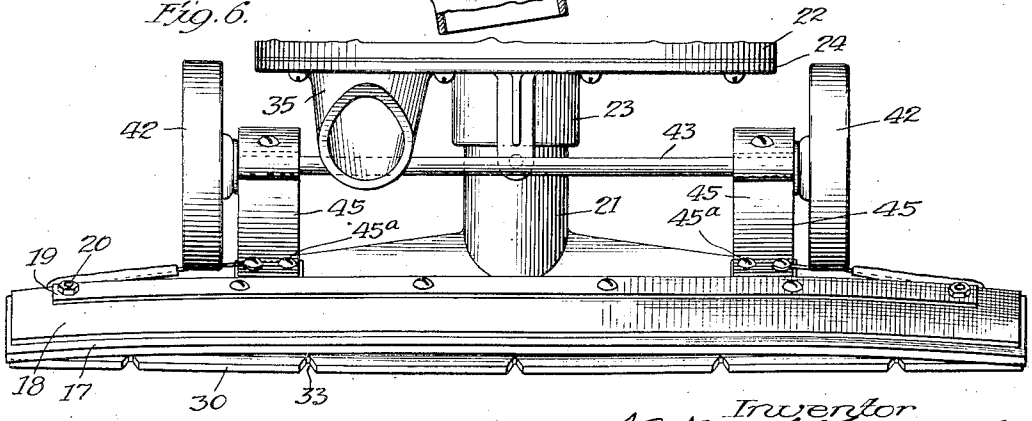

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Fig. 7.

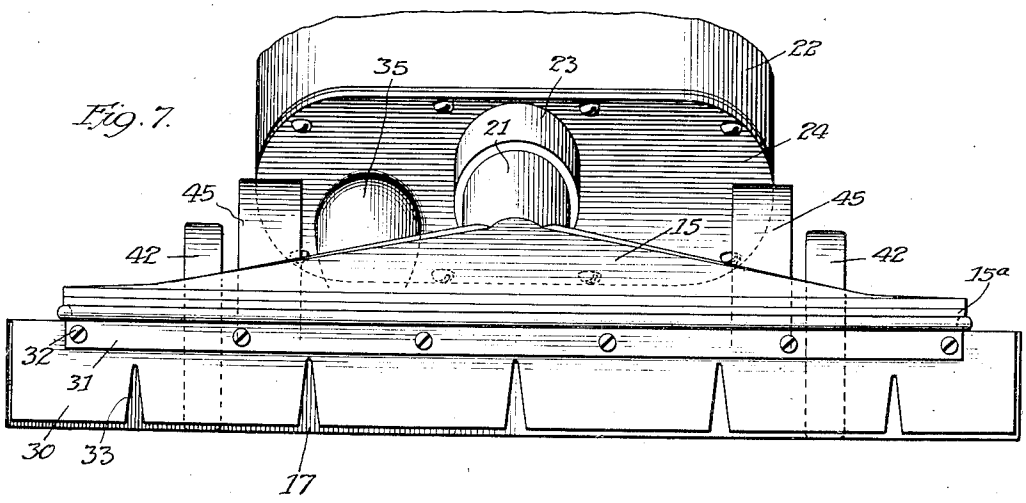


Fig. 8.

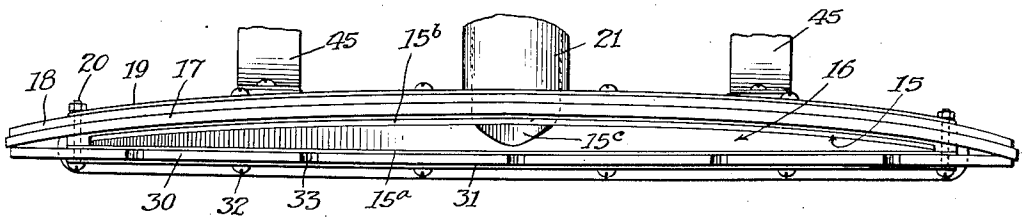


Fig. 9.

