United States Patent

Ashton

[15] **3,639,936**

[45] **Feb. 8, 1972**

[54] SELF-PROPELLED FLOOR SCRUBBER

[72] Inventor: **Walter G. Ashton**, Winnetka, Ill.

[73] Assignee: **Star Industries, Inc.**, Chicago, Ill.

[22] Filed: **June 8, 1970**

[21] Appl. No.: **44,168**

[52] **U.S. Cl.** **15/4**

[51] **Int. Cl.** **A47l 11/29**

[58] **Field of Search** ..... 15/4, 49 R, 50, 87, 340, 320, 15/319

[56] **References Cited**

UNITED STATES PATENTS

3,376,597 4/1968 Boyd 15/320

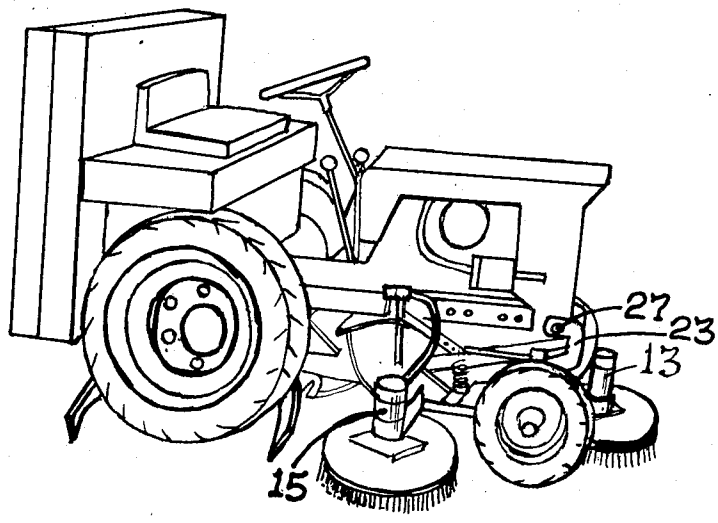
Primary Examiner—Leon G. Machlin

Attorney—Edward C. Threedy

[57] **ABSTRACT**

A hydraulic motor-propelled occupant-driven floor scrubber having a subframe supporting structure for rotating brushes and squeegee assemblies that are each independently hydraulically movable into and out of operating floor-engaging position, with each of the subframe structures having floating shock-absorbing arrangements.

8 Claims, 6 Drawing Figures



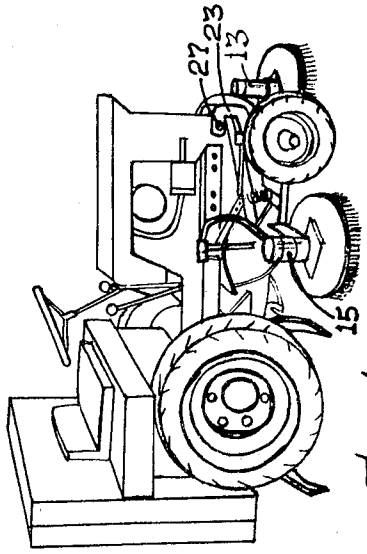


Fig. 1.

Fig. 2.

Fig. 5.

INVENTOR
WALTER G. ASHTON
BY Edward C. Threedy
HIS ATTORNEY.

