July 29, 1952 H. B. FECHTER 2,604,895

HOLLOW DEVICE CLEANING APPARATUS EMPLOYING AIR IMPULSED-GENERATED SURGES OF FLOWING LIQUIDS

Filed May 19, 1948 2 SHEETS—SHEET 1

FIG. 1.

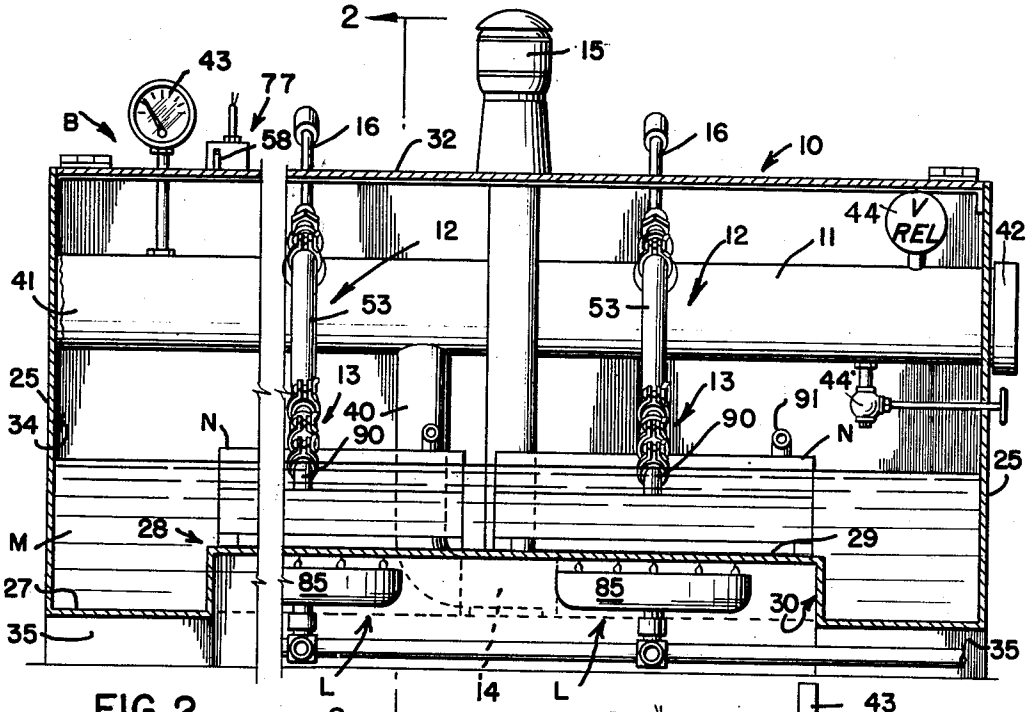
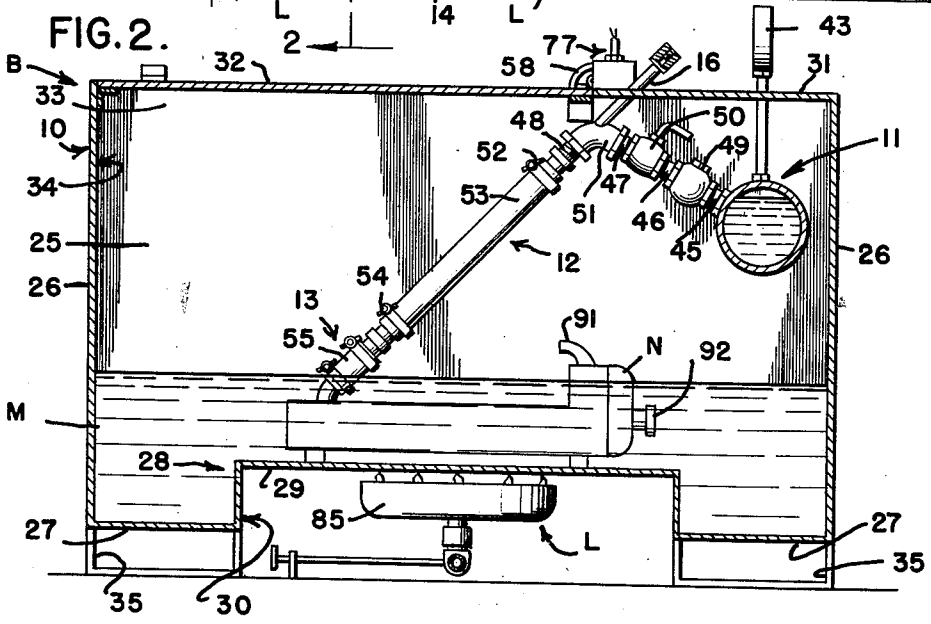


FIG. 2.