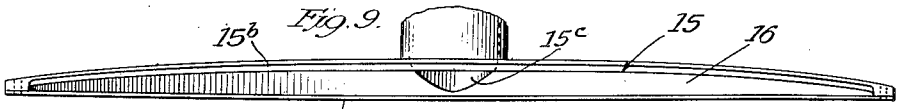
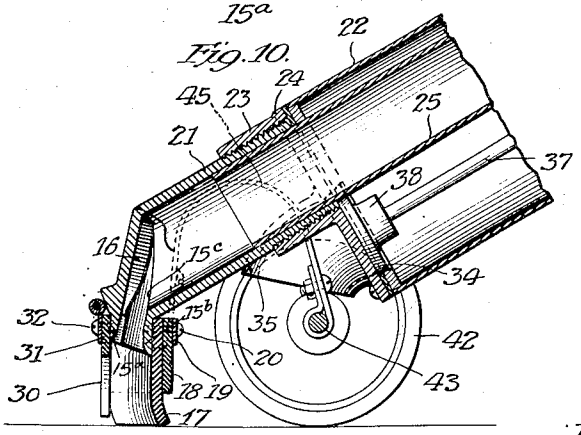


Fig. 10.



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UNITED STATES PATENT OFFICE

WALTER S. FINNELL, OF ELKHART, INDIANA

VACUUM FLOOR MOPPER

Application filed December 26, 1928. Serial No. 328,368.

My invention relates generally to floor mopping apparatus and has to do especially with a vacuum apparatus which is adapted for propulsion over the floor to collect and remove soil (dirt, water, etc.) therefrom.

One of the objects of my invention is to provide an improved, compact and light weight machine of the foregoing character which is simple, inexpensive, efficient and easily handled and which is well suited for use in the mopping of the floors of office, public buildings, manufacturing plants as well as for use in the home where relatively small floor spaces are to be cleaned.

Another object is to provide a vacuum mopper which may be moved quickly about the floor and beneath objects thereon, such mopper including a squeegee for collecting the soil upon the floor and a relatively large vacuum chamber in communication with the squeegee for effecting and insuring a uniform suction at the squeegee for removing the collected soil from the floor, the vacuum chamber also serving as a receptacle for the dirt, water, etc. removed from the floor.

A further object is to provide an improved form of squeegee which is adapted to more easily and positively direct and assist in delivering the soil (dirt, water, etc.) toward the receiving receptacle.

Still another object is to provide means for controlling the effectiveness of the vacuum at the squeegee mouth so as to insure a proper and uniform flow of the soil from the floor and squeegee into the soil receptacle.

A further object is to provide an improved wheeled support for said chamber and squeegee for propelling the same along the floor as a unit, such support including yieldable means which automatically positions the squeegee relative to the floor surface to prevent "grabbing" or "digging in" of the same as the apparatus is moved along the floor in different angular positions. This arrangement gives the apparatus a balance and insures the proper tension on the rubber squeegee so that the operator may mop the floor by moving the apparatus back and forth with one hand without changing the mopping effectiveness of the device due to the back and forth, arcuate-path swinging movement of the operator's arm.

Additional objects are to provide means for preventing the vacuum-producing means from abnormally affecting the flow of the dirt, water, etc. into the vacuum chamber and for preventing the discharge of the dirt, water, etc. from such chamber to atmosphere by such vacuum-producing means; and to provide convenient, improved means for draining the vacuum chamber without disassembly of any of the parts of the machine.

Other objects and advantages will become apparent as this description progresses and by reference to the drawings wherein,—

Figure 1 is a side view, partially in section, of one form of apparatus embodying my invention, and showing the same in one position which it may assume during the mopping of the floor;

Fig. 2 is a transverse section taken substantially on line 2—2 of Fig. 1;

Fig. 3 is a transverse section taken substantially on line 3—3 of Fig. 1;

Fig. 4 is a transverse section taken substantially on line 4—4 of Fig. 1;

Fig. 5 is a transverse section taken substantially on line 5—5 of Fig. 1;

Fig. 6 is an enlarged rear elevational view of the lower rear portion of the structure shown in Fig. 1;

Fig. 7 is an elevational view of the opposite side of the structure shown in Fig. 6;

Fig. 8 is a bottom plan view of the squeegee structure shown in Figs. 6 and 7;

Fig. 9 is a separated, bottom plan view of the squeegee nozzle; and

Fig. 10 is an enlarged vertical section taken through the lower part of the structure shown in Fig. 1.

