Aug. 10, 1971 V. K. VALAVAARA 3,598,651

METHOD AND APPARATUS FOR CLEANING MACHINE PARTS AND THE LIKE

Filed June 9, 1969 4 Sheets-Sheet 1

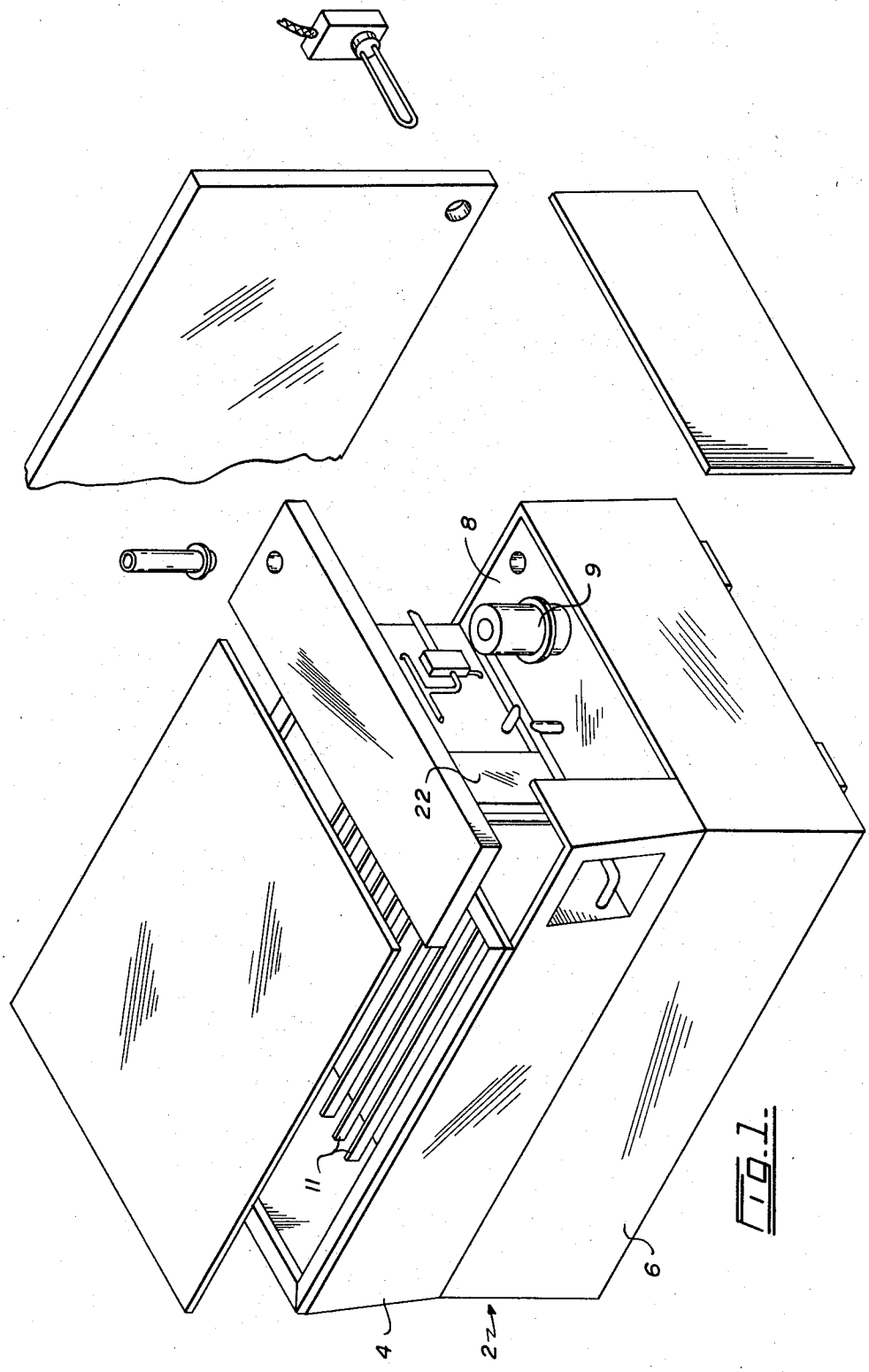


FIG. 1.