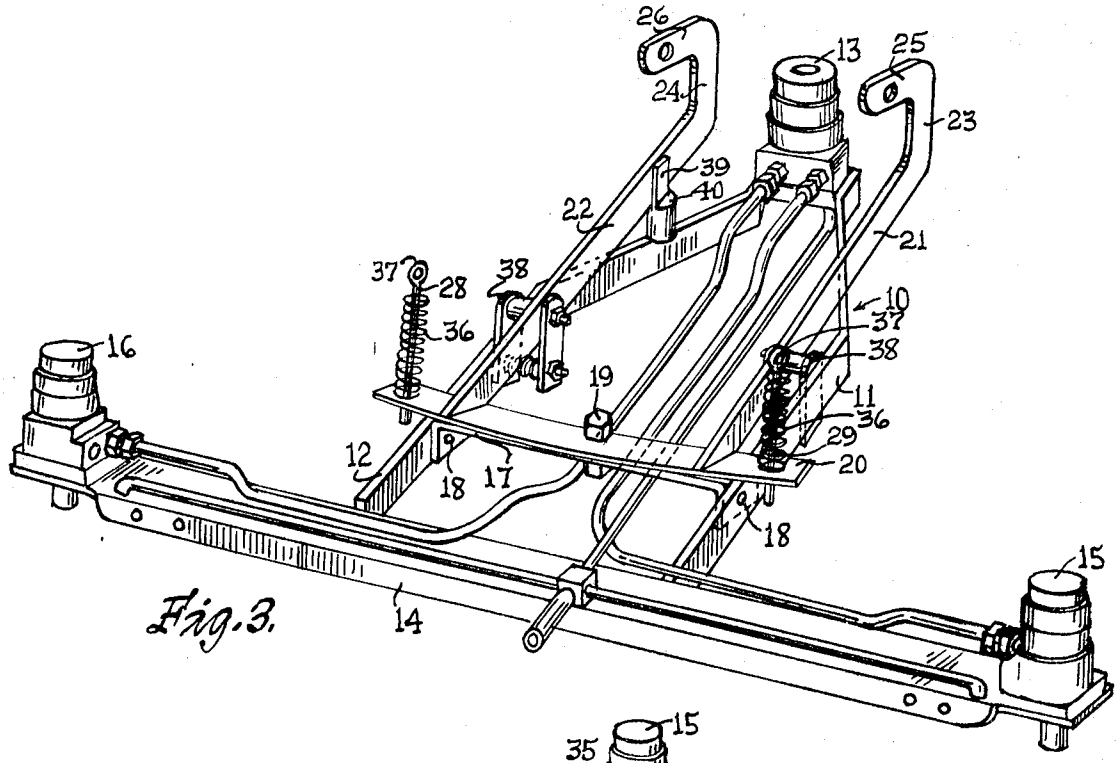


Fig. 3.

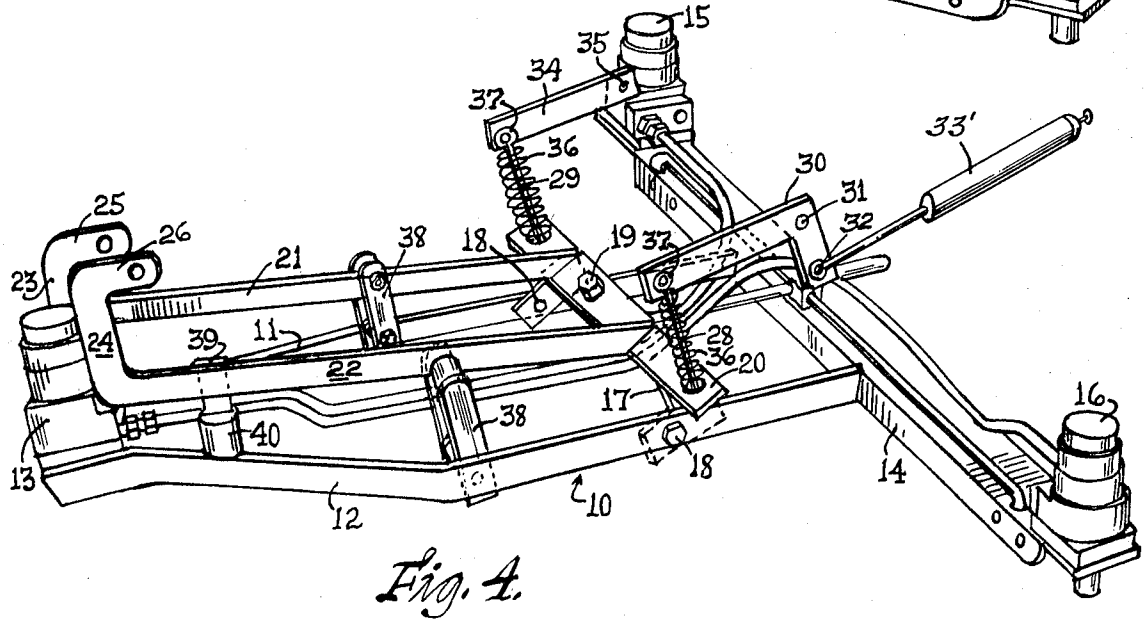


Fig. 4.

INVENTOR
WALTER G. ASHTON
BY Edward C. Threedy
HIS ATTORNEY.