With particular reference to the form shown in the drawings, the apparatus includes generally a squeegee unit, a combined vacuum chamber and soil receptacle, and an exhauster, all of which are yieldingly mounted upon a wheeled support for propulsion over the floor.

The sequeegee unit includes a nozzle 15 (Figs. 7 and 9), the front wall 15^a of which is practically straight and its back wall 15^b

is uniformly bowed from end to end to provide a flared nozzle mouth 16. The nozzle back wall 15^b supports a squeegee 17 which is backed and supported by a flexible strip 18 and metal strip 19 held in place by a plurality of screw bolts 20 which engage threaded openings in the nozzle wall. The nozzle walls 15^a and 15^b are so shaped and spaced that the nozzle chamber is slightly wider at the bottom, and its inner top wall surface tapers inwardly and upwardly from the opposite ends toward the nozzle outlet 15^c in the nozzle back wall 15^b. The nozzle outlet is in direct communication with the hollow nipple 21 to which the receptacle 22 is connected. The shape of the nozzle aids in the collection and removal of the dirt, water, etc., from the floor.

The receptacle 22 not only receives the soil removed from the floor, but also serves as a vacuum chamber for insuring a uniform suction at the squeegee nozzle. Specifically, this receptacle is connected to the squeegee nipple 21 by means of a threaded boss 23 in its lower removable head 24 (Figs. 1 and 10). The interior of the receptacle is connected to the squeegee nozzle by a conduit 25, the lower end of which is mounted in the nipple 21. Its upper or inner end extends toward and near the upper end of the receptacle and is turned over toward one side wall of the receptacle (Figs. 1, 2 and 4). A removable head 26 is mounted upon the upper end of the receptacle and this head has a hollow boss 27 which supports an exhauster which, in this instance, takes the form of an electrically operated exhaust fan 28. This exhaust fan is in communication with the interior of the receptacle through the head boss 27 and a conduit 29 carried by the upper head. This conduit may take the form of a cored passage, or otherwise, and its inlet 29^a (Figs. 1, 2 and 3) is at the side of the receptacle opposite the outlet of conduit 25. By this arrangement, with the exhaust device 28 in operation, water, dirt, etc. will not be drawn into the exhaust conduit 29, and the material passing through the conduit 25 into the receptacle will not be disturbed materially by the exhausting means. The water, dirt and air discharged from the inlet soil pipe 25 will be separated, the water and dirt falling toward the bottom of the receptacle while the air is exhausted through the passage 29 and fan exhaust 28^a.

It will be appreciated that as the fan 28 is operated to exhaust the air from the receptacle 22, a partial vacuum is produced in the latter, which provides, through the conduit 25, an effective suction at the mouth 16 of the squeegee nozzle. Due to the comparatively large-volume receptacle the suction effect at the nozzle is substantially uniform which avoids floor-streaking and uneven mopping action. To insure an effective lift suction at the nozzle and a positive flow of the collected floor soil into the receptacle 22, I control the flow of air to the squeegee nozzle by restricting the same within certain limits, and to that end I provide the following: A flexible flap 30 formed preferably of rubber is mounted upon the lower edge of the nozzle front wall 15^a by means of metal strip 31 and screw bolts 32. This flap is of lesser width than the squeegee 17 so that it will not not engage the floor surface in the operative position of the apparatus (Figs. 1 and 10), but it may be sufficiently wide to contact with or nearly contact with the upper surface of the film of dirt and water which may be on the floor so that, with the mopping apparatus in certain positions, its lower edge forms a seal with the material being mopped. Such a nozzle-sealed condition, with no air inlet to the nozzle, unless taken care of, would tend to affect the nozzle suction action in such a way that the water and dirt would not be uniformly lifted and sucked into the receptacle. To take care of this condition, the front flap 30 is provided with a plurality of air inlets 33 (Fig. 7) which extend, preferably (but not necessarily) from the bottom of the flap to the top thereof and which are open at all times to permit a predetermined amount of air to be sucked into the squeegee nozzle to satisfy the suction and material flow requirements. While I have shown these openings as V-shaped, it will be understood that their shape may be varied as desired and their number and size may also be varied as the conditions require, without departing from my invention, but they should always be such that, with or without the front flap 30 sealed against the material on the floor, the total air inlet to the nozzle will fall within a range which will not destroy the effectiveness of the suction lift.