METHOD AND APPARATUS FOR CLEANING MACHINE PARTS AND THE LIKE

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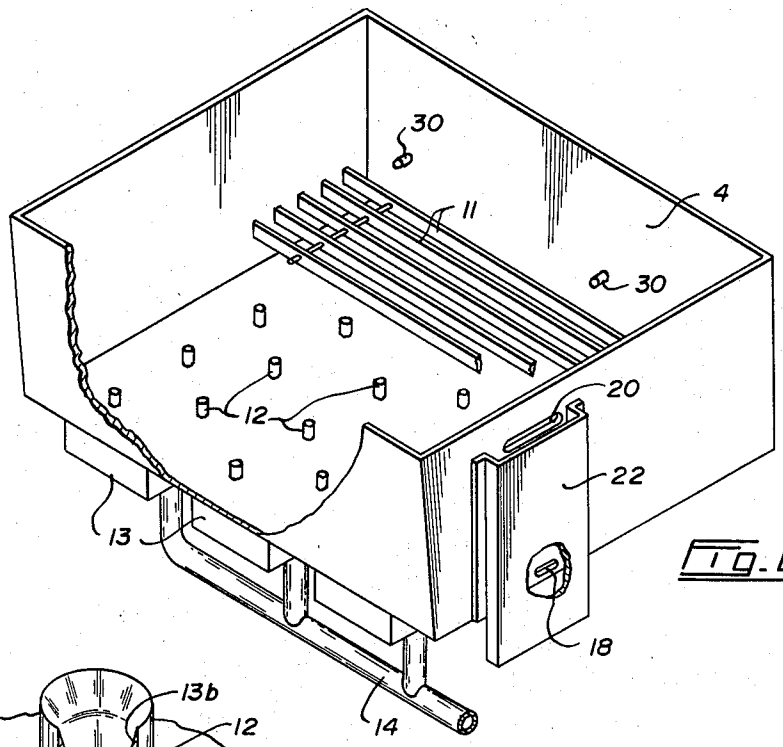


FIG. 2.

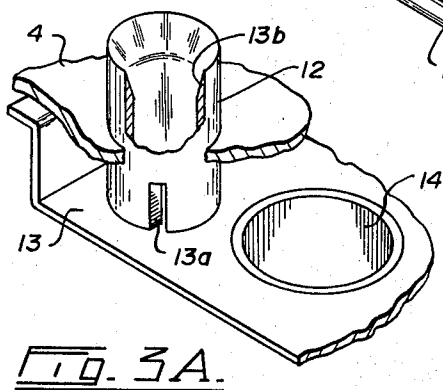


FIG. 3A.



FIG. 3B.

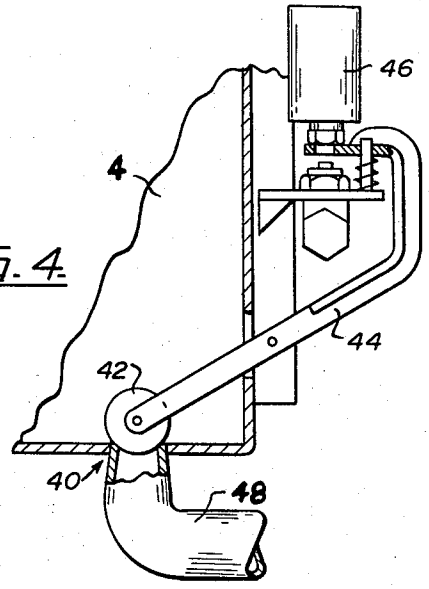


FIG. 4.

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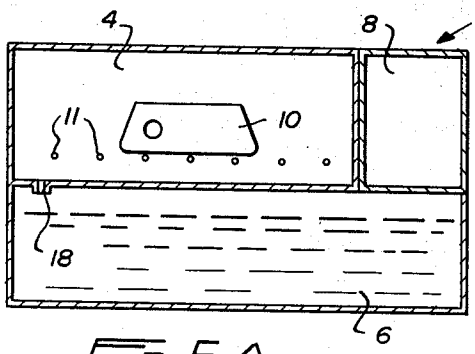