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FIG. 3.

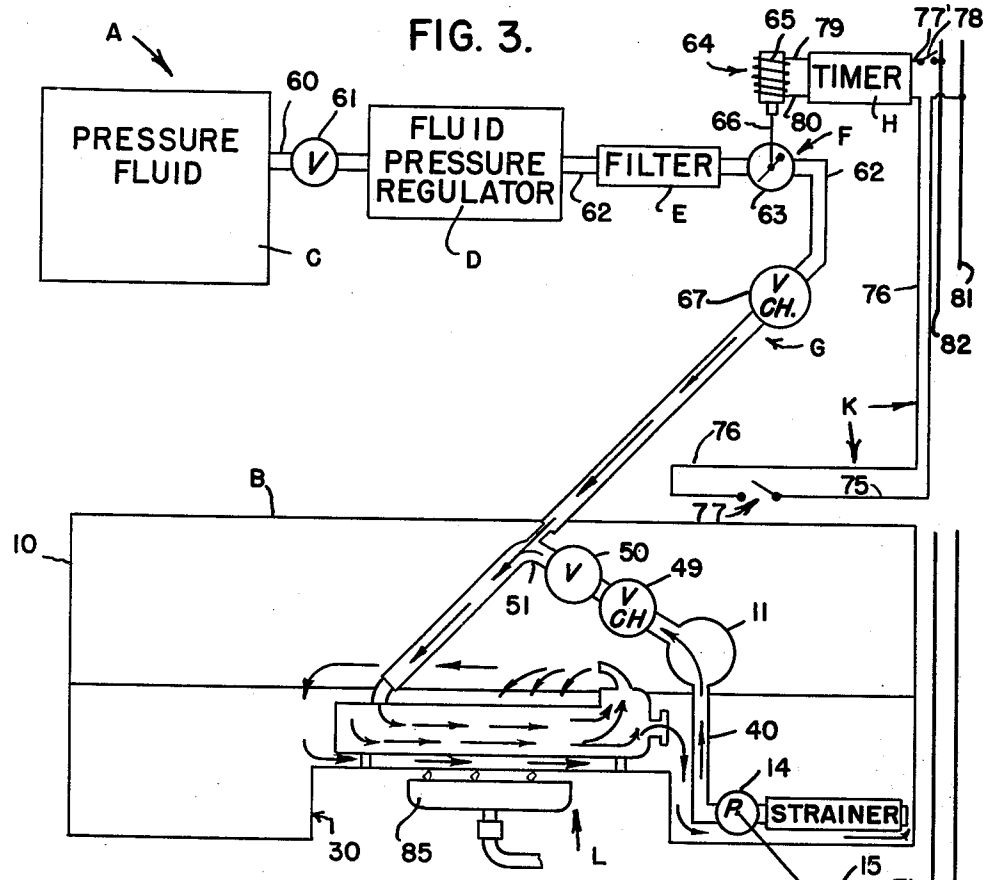


FIG. 4.

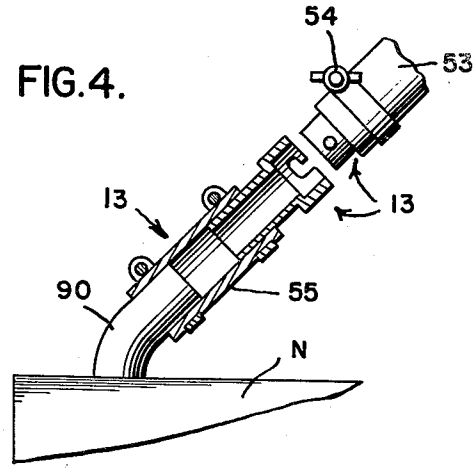
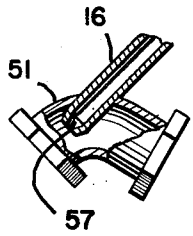


FIG. 5.



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Patented July 29, 1952

2,604,895

UNITED STATES PATENT OFFICE

2,604,895

HOLLOW DEVICE CLEANING APPARATUS EMPLOYING AIR IMPULSE-GENERATED SURGES OF FLOWING LIQUIDS

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Application May 19, 1948, Serial No. 27,934

3 Claims. (Cl. 134—58)

1

This invention relates to cleaning apparatus, and more specifically to apparatus for recycling a cleaning fluid thru a device for cleaning the latter. An example of such an apparatus is one which may be employed to clean automobile radiators, heater cores, oil filters, oil coolers, gasoline tanks and the like.