The receptacle 22 is provided with a drain which insures easy and quick draining of the same. Specifically, the bottom head 24 is provided with an opening 34 (Fig. 10) providing a valve seat and this head has an exterior, hollow, curved drain nozzle 35 which is in communication with the opening 34, such nozzle being shaped to discharge a substantially vertical stream when the apparatus is in a tilted position such as shown in Fig. 1. The drain is controlled by a manually operated unit which includes a handle 36 (Fig. 1) having a rod extension 37 which carries a valve 38 at its inner or lower end. This rod extension is slidingly supported and guided in the receptacle by a sleeve 39 carried by the upper head 26, and it is yieldingly held down to seat the valve in the opening 34 by a spring 40 confined between the lower end of the guide sleeve 39 and a stop 41 on the extension 37. Obviously, upward movement of the handle 36 will unseat the valve 38 to drain the receptacle through the drain nozzle 35. When the handle is released, the valve will

be closed by the action of the spring 40. If desired, the valve 38 may be held open by raising the handle 36 and rotating the same until its shank 36ª rests upon the top of the receptacle head 26.

The wheeled support for the apparatus takes the form of a pair of wheels 42 mounted upon an axle 43 to the rear of the squeegee. It will be appreciated, that, if this support were rigidly connected to the remainder of the structure, the squeegee would tend to "dig in" or "grab" as the machine is moved along the floor and as the receptacle is tilted upwardly from the position of say Fig. 1. This is particularly true where rough spots in the floor are encountered and where the operator moves the machine back and forth with his one hand grasping the handle 44, during which movement the handle 44 is raised and lowered somewhat. To provide against the foregoing "grabbing" and the like, conditions (which would result in floor-streaking and uneven mopping) the receptacle and squeegee unit is mounted upon the wheels 42 by yielding means which is likewise located to the rear of the squeegee. More particularly, I provide a pair of U-shaped spring straps 45 each of which has one end fastened to the rear of the squeegee nozzle by screws 45ª (Fig. 6) and the other end looped around the wheel axle 43 with the U-bow projecting upwardly. With this form of support, there is a relative yielding action between the wheels and the squeegee unit when the latter tends to grab and resists forward movement of the same, and this yielding action is effective to release the squeegee 17 and maintain substantially a predetermined relationship between the squeegee and floor regardless of the varying tilting position of the receptacle 22 and handle 44. It has been found by practical demonstration that the two wheels mounted in this manner give the machine, as a whole, a balance and the yielding spring connectors to the rear of the squeegee provide that certain desired tension on the rubber squeegee which is necessary for accurate and complete mopping. It has also been found that, in this form of apparatus, such advantages are not gained if the yieldable supports are mounted forwardly of the squeegee.

The handle 44 is mounted for slip adjustment upon the receptacle 27 by the clamp 46. By loosening the clamp screw 46ª, the handle may be adjusted longitudinally of the receptacle 22 to better accommodate the apparatus to persons of different heights, and to further insure proper seating of the squeegee 17 upon the floor.