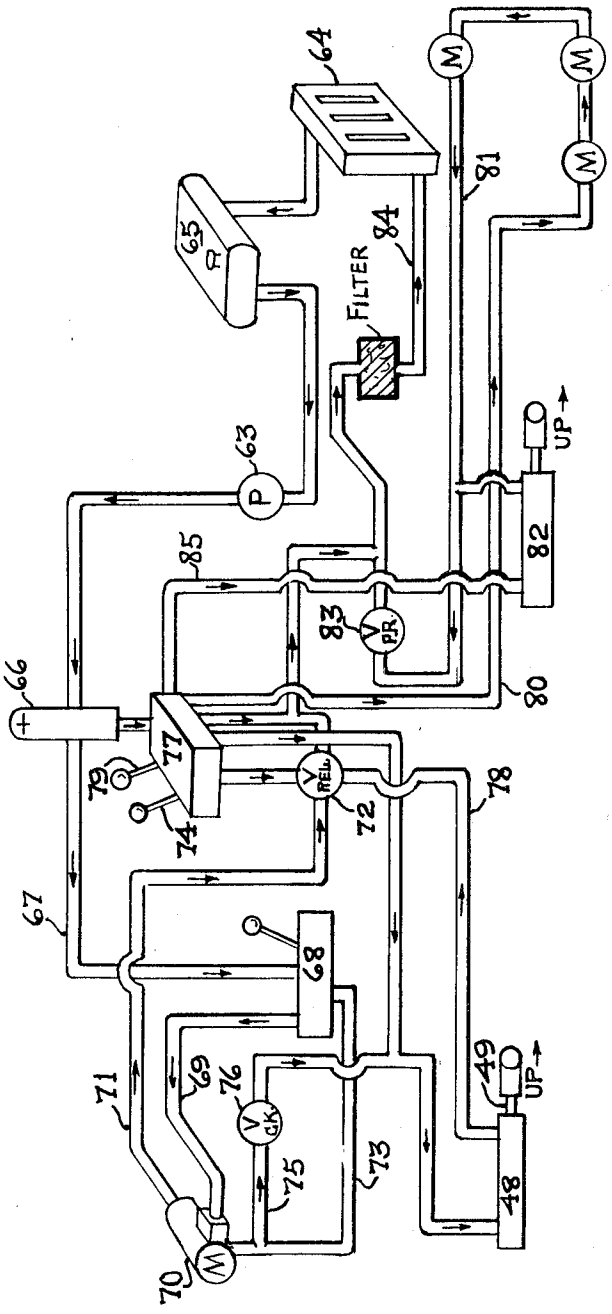


Fig. 6.

INVENTOR.
WALTER G. ASHTON
BY Edward C. Threedy
HIS ATTORNEY.

SELF-PROPELLED FLOOR SCRUBBER

SUMMARY OF THE INVENTION

A self-propelled floor scrubber which includes a tractor unit having an internal combustion engine which operates an alternator as an electrical power source and a pump for pressurizing the hydraulic system which in turn operates the hydraulic brush-rotating motors as well as a hydraulic drive motor for propulsion of the tractor unit.

The rotating brush assembly provides three circular flat-to-the-floor brushes arranged in a triangular pattern, and is pivotally connected to the under frame of the tractor unit and operatively connected to a movable piston of a hydraulic cylinder which functions to pivotally raise and lower the brush assembly.

The squeegee assembly consists of a parallelogram arrangement which, through the operation of a hydraulic cylinder, is pivotally associated so as to raise and lower the squeegee elements into and out of floor-engaging position.

The hydraulic system also includes an automatic bypass conduit arrangement whereby when the tractor unit is propelled in a reverse direction, the squeegee assembly will be automatically raised so as to prevent damage thereto and to permit continuing the scrubbing operation of the rotating brushes in either forward or reverse direction.

GENERAL DESCRIPTION

The invention will be best understood by reference to the accompanying drawings, in which:

FIG. 1 illustrates a self-propelled floor scrubber unit;

FIG. 2 is a perspective view of the squeegee subassembly;

FIG. 3 is a perspective view of the brush subassembly;

FIG. 4 is a perspective side view of the brush subassembly;

FIG. 5 is a fragmentary detailed sectional view of a shock-absorbing connection associated with the squeegee subassembly;

FIG. 6 is a schematic flow chart of the hydraulic system employed in the floor scrubber unit.

As illustrated in FIG. 1, the self-propelled floor-scrubbing unit includes a plurality of rotatable floor brushes positioned forwardly and beneath the main frame portion of the tractor unit. The floor scrubber includes a squeegee assembly which positions a first squeegee forwardly of the rear driving wheels of the tractor unit, and a second squeegee to the rear thereof.