An important object of the invention is to provide an apparatus of this kind which combines heating, recirculating and agitating the cleaning fluid, whereby the fluid has the maximum opportunity to rid the device of foreign matter.

Another important object is to provide, in an apparatus for cleaning purposes, a cleaning or washing action upon the device to be cleaned, augmented by the provision of means to be able to impart sudden, automatically-controlled and timed air jet impulse shocks to the cleaning fluid.

Still another important object is to provide an apparatus which is speedy, with a continuous cleaning action so that, from the time the device to be cleaned is introduced to the cleaning fluid, to the time it is ready for removal, the cleaning action is continuous.

A further important object is to provide means to cause numerous momentary changes in the direction of flow of cleaning fluid thru the device to be cleaned, as the fluid is surged, and this is accomplished without the use of means to mechanically rock or agitate the device.

Another major object is to combine with liquid cleaning, aeration of the device to be cleaned, all without the formation of air pockets within the device, which might prevent the entrance of cleaning liquid to all accessible parts of the interior of the device.

Because of the varying capacity of the devices being cleaned, a further major object is to provide the operator with a wide range of selectivity of control of the volume of cleaning fluid flowing thru each device being cleaned as well as selective control of the force of the jet impulses.

Other objects and advantages of the invention will be apparent during the course of the following detailed description of the invention, taken in connection with the accompanying drawings, forming a part of this disclosure, and in which drawings:

Fig. 1 is a longitudinal section thru the novel cleaning apparatus of the invention.

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

Fig. 3 is a diagrammatic view of the novel cleaning system, employing the apparatus of Figs. 1 and 2.

Fig. 4 is an enlarged view partly in section, of a coupling means between the new apparatus and a device to be cleaned thereby.

2

Fig. 5 is an enlarged view mostly in section of that portion of the novel apparatus where air and cleaning fluid meet.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of the invention and wherein similar reference characters designate corresponding parts thruout the several views, the letter A designates the novel cleaning system as a whole, including the new cleaning apparatus B, source of pressure fluid C, fluid pressure regulator D, filter means E, electrically-operated shut-off valve structure F, conduit system G in which the various elements B to F inclusive are interposed and which extends to the apparatus B, electric timer G for valve F, electric conductors K, heating means L and cleaning fluid M. There are also shown devices N for cleaning.

The new cleaning apparatus B comprises a housing 10, mounting a main cleaning fluid-supply conduit 11, provided with special conduit means 12 and coupling means 13 to the devices N, pump 14 with operating means 15, and pressure fluid conduit section 16.

The housing 10 may be provided with vertical end walls 25, vertical side walls 26, a bottom wall 27 having an upwardly-stepped central portion 28 providing a support 29 for the devices N being cleaned and a recess 30, exteriorly of the housing, for accommodating portion of the heating means L. There is also a partial top wall 31 and hinged closure 32 for the mouth 33 of the housing 10 which closure 32, with the partial top wall 31, close the upper end of the housing and these several walls and closure 32 define a compartment or chamber 34. Because the bottom wall 27 is stepped, there are portions of the chamber 34 below the horizontal plane of the support 29 for purposes later detailed. The housing is provided with suitable legs 35.

The main, cleaning fluid supply conduit 11 extends longitudinally of and within the housing 10 and its chamber 34, preferably adjacent the top wall 31 and closure 32, being near the rearmost side wall 26, and has an intake section or lateral 40 extending from intermediate its ends to the bottom of the chamber 34 where it is operatively connected with the pump 14. One end 41 of the conduit 11 may be welded to an end wall 25 and its opposite end may be closed by a suitable removable closure 42 to provide for clean out. This conduit 11 may be provided with a conventional pressure gauge 43 exteriorly of the housing 10, a relief valve 44 within the chamber 34, and a by-pass valve 44' opening into the chamber 34 and having a valve handle extending to exteriorly of the housing 10, whereby the operator may open the valve to avoid splash

and provide the operator with means to adjust the fluid pressure in the conduit 11.

There may be a plurality of special conduit means 12 extending from the main conduit 11 in spaced-apart relationship. Each includes a plurality of small conduit sections 45, 46, 47 and 48, with the section 45 opening into the conduit 11 and into a check valve 49; the section 46 extends from the check valve to a shut-off valve 50; the section 47 from the valve 50 to an elbow 51; and the section 48 from the elbow to a connecting means 52 with one end of a flexible conduit 53. At the lower end of the conduit 53 is a connecting means 54 to connect the flexible conduit 53 to one section of a coupling means 13, such as a conventional bayonet slot device, with the other section thereof provided with means 55 to attach it to a convenient portion of the device N. The conduit means 12 preferably extends downwardly and toward the front side wall of the housing 10.