In operation, the electric cord 47 is connected to any suitable electric source and the operation of the motor-driven fan 28 is controlled by a switch 48 on the handle 44 and located convenient to the handgrip 44ª. The structure is propelled along the floor on its two wheels with the receptacle tilted upwardly to the desired extent. This mopping structure is well adapted to follow a scrubbing machine along the floor to complete the floor cleaning operation, but not necessarily so, because the floor may first be scrubbed by hand or otherwise. As the machine is moved along, the squeegee collects the soil and its bowed shape causes the soil to collect and build up at the center beneath the nozzle outlet opening 20. The suction at the squeegee nozzle setting up air friction drag conditions at the squeegee and nozzle by the air flowing into the squeegee and nozzle, coupled with the shape of such nozzle, as above described, causes the inflowing air and the collected water and dirt to rise in the squeegee nozzle and pass through the outlet 15ᶜ, nipple 21 and conduit 25 into the receptacle 22. The converging of the walls of the nozzle chamber 16 toward the nozzle outlet 15ᶜ sets up an increased velccity condition at the outlet 15ᶜ which, coupled with proximity of the bottom of such outlet to the floor surface, insures a positive uniform drag and flow movement of the material into the receptacle 22.

It is to be understood that while I have shown only one form of my invention, various changes in details and arrangement of parts may be made without departing from the spirit and scope of my invention as defined in the claims which follow.

I claim:

1. A mopping machine which comprises a unit consisting of a receptacle, a handle connected to one end of said receptacle, a nozzle connected to the other end of said receptacle, and a flexible floor-contacting squeegee member carried by said nozzle; and supporting means for said unit consisting of a pair of wheels connected by an axle, and a pair of U-shaped spring members each of which is disposed in inverted condition with one end fixedly connected to said nozzle and its other end pivotally secured to said axle adjacent one of said wheels, the downwardly-depending U-legs of each spring member being adapted to flex toward and from each other for relative adjustment of said wheels and said unit with respect to each other and the floor surface to maintain said squeegee member in substantially uniform contact with the floor surface notwithstanding rocking motion permitted by said supporting means, as said unit is propelled along.

2. In a mopping apparatus, a soil-receiving receptacle, and a squeegee unit rigidly mounted on the lower end of said receptacle, a handle on the other end of said receptacle, said squeegee unit, receptacle and handle being positively movable as a unit as said handle is moved, said squeegee unit comprising a nozzle connected directly to said receptacle and having an outlet leading directly into

said receptacle and a chamber the walls of which converge toward said outlet, said nozzle also having a flared mouth, a squeegee mounted on said nozzle to the rear of said mouth, and a pair of inverted U-shaped spring members directly connected to said nozzle adjustably supporting said nozzle and squeegee to insure proper floor-engagement of the squeegee with the floor as said handle, receptacle and squeegee unit are moved along the floor.

3. In a floor mopping apparatus, a receptacle, an air exhauster connected to said receptacle, for producing and maintaining a partial vacuum therein, and a squeegee unit also connected to said receptacle, said unit including a nozzle having an inlet and an outlet in direct communication with the interior of said receptacle for producing a suction through said nozzle, a squeegee associated with the inlet of said nozzle to the rear thereof, and means at the inlet to said nozzle and forwardly thereof; independent of said exhauster for regulating the flow action of liquid soil from the floor surface into said receptacle.

4. In a floor mopping apparatus, a receptacle, an air exhauster supported by said receptacle, for producing and maintaining a partial vacuum therein, and a squeegee unit also supported by said receptacle, said unit including a nozzle having an oblong mouth wider at its center than at its sides and an outlet, a conduit leading from said outlet directly into the interior of said receptacle, a squeegee mounted on said nozzle to the rear of said mouth for collecting the soil on the floor and directing the same toward the center of said mouth and outlet, and soil flow control means in front of said mouth.

5. In a floor mopping apparatus, a receptacle, an air exhauster connected to said receptacle, for producing and maintaining a partial vacuum therein and a squeegee unit also connected to said receptacle, said unit including a nozzle having an oblong mouth and an outlet, a conduit leading from said outlet to the interior of said receptacle, a squeegee mounted on said nozzle to the rear of said mouth for collecting the soil on the floor and directing the same toward the center of said mouth and outlet, and a flap mounted on said nozzle in front of said mouth and of lesser width than said squeegee, said flap having a plurality of openings therein for the admission of air to said nozzle.