Referring to FIGS. 3 and 4, the brush-supporting assemblies comprise a substantially T-shaped subframe **10**, with the leg portion thereof comprising two spaced-apart members **11** and **12** formed to converge at their free ends to support a hydraulic brush-rotating motor **13** for the forward scrubbing brush. The opposite ends of the members **11** and **12** are fixedly connected to the crossbar **14** of the T-shaped subframe which in turn at its extremities supports additional hydraulic brush-rotating motors **15** and **16**.

Extending between the spaced members **11** and **12** of the T-shaped subframe **10** is a connector plate **17**, the ends of which are connected as at **18** to each of the spaced members **11** and **12**. Mounted on the connector plate **17** by a loose connection **19**, is a concaved cambered beam **20**. The beam **20** is of a length greater than the connecting plate **17** so as to extend beyond the ends thereof as well as beyond the spaced members **11** and **12**.

Fixedly connected to the cambered beam **20** are a pair of supporting bars **21** and **22** which at their free ends provide a right-angled portion **23** and **24** which in turn terminates into leg portions **25** and **26** extending substantially parallel to their respective supporting bars **21** and **22** and which in turn are pivotally connected as at **27** to the under frame of the tractor unit as seen in FIG. **1**.

From the foregoing description, it is obvious that the limited connection between the brush-supporting T-frame and the supporting bars **21** and **22** is the loose connection **19** between the connector plate **17** and cambered beam **20**. Thus, the cambered beam **20** is rockable throughout its longitudinal length upon the connector plate **17**, and consequently the brushes mounted on the ends of the crossbar **14** may float over the floor irregularities or obstructions.

At the ends of the cambered beam **20** and extending vertically therefrom are a pair of connecting rods **28** and **29**. As shown in FIG. **4**, the connecting rod **28** is in turn connected to an L-shaped link **30** which at a point **31** is likewise pivotally connected to the under frame of the tractor unit. One end of the L-shaped link **30** has connected thereto as at **32**, the exposed end of a piston **33** of a hydraulic cylinder **33'**. The rod **29** has its free end connected to a pivot bar **34** which is pivotally connected at a point **35** to the under frame of the tractor unit.

The supporting rods **28** and **29** are journaled through a pair of spring members **36** which have one end bearing against the cambered beam **20** and their opposite ends restrained by a looped end **37**. These spring members **36** act as a shock-absorbing connection between the entire brush-supporting T-shaped subframe and the tractor unit.

When the piston **33** is expelled under hydraulic pressure, out of its cylinder **33'**, it will effect pivoting of the link **30** in a clockwise direction, as seen in FIG. **4**, which in turn through the associated structure hereinbefore described, will effect pivoting of the supporting bars **21** and **22** in anticlockwise direction, as shown in FIG. **4**, about their pivotal connection to the under frame of the tractor unit, which pivotal movement in turn will raise the T-shaped brush-supporting subframe, thus raising the brushes out of floor-engaging position.

Depending from the supporting bars **21** and **22** are guide fingers **38** which bear against the inside surfaces of the spaced members **11** and **12**, guiding the movement thereof upwardly as the assembly is pivotally actuated. The member **11** also carries a guide **39** and bumper **40** which prevents over pivotal movement of the T-frame relative to the supporting bars **21** and **22**.

Referring to FIG. **2**, the squeegee assembly **41** comprises a pair of parallelogram structures each of which includes an upper fixed supporting bar **42** and a parallel squeegee-supporting bar **43**, connected to the supporting bar **42** by parallel side bars **44** and **45**. Each of the supporting bars **42** is connected to the underframe of the tractor unit so as to be stationary with respect thereto. The connection of the side bars **45** to the supporting bars **42** includes a shaft **46** upon which is freely journaled by a U-shaped bracket **47**, a hydraulic cylinder **48** having a piston **49**, the free end of which by a U-shaped bracket **50** is connected to a second shaft **51** which extends between and forms a part of the pivotal connection between the opposite ends of the side bars **44** and the support bars **43**.

It is readily apparent that when the hydraulic cylinder **48** is actuated to expel its piston **49**, it will collapse the parallelogram structure by effectively pivoting forwardly and upwardly the supporting bars **43**, raising the squeegee carried thereby out of floor-engaging position.