FIG. 5A

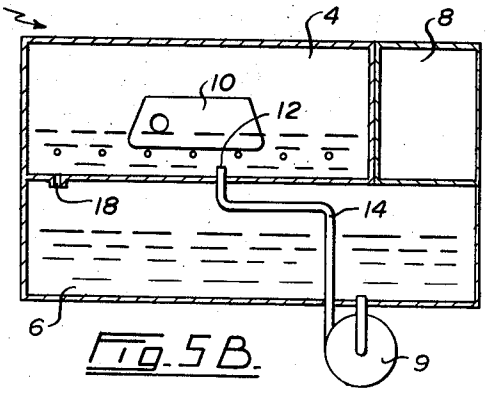


FIG. 5B

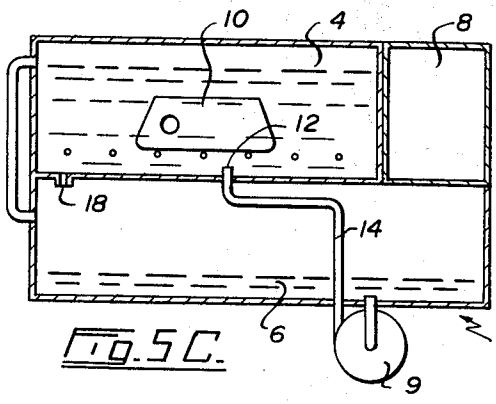


FIG. 5C

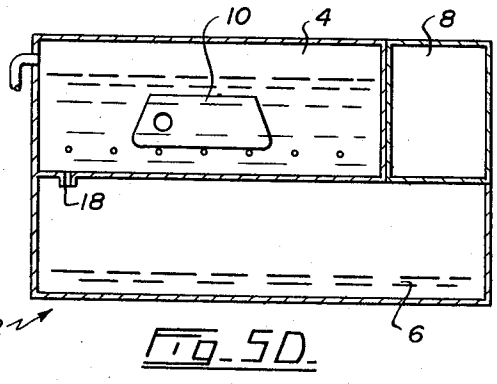


FIG. 5D

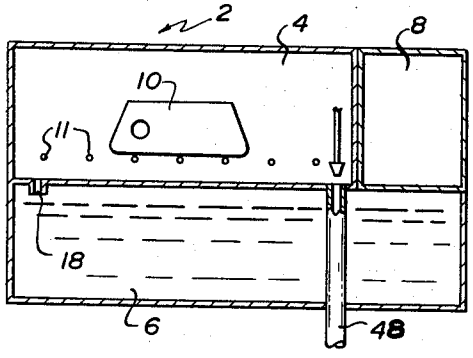


FIG. 5E

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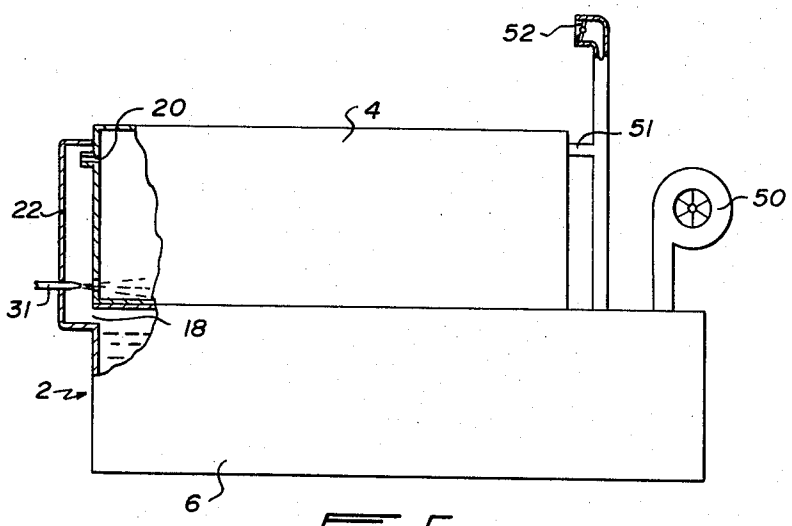


Fig. 6.

