

[54] **MOBILE POWER WASHER**
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3,454,042 7/1969 Phillips134/100 X
3,570,503 3/1971 DeBoliac134/100 X
FOREIGN PATENTS OR APPLICATIONS
548,975 11/1957 Canada134/101

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[57] **ABSTRACT**

Self-contained mobile power washer system has a water storage tank, a pump, a heater which selectively heats or boils wash water. A steam wand and a pressure wash nozzle are fitted at a quick disconnect coupling at the end of a wash hose. Surfactants and steam cleaning compounds are separately stored and are selectively pumped through a single pump and additive line to the discharge line. Surfactant may be diverted to a scrub brush dispenser. Solvent and acid lines are separately provided, and a rinse line includes a wax injector. In one embodiment, proportioning pumps are driven by water flow to insure correct mixtures.

6 Claims, 2 Drawing Figures

[56] **References Cited**

UNITED STATES PATENTS			
3,447,505	6/1969	Wagner	134/101 X
2,222,516	11/1940	Powell et al.	134/101 X
3,170,539	2/1965	Snay et al.	134/101 X
3,157,361	11/1964	Heard	134/100
3,207,165	9/1965	Durrant	134/100 X
3,229,703	1/1966	Thompson et al.	134/100

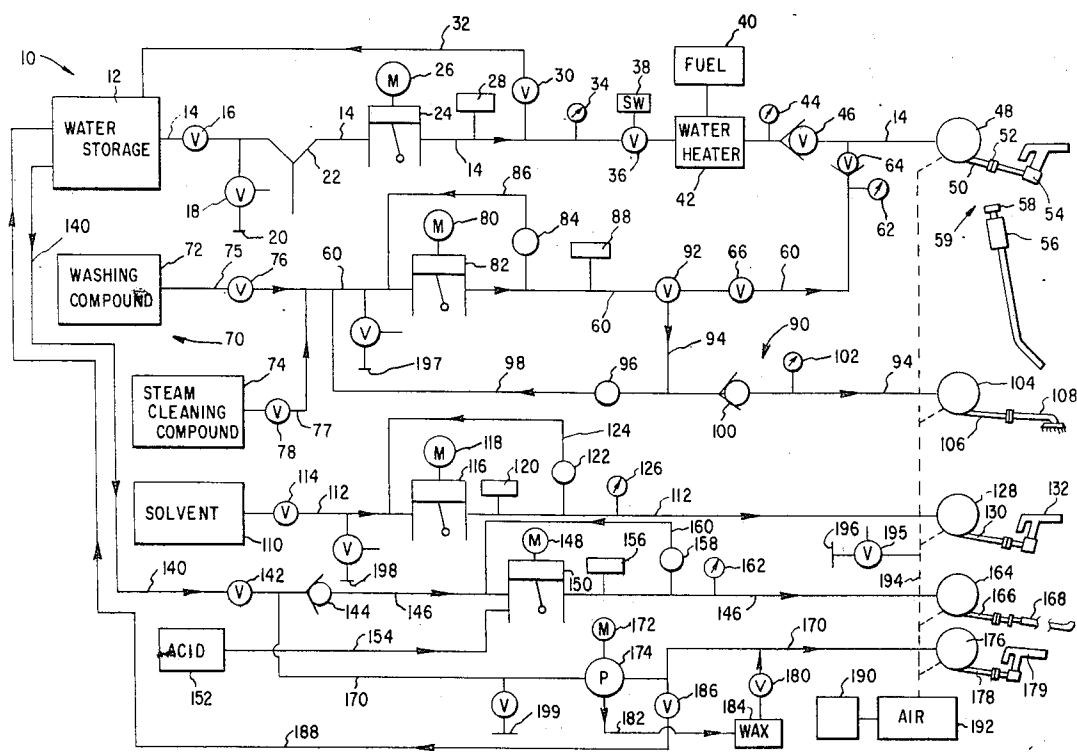
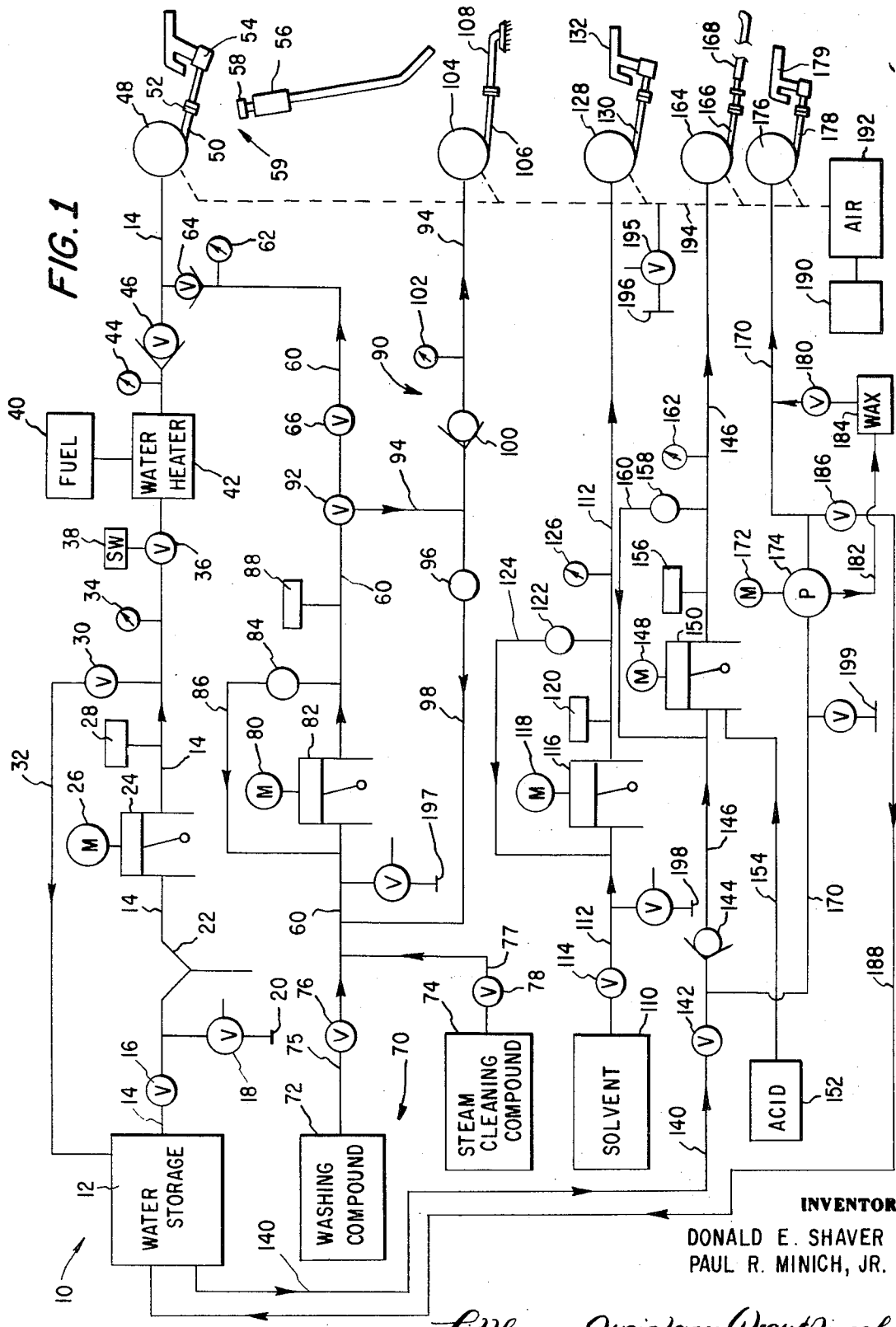