The squeegee-supporting bars **43** are comprised of two bar members **52** and **53**, with the bar **52** terminating at its point of pivotal connection of the side bars **45** thereto, as shown in FIG. **2**.

The bar **52** extends forwardly beyond its pivotal connection to the side bar **44** and supports the forward squeegee-carrying bar **52'**. The bar **53** extends rearwardly beyond its pivotal connection to the side bar **45** and supports the squeegee-carrying bar **53'**. As shown in FIG. **5**, the two bars **52** and **53** are connected to the lower end of the side bars **45** by a nut and bolt arrangement **54** which extends through an elongated slot **55** formed in the bar **53** and through a close tolerance opening **56** in the end of the bar **52**. The end of the bar **52** provides a perpendicular rod **57** which is freely journaled through a flange **58** provided by the bar **53**. Over the rod **57** is a coil spring **59** which is compressed against the flange **58** by a retaining nut and washer **60**. By this arrangement, the bar **53** has a loose connection to the end of the bar **52** as well as to the end of the side bar **45**. This loose connection permits a floating shock-ab-

sorbing connection of the rear squeegee to its support to accommodate any unevenness in the floor surface being treated by the floor scrubber.

To regulate the length of movement of the piston **49** and thus the relative spacing between the fixed supporting bars **42** and squeegee-supporting bars **43**, there is provided a pair of adjusting rods **61** that extend between shafts **46** and **51**. These adjusting rods **61** comprise telescoping elements (not shown) that have their opposite ends journaled onto the shafts **46** and **51**. One of the telescoping elements is threaded and carries adjusting nuts **62** which by threadable adjustment determine the overall length of the rods **61**.

Referring to FIG. **6**, there is schematically shown a hydraulic flow chart utilized in the floor-scrubbing unit. The system includes a hydraulic pump **63**, an engine-cooled heat exchange **64**, and a large oil reservoir **65**. A flow divider **66** directs the hydraulic fluid to the tractor drive valve and the control valves for the brush and squeegee assemblies. As shown, the fluid from the flow divider is by the conduit **67** passed into the tractor drive valve **68**, which in its forward drive position is connected by conduit **69** to the hydraulic tractor drive motor **70**. A return conduit **71** is connected to the relief valve **72** and back to the lines of conduit that terminate at the reservoir **65**. When the tractor drive valve **68** is actuated so as to drive the unit in a reverse direction, the tractor drive valve **68** is connected by conduit **73** to the reverse flow direction of the tractor drive motor **70**. If, however, in the reverse direction the squeegee cylinder **48** through its control valve lever **74** is operated so that the squeegee assembly is in a down position, the hydraulic fluid flowing through the tractor drive valve **68** and conduit **73** is permitted to pass through conduit **75** and directional check valve **76** into the cylinder **48** so as to expel the piston **49** thereof, raising the squeegee assembly before the tractor drive motor **70** moves the unit in a reverse direction.

If the squeegee valve lever **74** is operated so as to open the squeegee valve contained in the valve control unit **77**, the hydraulic fluid passes through conduit **78**, through the relief valve **72**, and into the squeegee cylinder **48**, retracting the piston **49** thereof, which in effect lowers the squeegee assembly into its floor-engaging operative position.

When the brush assembly valve lever **79** is actuated so as to lower the brush assembly, it will also function to actuate the hydraulic brush motors **13**, **15** and **16**. This is accomplished by having the hydraulic fluid introduced into conduit **80** which is in series connection to the three brush motors **13**, **15** and **16**, conduit **81** which introduces fluid into the brush assembly cylinder **82**, retracting its piston so that the brush assembly unit is lowered onto the floor, through a brush pressure relief valve **83**, conduit **84**, and back to the reservoir **65**. When the brush control valve lever **79** is moved so as to raise the brush assembly, the hydraulic fluid is caused to pass through conduit **85** and into the brush assembly cylinder **82**, expelling the piston thereof and pivotally raising the brush assembly out of operative position.

From the foregoing it is apparent that I have provided a direct-drive hydraulic system for propelling the tractor unit as well as for individually controlling the position and operation of the rotatable brushes and their supporting assemblies, as well as the squeegee assemblies. The floating shock-absorbing brush and squeegee assemblies permit the unit to be operated in either a forward or reverse direction, with the squeegee assembly being automatically raised when the tractor unit is in reverse.