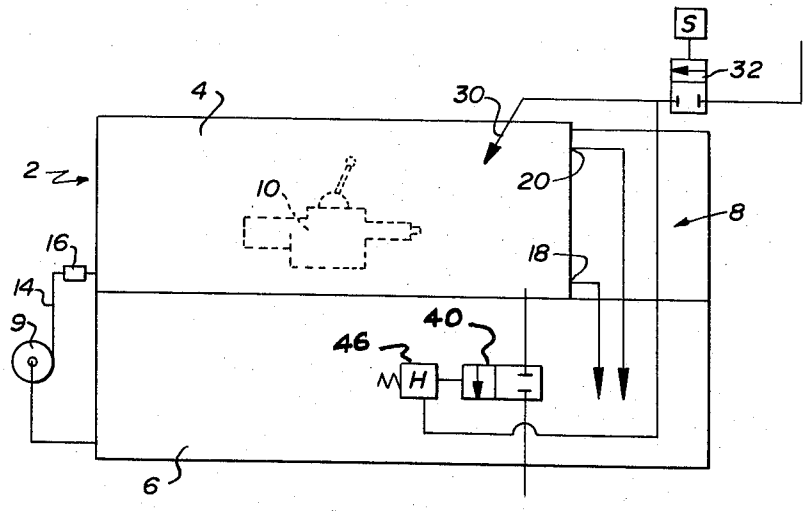


Fig. 7.

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3,598,651

METHOD AND APPARATUS FOR CLEANING MACHINE PARTS AND THE LIKE

Viljo K. Valavaara, 310 Clarke St., Woodstock, Ontario, Canada

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Claims priority, application Canada, June 12, 1968, 22,404
Int. Cl. B08b 3/04, 15/00
U.S. Cl. 134—25A 2 Claims

ABSTRACT OF THE DISCLOSURE

Method and apparatus for continuously cleaning machine parts, such as parts of automobiles. The parts to be cleaned are subjected, in sequence, to cleaning and rinsing cycles the liquid level in the tank being maintained at a predetermined level during the cleaning cycle and the liquid being drained from the tank at the end of the cleaning cycle to ensure good settlement of entrained sedimentation; latter is then removed during the subsequent rinsing cycle.

This invention relates to a method and apparatus for cleaning machine parts and the like and more particularly to cleaning tanks suitable for use by garages, maintenance shops and the like for the cleaning of machine parts and components such, for example, as parts of automobiles.

It is an object of the invention to provide an apparatus adapted for the cleaning of machine parts and the like in which the liquid level of a cleaning solution in the treatment tank is maintained at a desired predetermined level during the cleaning cycle and in which at the end of the cleaning cycle cleaning liquid remaining in the treatment tank is drained at slow metered rate to provide good settlement of entrained sedimentation in the treatment tank which sediment is subsequently removed by and during the rinsing cycle.

A further object of the invention is to provide cleaning apparatus in which machine parts to be cleaned may be loaded and/or unloaded to and from a dry space within the apparatus rather than to and from a space filled with a liquid.

Another object of the invention is to provide an apparatus of this type in which the machine parts being treated are subjected in sequence to cleaning and rinsing cycles and in which during the rinsing cycle the sediment remaining in the apparatus after the cleaning cycle is substantially entirely removed.

A still further object of the invention is to provide apparatus of this type which does not require filters or strainers, which can be continuously operated, which incorporates complete cleaning and rinsing cycles obviating the need for separate rinsing facilities, and in which any sediment remaining in the apparatus after a cleaning cycle is automatically removed during the rinsing cycle thereby minimizing maintenance and service requirements.

In accordance with the foregoing and other objects the present invention contemplates the provision of a cleaning apparatus comprising a reservoir for a cleaning liquid; a tank into which parts to be cleaned may be loaded; a plurality of nozzles located in said tank; a pump connected to said reservoir and operable to direct cleaning fluid from said reservoir through said nozzles into the tank; liquid level control means in said tank communicating with said rservoir and adapted to maintain a predetermined liquid level in said tank during operation of the pump; flow control means in said tank and communicating with said reservoir to provide a controlled return flow of liquid from the reservoir to the tank upon deactivation of said pump; and rinsing means operable to direct jets of rinsing liquid onto a part being cleaned in said tank, said rinsing liquid being discharged from the tank along with sedimentation removed from said part during the cleaning process, and means to direct a jet stream to preclude flow from said flow control means with actuation of said rinsing means thereby to prevent flow of rinsing liquid and entrained sedimentation into the reservoir during the rinsing cycle.

Other features which may be included in the invention will be described hereinafter and referred to in the appended claims.