FIG. 1



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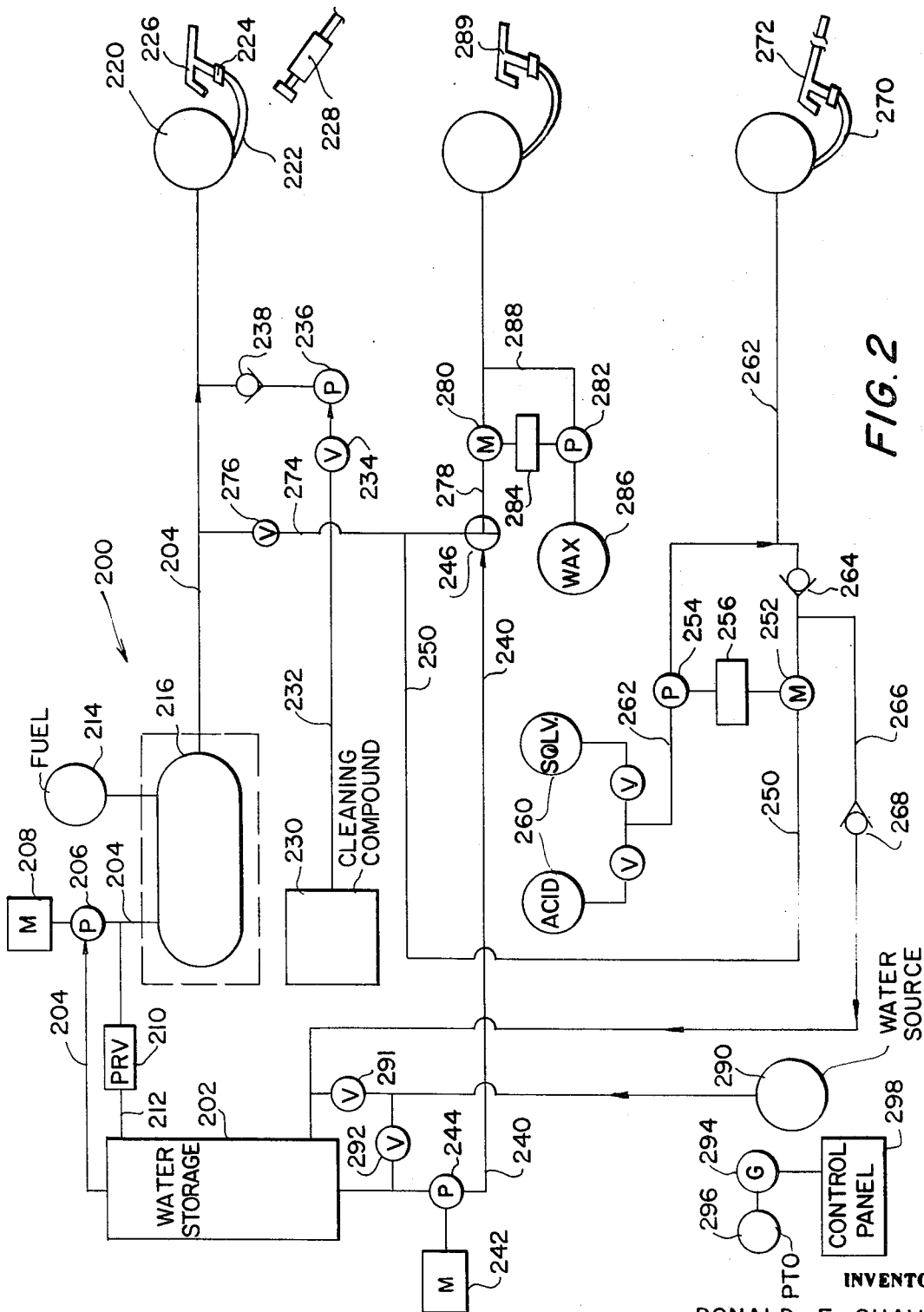


FIG. 2

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MOBILE POWER WASHER

BACKGROUND OF THE INVENTION

Some wash systems having separate water and detergent lines culminating at a common nozzle incorporate a detergent supply valve at the nozzle and are capable of shutting off the detergent flow to provide a water rinse. Such systems have several disadvantages.