While I have illustrated and described the preferred form of construction for carrying my invention into effect, this is capable of variation and modification without departing from the spirit of the invention. I, therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent is:

1. A self-propelled floor-scrubbing machine including a tractor-type wheeled hydraulically driven body, carrying scrubbing brush and squeegee assemblies, wherein the improvement comprises:

a. a scrubbing brush supporting subframe mounted beneath the forward end of the tractor body,

b. a pivotal support for said subframe including a pair of elongated supporting arms having one end pivotally connected to the tractor body and their opposite ends connected to a concaved cambered crossbeam,

c. means mounting said brush supporting subframe to said cambered crossbeam of said pivotal support for tiltable movement of said subframe relative to said crossbeam and transversely to the long axis of said supporting arms,

d. means providing shock-absorbing connections between the ends of said crossbeam of said pivotal support and the body of the tractor,

e. a hydraulically operated pivoting link pivotally connected to the tractor body at a point removed from and in substantial horizontal alignment with the pivotal connection of said supporting arms of said pivotal support to the tractor body and to said shock-absorbing connections for raising and lowering said brush-supporting subframe relative to the tractor body,

f. hydraulic means for pivoting said link relative to its connection to the tractor body for pivoting said supporting arms relative to their connection to the tractor body for raising and lowering said brush-supporting frame,

g. a squeegee subframe connected to the tractor body between certain wheels thereof, said squeegee subframe including a pair of four-bar mechanisms pivotally joined together in the form of a parallelogram with certain of said bars of each mechanism fixedly connected to the underside of the tractor body and certain other of said bars supporting squeegee elements, and

h. hydraulic means for pivotally collapsing and extending the parallelogram formed by said mechanisms to raise and lower said squeegee elements relative to the tractor body.

2. The floor-scrubbing machine defined by claim **1** including a hydraulic system having manually operated valves for controlling the direction of operation of all of said hydraulic means so as to raise or lower said brush-supporting subframe and said squeegee subframe, said system including a directional hydraulic bypass relative to the control valve for said squeegee subframe adapted to operate said squeegee subframe hydraulic means in one direction so as to raise said squeegee subframe when the scrubbing machine is hydraulically driven in a reverse direction.

3. A self-propelled floor-scrubbing machine as defined by claim **1** wherein said scrubbing brush-supporting subframe is substantially T-shaped, with the extremities terminating in front of and to either side of the tractor body, said T-shaped subframe providing a supporting plate extending in a plane normal to said cambered crossbeam and having a loose connection thereto so as to have a limited tiltable movement through the length of said cambered crossbeam to permit the extremities of said T-shaped subframe at either side of the tractor body to ride upon an uneven floor surface.

4. A self-propelled floor-scrubbing machine as defined by claim **3** including a hydraulic system having manually operated valves for controlling the direction of operation of all of said hydraulic means so as to raise or lower said brush-supporting subframe and said squeegee subframe, said system including a directional hydraulic bypass relative to the control valve for said squeegee subframe, adapted to operate said squeegee subframe hydraulic means in one direction so as to raise said squeegee subframe when the scrubbing machine is hydraulically driven in a reverse direction.

5. A self-propelled floor-scrubbing machine as defined in claim **1** where in the squeegee element supporting bars of said squeegee subframe comprise separated elongated members, the end of one of which is loosely connected and spring re-

sisted to the other elongated member so as to provide a shock absorber between the squeegee subframe and the tractor body.

6. A self-propelled floor-scrubbing machine as defined by claim 5 including a hydraulic system having manually operated valves for controlling the direction of operation of all of said hydraulic means so as to raise or lower said brush-supporting subframe and said squeegee subframe, and said system including a directional hydraulic bypass relative to the control valve for said squeegee subframe adapted to operate said squeegee subframe hydraulic means in one direction so as to raise said squeegee subframe when the scrubbing machine is hydraulically driven in a reverse direction.

7. A self-propelled floor-scrubbing machine as defined by claim 3 wherein the squeegee element supporting bars of said squeegee subframe comprise separated elongated members, the end of one of which is loosely connected and spring resisted to the other elongated member so as to provide a shock absorber between the squeegee subframe and the tractor body.

8. A self-propelled floor-scrubbing machine as defined by claim 4 wherein the squeegee element supporting bars of said squeegee subframe comprise separated elongated members, the end of one of which is loosely connected and spring resisted to the other elongated member so as to provide a shock absorber between the squeegee subframe and the tractor body.

* * * * *