6. In a floor mopping apparatus, a receptacle, an air exhauster connected to said receptacle, for producing and maintaining a partial vacuum therein, and a squeegee unit also connected to said receptacle, said unit comprising a hollow member having its interior of inverted V-shape with the walls converging to an outlet opening and having an inlet mouth, means for connecting said outlet to the interior of said receptacle, a squeegee mounted to the rear of said mouth and adapted to engage the floor to collect the soil and direct it into said mouth and toward said outlet, and a flexible flap mounted in front of said mouth and of such width as to not normally engage the floor, said flap having a plurality of openings therein for the flow of air therethrough as a suction is set up in said nozzle.

7. In a floor mopping apparatus, a receptacle, an air exhauster connected to said receptacle, for producing and maintaining a partial vacuum therein and a squeegee unit also connected to said receptacle, said unit comprising a hollow open bottom member having spaced front and back walls with a top wall converging from the opposite ends toward an opening in the upper part of said back wall, means for connecting said opening to the interior of said receptacle, a squeegee mounted on said back wall, a flexible flap mounted on and extending along said front wall from end to end and extending toward, but not to, the floor, said flap having a plurality of air admission openings.

8. In a mopping apparatus, a soil-receiving receptacle, an exhauster, a squeegee, a connection between said squeegee and receptacle which includes a conduit leading from said squeegee to the interior of said receptacle at one end, said conduit having its inner receptacle end turned over and directed toward one side of the receptacle, and a connection between said exhauster and receptacle which includes an exhaust passage in communication with said receptacle at the side opposite the said inner end of said conduit.

9. In a mopping machine, a receptacle, a squeegee mounted at one end of said receptacle, an exhauster, a conduit connecting said squeegee with the interior of said receptacle, the inlet to said conduit being at said squeegee and its outlet being at the end of the receptacle opposite said squeegee, its outlet end being turned over to discharge at one side of the receptacle, and means for connecting said exhauster, and the interior of said receptacle which includes a passage leading from the interior of said receptacle at the side opposite said conduit outlet.

10. In a mopping apparatus, a receptacle, a nozzle at one end of said receptacle, a squeegee supported by said nozzle, an exhauster at the other end of said receptacle, a conduit leading from said nozzle to the interior of said receptacle at the end adjacent said exhauster, the inner end of said conduit being turned over horizontally to discharge at one side of the receptacle, and means for connecting said exhauster to the interior of said receptacle including a laterally directed conduit in the exhauster end of said receptacle and having its inlet at the side of said re-

ceptacle opposite said conduit inner discharge end.

11. In a mopping machine, an elongated soil-receiving receptacle, means for producing a partial vacuum in said receptacle, a squeegee mounted on the lower end of said receptacle and adapted to engage the floor surface, a wheeled support upon which the lower end of said receptacle is pivotally mounted for rocking movement thereof relative to the floor, said squeegee by such rocking movement of the receptacle being normally variably engageable with the floor surface, a handle mounted on the upper end of said receptacle opposite said squeegee and extending longitudinally away from said receptacle for propelling the receptacle along upon its wheeled support, a connection between said receptacle and handle permitting of longitudinal adjustment of the latter relative to said receptacle, and inverted U-shaped springs having their opposite ends secured to said wheeled support and said receptacle-and-squeegee unit respectively comprising said pivotal connection between said receptacle and said wheeled support.

12. In floor mopping apparatus, a receptacle, means creating and maintaining a partial vacuum in said receptacle, a nozzle member connected to and communicating with said receptacle, whereby a partial vacuum is produced in said nozzle, said nozzle having an inlet located adjacent the floor surface, a squeegee supported at the rear of and associated with the inlet to said nozzle, and means located forwardly of said nozzle and associated with the inlet thereof, and independent of said vacuum-creating means, for aiding in the regulation of the flow of liquid soil from the floor surface through the nozzle inlet into said receptacle.

In testimony whereof, I have subscribed my name.

WALTER S. FINNELL.