It may not be necessary or desirable that rinse water be the same temperature as to wash water. An uneconomical use of heated water results. Uneconomically large heating apparatus wastes money and space. An election wash negates a simultaneous election to rinse, and vice versa. Thus, such prior art systems are limited to one operator who must wash and then rinse. Expensive equipment is thus limited to the speed of one operator. A more preferable arrangement when washing, for example, fleets of vehicles, is to have one operator continuously moving among the vehicles washing their exposed surfaces and another operator continuously rinsing, waxing and brightening the vehicles.

Known mobile washing apparatus are limited in versatility by the limited space and weight available for equipment and storage. The limited versatility makes the mobile equipment ineffective in some jobs and especially makes the known mobile equipment inefficient when the equipment is first used on one type of job, such as truck fleet washing, and then is moved to another job site to wash aircraft.

SUMMARY OF THE INVENTION

The present invention concerns complete and self-contained mobile power washing apparatus which is intended for truck mounting to be moved among washing job sites.

The apparatus is operated chiefly by electric motor driven pumps which are supplied power from a truck engine power take off driven generator. Water is heated in the wash line, and steam is produced therein by selectively controlling a kerosene-fired heater. Servo valves open lines and control flows as directed from a control panel mounted near the hose reels on the truck. Steam nozzles and pressure wash nozzles are interchangeable at quick disconnect couplings at the distal ends of wash hoses. A steam cleaning compound or washing compound may be selected at the panel. Either compound flows through the additive line, and the flow rate is selected for the most economical use of the compound.

For extra dirty jobs, and for soil which does not loosen with the steam or pressure wash treatment, a washing compound dispensing scrub brush is provided at the end of a 100 foot hose.

A solvent hose and pressure gun is provided for types of soils which are not removed by hot water and steam or their additives. A dilute acid is provided at a pressure gun for brightening surfaces such as aluminum. A high volume rinse line is provided with a wax injector which may be turned off and on and varied according to the desired volumetric proportion.

Preferably, the solvent line is supplied by a 30 gallon storage tank containing as a solvent chlorinated organic solvent combined with petroleum solvent, talloil soaps and emulsifying and wetting agents. Especially useful acids are inorganic acids such as hydrofluoric

acid, phosphoric acid and sulfuric acid chemically combined with non-ionic wetting agents.

In the versatile and universal surface cleaning system of the present invention, a variety of cleaning agents is desirable. The present system provides separate storage of the cleaning agents and provides separate and joint access to the storage tanks for separate or joint use. Agents which are particularly useful in the apparatus of the present invention include surfactants such as wetting, emulsifying and deterging compounds which typically are non-ionic or anionic, but many be cationic and advantageously have balanced lipophilic and hydrophilic properties. Certain types of soiling deposits are best attacked in aqueous media by alkalies such as caustic soda or sodium or potassium tetra or hexamethaphosphate or by acid cleaning and brightening agents especially where aluminum surfaces are involved. In addition, there are certain types of soil deposits which are removable only by organic solvents such as hydrocarbon solvents typified by toluene or benzene, chlorinated hydrocarbons typified by methylene chloride, or ketone solvents typified by methyl isobutyl ketone or the like. A suitable steam cleaning compound for use in the present invention is made of organic wetting agent, organic solvent and chelating agent in combination with complex phosphates. A suitable pressure washing compound is similar to the steam cleaning compound with the addition of silicate inhibitors. Washing and steam cleaning compounds preferably are tricomponent systems containing biodegradable surfactants and emulsifiers for removing soils without pitting the surface which is being treated.

The several hoses of the present apparatus may be used concurrently or independently. In the preferred use, at least two operators accompany each truck so that one operator may continuously wash or scrub while the other operator continuously rinses, waxes and brightens.