The invention will now be more particularly described with reference to the accompanying drawings in which:

FIG. 1 is a general view in perspective and partially exploded showing the general layout of the apparatus;

FIG. 2 is a perspective view partly in section showing the cleaning tank proper with the associated liquid supply.

FIG. 3A is a perspective view partly in section showing the construction of the cleaning liquid nozzle;

FIG. 3B is a top sectional view through the nozzle of FIG. 3;

FIG. 4 is a schematic diagram showing the principle of construction of the drain valve;

FIG. 5*a–e* illustrate the various stages in the operating cycle of the apparatus.

FIG. 6 is a schematic diagram illustrating one arrangement for pressurizing the apparatus;

FIG. 7 is a schematic hydraulic circuit diagram.

Referring to the drawings, the apparatus comprises a casing **2** having upper and lower compartments designated **4** and **6** respectively and a further compartment **8** located to one side of the casing and housing pump equipment and associated drain, vent and control means.

The upper compartment **4** constitutes a treatment tank into which parts to be cleaned such, for example, as a component **10**, are loaded, the parts being disposed on a grid **11** placed near the bottom of the tank.

A series of nozzles **12** disposed in groups extends from back to front of the treatment tank and these communicate with headers **13** mounted in spaced parallel relationship beneath the bottom of the tank within the lower compartment **6** which latter constitutes a reservoir for receiving a liquid solvent used for cleaning parts loaded into the apparatus. The nozzles, as best seen in FIG. 3, are of tubular configuration with a radial inlet **13***a* disposed adjacent the lower end thereof which is located in the header **13** and an inwardly tapered outlet opening **13***b* into the treatment tank above the base thereof and below grid **11**.

A pump **9** located in compartment **8** communicates at its intake with the reservoir **6** and is adapted to direct liquid solvent from the reservoir through conduit **14** and nozzles **12** into the tank **4** wherein the part or parts to be cleaned have been loaded.

The rate of flow of liquid from the pump to the nozzles **12** is controlled by a suitable restrictor **16** which may be of any known suitable type. The tank **4** is provided with a flow control orifice **18** and a liquid level control or metering orifice **20** or overflow drain respectively. The two control orifices open into an overflow weir **22** which communicates at its lower end with the reservoir and through which liquid from the tank can return to the reservoir. The rate of liquid flow through the flow control orifice **18** back to the reservoir **6** is determined by the size of the orifice relative to the rate of supply of liquid to the tank **6** by the pump **9**. The control orifice **20** is an overflow drain which maintains a substantially constant level of cleaning fluid in the tank **6** during operation of the pump **9**.

After the cleaning cycle of the apparatus has been completed the cleaning fluid drains from the tank through the flow control orifice **18** which meters the flow at a

rate such as to allow sediment and the like to settle in the bottom of the tank **4** instead of being flushed into the reservoir **6**.

A plurality of rinse jets **30** are disposed in spaced relationship around the walls of the tank and these rinse jets, which are supplied with rinsing liquid from a separate liquid supply (not shown) through a rinsing valve **32**, are adapted to direct jets of rinsing liquid to any point of the tank so as to rinse a component being treated. Flow from the control orifice is precluded during the rinsing operations by means of a further rinse jet **31** supplied from said separate liquid supply. As shown in FIG. 6, the jet **31** is directed towards the flow control orifice **18** from outside the tank to form a fluid lock therein thereby to prevent rinsing liquid and sedimentation from entering orifice **18**. The rinsing liquid and sedimentation are discharged from the apparatus through a drain **40** provided in the bottom of the tank **4** and communicating with a sewer or the like. The drain valve preferably is a ball valve **42** mounted on a bell crank lever **44** controlled by a hydraulic actuator **46** as shown in FIG. 4. This type of valve unlike a valve having any type of cavity above the sealing member which is liable to malfunction due to plugging thereof by chemicals or sedimentation, even if covered with slit or caked chemical can at all times be opened by the hydraulic actuator. The drain pipe **48** leading from the tank **4** to a disposal channel such as a sewer is provided with a section immediately below the drain valve **42** which tapers toward the outlet in order to ensure that particles entering the valve seat will not be caught therein.