As the particular job determines, the wash operator may use water or steam or both in unique sequence, either the wash operator may use the solvent gun on recognizing particular soil conditions which are not economically susceptible to water or steam application, or the rinse operator may use the solvent gun on portions of soil which have obviously remained resistant to wash water and steam applications.

The additive washing compound, rinsing compound, solvent and additive systems of the present invention may be supplied individually or concurrently as is necessary for soil conditions. In certain embodiments, interconnections are provided to vary the temperature of the rinse water and additive propelling water.

This invention has as one object the provision of a portable and mobile power washer apparatus having completely self-contained water supply, hot water heater and steam generator in a line fitted with an additive supply and terminating in interchangeable steam and power wash nozzles.

Another object of the invention is the provision of combined additive supply apparatus in single output lines.

Another object of the invention is the provision of an interchangeable and interflow system with flow rate controls of additives and wash and rinse water and steam.

The foregoing and other objects of the invention are apparent in the disclosure which includes the foregoing and ongoing specification with the claims and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic flow diagram of a preferred embodiment of the invention.

FIG. 2 is a schematic flow diagram of an alternate preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to FIG. 1, mobile power wash apparatus is generally referred to by the numeral 10. A water storage tank 12 has a capacity, for example, of 270 gallons. Water is withdrawn from the storage tank via discharge line 14. Valve 16 is used to shut off the discharge line when the discharge line is purged by air delivered by valve 18 and quick disconnect coupling 20. A wide strainer 22 removes all dirt from the line. Piston pump 24 which is driven by electric motor 26 draws water from storage tank 12 through line 14 and increases pressure of the water in line 14. As an example, discharge line 14 is a 1 inch line, and a five horsepower electric motor 26 drives piston pump 24 with a 5 gallon per minute output at 800 psi.

Vibration damper 28 reduces surges in line 14. Pressure relief valve 30 is connected in relief line 32 which returns water to the storage tank upon excessive pressures in line 14 caused, for example, by shut off of discharge nozzles. Preferably, pressure relief valve 30 is adjustable, for example, between 800 and 900 psi. Gauge 34, which is used with an additional vibration damper not shown, records pressure in line 14.

Valve 36 controls flow through line 14 according to flow switch 38. An 80 gallon fuel tank 40 supplies a 1.4 million Btu water heater 42 to selectively produce either hot water or steam. Pressure gauge 44, like pressure gauge 34, has a range from zero to 1,500 or 2,000 psi. Check valve 46 prevents return toward the direction of the heater. Discharge line 14 continues to a reel 48 and then to a hose 50 which forms part of the discharge line. Discharge line 14 and its half-inch hose 50 terminate at a distal end in quick disconnect coupling 52. A pressure wash gun 54 is provided for normal operating procedures and, a steam wand 56 is provided for steam cleaning. Both wand 56 and pressure gun 54 have quick disconnect couplings 58. Together the pressure gun 54 and wand 56 are referred to as flow control valve means generally indicated by the numeral 59.

Additive line 60 is connected to wash discharge line 14 between check valve 46 and reel 48 downstream from water heater 42. Gauge 62 indicates pressures from 0 to 1,500 psi. Check valve 64 prevents water flow from discharge line 14 into additive line 60. A flow control valve 66 is set preferably to control flow of additive from 0 to 3 ounces per gallon of water. Additive storage means are generally indicated by the numeral 70 and comprise two 30 gallon tanks 72 and 74. Washing compound is contained in tank 72 and, a steam cleaning compound is contained in tank 74. As an example, the steam cleaning compound may be a combination of an organic wetting agent, an organic solvent and a chelating agent combined with complex phosphates. The washing compound in tank 72 may be

a surfactant similar to the steam cleaning compound with the addition of a silicate inhibitor. The compounds in tanks 72 and 74 are generally considered surfactants and may be considered tricomponent systems containing biodegradable surfactants and emulsifiers to remove soils without pitting. A first line 75 removes washing compound from tank 72, and first valve 76 controls the movement of compound through line 75. Second line 77 communicates tank 74 with additive line 60, and valve 78 controls the flow of the second additive through second line 77.

Motor 80 drives piston pump 82 to draw washing or steam cleaning compound from the lines, 75 or 77, through additive line 60. An 850 Psi pressure relief valve 84 returns additive under excessive pressure through relief line 86. Vibration damper 88 absorbs surges in the line. An auxiliary scrubbing system generally referred to by the numeral 90 provides direct scrubbing application of a compound to a surface to be cleaned. Three-way valve 92 may be turned to connect scrubber line 94 to additive line 60. An adjustable pressure relief valve 96, which may be set from 0 to 650 psi, returns additive under excessive pressure through relief line 98. Check valve 100 insures against backup in the scrubber line 94. Pressure gauge 102 indicates pressure from 0 to 300 psi. Scrubber line 94 includes a reel 104 and a $\frac{3}{8}$ inch hose 106. A conventional heavy duty scrubbing dispensing brush 108 is mounted on the distal end of hose 106.

A 30 gallon solvent storage tank 110 delivers solvent to solvent line 112 as controlled by valve 114. Piston pump 116, which is driven by electric motor 118, draws solvent from tank 110 through line 112 and increases the pressure of solvent in line 112 downstream from the pump. An accumulator 120 reduces surges downstream from the pump. Pressure relief valve 122 may be set at about 75 pounds per square inch, for example, to return solvent under excess pressure through relief line 124 to an upstream side of pump 116. Gauge 126 is preferably a pressure dampened gauge. Reel 128 stores line 130 which may for example be a $\frac{3}{8}$ inch hose, and which is referred to as a portion of solvent line 112. Pressure gun 132 is mounted on a distal end of the line.

An outlet water supply line 140 is connected to water storage tank 12 for supplying water through valve 142 to a brightening line and to a rinse line. Check valve 144 in brightener line 146 prevents reverse flow of acid towards supply line 140. Motor 148 drives pump 150 to draw water through supply line 140 and check valve 144 and to draw acid from an 18 gallon storage tank 152 through acid line 154. Accumulator 156 prevents surges in the line, and pressure relief valve 158 returns dilute acid to an upstream side of pump 150 through relief line 160. Gauge 162 is provided with a dampening device. Brightener line 146 terminates in reel 164 and a three-eighths inch high pressure hose 166 with an acid brightening wand 168 at its distal end. The reel and hose are a part of the brightener line 146. Rinse line 170 is connected to supply line 140. A 2 horsepower motor 172 drives a 12 gallon per minute 100 pounds per square inch rinse pump 174. Rinse line 170 includes power reel 176, a three-quarter inch pressure hose 178 and a pressure rinse gun 179. When valve 180 is open, pump 174 drives fluid through wax injector

line 182 and wax injector 184 which draws wax from a separate storage source not shown. Pressure relief valve 186 is set at about 100 pounds per square inch to return rinse water through return line 188 to water storage tank 12.

Air compressor 190 supplies air to storage tank 192. Air service line 194 supplies all of the air powered hose reels 48, 104, 128, 164 and 176. Valve 195 may be turned on when an air hose is connected to quick disconnect coupling 196 for selectively purging the line such as through quick disconnect air purge couplings 20, 197, 198 and 199.

In the alternate embodiment shown in FIG. 2, a mobile power wash apparatus is generally referred to by the numeral 200. A water storage tank 202 supplies water through a discharge line 204 to pump 206, which is driven by electric motor 208. Pressure relief valve 210 returns water under excessive pressure in discharge line 204 to storage tank 202 through relief line 212.