The upper and lower compartments i.e. the tank **4** and reservoir **6**, respectively, may be pressurized. One arrangement for pressurizing the tank and reservoir is shown schematically in FIG. 6. As will be appreciated if the cleaning liquid is heated say to 212° F., a considerable amount of steam will be generated and this has to be exhausted from the apparatus. This steam generation may be reduced by pressurizing the entire casing by means of a small air blower **50** which is mounted against the reservoir **6** and the treatment tank **4** is connected to exhaust by an exhaust duct **51** which duct also forms a pressure regulating orifice controlled by a weighted baffle **52** which is adjustable to vary the pressure. The reservoir and the tank are connected by means of the overflow weir and thus remain at the same pressure and at the same time the pump compartment is provided with a fresh air atmosphere and all corrosive steam is excluded from the cleaning liquid.

In operation of the apparatus the reservoir is loaded with a suitable liquid solvent and the parts to be cleaned are loaded into the tank on the grid **11**.

Thereafter the tank is closed and the cleaning cycle is initiated. To initiate the cleaning cycle, the pump **9** is activated and liquid solvent is transferred from the reservoir **6** to the tank **4**. When the liquid level reaches the upper level control orifice **20**, overflow of liquid through orifice **20** maintains the liquid level in the tank **4** substantially constant. Thereafter during the remainder of the cleaning cycle the cleaning liquid is continuously recirculated between the reservoir and the tank via the pump and the overflow weir. During the cleaning cycle the tank is thus filled to a level such that the component being treated is completely immersed and the cleaning liquid is continuously agitated by the recirculating flow of cleaning liquid through the tank **4**. In this manner the component being treated is subjected to a combined chemical (liquid solvent) and mechanical (liquid agitation) action.

At the end of the cleaning cycle the pump **9** is stopped and the liquid solvent gradually drains through the flow control orifice **18** back to the reservoir **6** at a rate enabling sediment to settle in the bottom of the tank.

Upon completion of the cleaning cycle, the rinse system is activated to direct rinsing liquid onto the component **10** and simultaneously to stop flow from the control orifice **18** by the jet stream from orifice **31** and open the drain valve. The rinsing liquid with entrained sediment flows through the drain to an outside disposal channel, preferably a sewer, and the tank is thus purged of substantially all sediment leaving it clean and ready for treatment of other components.

What is claimed is:

1. Apparatus for cleaning machine parts comprising a lower tank to receive an amount of a liquid cleaning solution, an upper tank to receive parts to be cleaned, a pump having an inlet in communication with said lower tank and an outlet in communication with said upper tank, said pump to deliver the cleaning solution to said upper tank at a predetermined rate of flow, an overflow drain in said upper tank in communication with said lower tank, said overflow drain having a flow capacity greater than the rate of flow delivery by said pump to maintain the level of the cleaning solution in said upper tank at a substantially constant level during operation of said pump, a metering orifice in said upper tank below said overflow drain and discharging into said lower tank, said metering outlet having a flow capacity less than said pump to effect a reduced rate of return of liquid to said lower tank after cessation of operation of said pump with accompanying settling of foreign matter and sediment in the bottom of said upper tank, nozzles disposed to direct rinsing sprays onto the parts in said upper chamber after cessation of operation of said pump, a drain in the bottom of said upper tank, a valve member normally closing and operable to open said drain, and a fluid jet nozzle to direct a counterflow jet steam from externally of said upper tank into said metering orifice to preclude flow therefrom while said valve member is closed.

2. A method of cleaning parts in a cleaning apparatus having an endless cleaning solution circulatory system including a lower reservoir and an upper parts cleaning tank, said method comprising pumping the solution through the circulatory system, maintaining a substantially constant liquid level of the solution in the cleaning tank during the pumping operation, discontinuing the pumping after a predetermined interval, metering the return of the solution from the cleaning tank through a metering orifice emptying into the reservoir at a rate less than the rate of circulation of the cleaning by the pump so as to allow settlement of sediment entrained in the solution in the tank, spray rinsing the parts in the tank and simultaneously precluding flow of liquid solution from the cleaning tank through said metering orifice back to the reservoir by directing a counterflow jet stream from externally of said upper parts cleaning tank into said metering orifice, and then draining the cleaning tank or rinsing fluid and entrained sediment while precluding the draining of the cleaning solution back to the reservoir.

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MORRIS O. WOLK, Primary Examiner

J. T. ZATARGA, Assistant Examiner

U.S. Cl. X.R.

134—34, 95, 99, 104