Fuel tank 214 supplies fuel to heater 216 to selectively heat water in the discharge line or turn the water therein to steam. Discharge line 204 includes a reel 220 and a hose 222, which has a quick disconnect coupling 224 at its distal end. Wash gun 226, or steam wand 228 may be connected to the distal end of the hose as a flow control valve means. An additive tank 230 contains cleaning compound and supplies the cleaning compound through additive line 232 as controlled by valve 234. Pump 236 drives the detergent to check valve 238 which prevents return of water or steam. Water is drawn out of storage tank 202 through delivery line 240 by motor 242 and pump 244. Delivery line 240 is connected to conduit 250 by three-way conduit valve 246. Water in conduit 250 drives an impeller motor 252 which in turn drives a piston pump 254 through variable speed coupling 256. Fluid pump 254 propels fluid from storage tank means 260 through fluid supply line 262. Water from conduit 250 proceeds through check valve 264 to fluid supply line 262. Excess water returns to water storage tank 202 through return line 266 and check valve 268. Acid or solvent from one or the other of tanks 260 is thus supplied in a diluted form to hose 270 and pressure gun 272. Interconnection line 274 as controlled by reducing valve 276 may supply water to conduit 250 or to rinse line 278. Rinse line 278 is supplied either with warm water through interconnection line 274 or with cold water through delivery line 240. An impeller motor 280 in rinse line 278 drives wax pump 282 through a variable speed drive connection 284. Thus, wax is pumped from a wax supply 286 through line 288 into the rinse gun 289. The rinse gun 289 distributes pure rinse water or wax-laden water according to the setting of speed control 284. Water source 290, such as a city water source, supplies water to the water storage tank through valve 291, and water may be supplied directly from an external source to delivery line 240 through valve 292.

The entire system is supplied with electrical power from generator 294 driven by a vehicle engine power take off 296. Control panel 298 controls the state of the valves through conventional solenoids.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art

that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. Mobile power washer apparatus comprising a water storage tank, a discharge line connected to the water storage tank for receiving water therefrom, wash pump means connected in the discharge line for increasing pressure of water in the discharge line, water heater in the discharge line downstream of the wash pump means for increasing temperature of water in the discharge line and for selectively producing hot water and steam, controllable heating means connected to the water heater for controlling water temperature and for controlling liquid and gaseous state of the water, additive storage means, an additive line connected to the additive storage means, additive pump means mounted in the additive line for drawing fluid from the additive storage means and for increasing pressure of additive in the additive line, flow control valve means mounted in the additive line for controlling flow of additive through the line, interconnection means connected to the water discharge line and to the additive line for adding additive to flow in the discharge line, check valve means mounted in the discharge line upstream of the interconnection means for preventing flow of additive through the discharge line toward the heater means, and fluid output control means connected to a distal end of the discharge line for controlling steam, water and additive output therefrom.

2. The mobile power washer apparatus of claim 1 wherein the additive storage means comprises a first storage tank for supplying a first cleaning additive, a first line connected to the first tank, a first valve in the first line for controlling flow therethrough, a second storage tank for supplying a second cleaning additive, a second line connected to the second tank and a second valve mounted in the second line for controlling flow therethrough, the first line and the second line being connected to the additive line for respectively supplying first or second cleaning additives thereto.

3. The apparatus of claim 1 further comprising an outlet water supply line connected to the water storage tank.

4. The apparatus of claim 1 further comprising a rapid disconnect purge air fitting connected to the discharge line between the water source and the wash pump.

5. The apparatus of claim 1 further comprising a scrubber line connected to the additive line downstream of the additive pump, valve means connected to the scrubber line and to the additive line for selectively directing flow to the scrubber line and to the additive delivery line and further comprising a distributor at the distal end of the scrubber line for distributing additive from the scrubber line directly into soil on surfaces to be cleaned.

6. The apparatus of claim 5 wherein the additive line further comprises a first pressure relief line connected to the additive line upstream and downstream of the additive pump thereby shunting the additive pump, first relatively high pressure release valve means connected in the first relief line for returning fluid under excessive pressure from a high pressure downstream side of the additive pump to a low pressure upstream side of the

additive pump, and a second relatively low pressure relief valve connected in the second bypass line for returning fluid under excessive pressure in the scrubber line to the additive line upstream side of the additive pump.

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