Opening into the elbow 51, as shown in Fig. 5, is one end of the pressure fluid conduit section 16. This end has a restricted outlet 57 preferably disposed intermediate the ends of the elbow and with its axis substantially coincident with the axis of the discharge end opening of the elbow and, since the axis of this opening is also preferably coincident with the axes of the portions 48, 53 and 55 of the means 12, the axis of the outlet 57 is also coincident with these axes.

Any suitable pressure fluid may be provided, such as air or other suitable gas under pressure which may exit from the source C, thru section 60 of conduit system G, in which is interposed a shut-off valve 61 and the section 60 is operatively connected, beyond the valve 61 with laterals, each having a conventional fluid pressure regulator D. Beyond each regulator D is a lateral conduit section 62, with which a regulator D is operatively connected, and in which section 62 are interposed a filter means E and electrically-operated shut-off valve structure F including a flap valve 63 operated by a suitable means, as solenoid 64 having wiring 65 and armature 66 with the latter connected with the valve of the shut-off valve as is well known in the art. Each lateral conduit 62, beyond the valve 63 is provided with a check valve 67, extends to and opens into and is connected with a section 16.

Operatively connected with the solenoid 64 is an electric timer H. The electric wiring or conductors K may comprise, a lead 70 operatively connected with the motor 15, and operatively connected with one of the main heavy-duty (such as 220 volts) conductors 71, a lead 72 operatively connected with the motor 15 and the other main heavy-duty conductor 73 and in which lead 72 is interposed a manually-operated electric switch 74. A lead 75 extends from a 110-volt (or like) conductor 81 to one terminal of the switch 77, a lead 76 from the other terminal thereof extends to a conventional electric timer H with which it is operatively connected as is common in the art. From the 110-volt (or like) conductor 82 a lead 77' extends to the timer H and is also operatively connected therewith, with an electric switch 78 interposed in the lead 77'. From the timer H a lead 79 extends to one end of the wiring 65 of the solenoid 64 and from the other end of this wiring, a lead 80 extends to the timer H.

The heating means L may be a battery of suitable burners 85, disposed in spaced-apart relationship in the recess so that they will heat the support 29.

In use, after one or more devices N are disposed upon the support 29 (if more than one, they may be disposed side-by-side) a suitable volume of cleaning fluid M may be introduced into the chamber 34 thru the mouth 33 to a suitable level depending upon the size and shape of the devices N to be treated. For example, if the devices N are conventional automobile radiators, the level may be approximately that shown in Fig. 2.

The heating means L may then be ignited and the pump 14 started by closing the switch 74, recycling of the cleaning fluid M will then commence. By opening the valve 61 which may then remain open at all times except for shutting off the pressure fluid when making repairs and the like, and closing the switch 78 the flow of pressure fluid will commence and continue, in timed intervals (depending upon the setting of the timer—a conventional timer feature). As a result of the introduction of the air jets into the elbow 51, and in a direction along the longitudinal axis of the downwardly-extending portion of the means 12, the cleaning fluid M will not only flow thru the device N but will be rendered exceedingly turbulent and reach every reachable part of the interior of the device. Moreover, the turbulent fluid will be ejected from the device N under pressure so that it will create a momentary vacuum, causing the cleaning fluid exteriorly of the device N to pass over and around the device with some violence and dislodge foreign matter upon the exterior portions of the device. (The device N is ordinarily raised slightly above the supporting surface, in any approved way). Not only does the air cause this turbulence and vacuum, but the air also assists in aerating the interior of the device N and the cleaning fluid. The turbulence is also of major value in agitating the cleaning fluid so that any undissolved cleaning powder therein will be more apt to become dissolved.

Of course, before introducing the device N into the apparatus B, the coupling means 13 may be separated at the bayonet slot and the lower portion of the means attached to the inlet port 90 (as in Fig. 4) whereupon the device is disposed upon the support and the coupling means 13 connected. Shown too, are ports 91 and 92 which, in this case, are the exhaust ports for the cleaning fluid.

The air regulator valves D permit the operator to individually select a desirable velocity for the jet impulse for each device N.

The switch 77 is so positioned with reference to the hinged side of the closure, that the switch will open when the closure 32 is raised thus causing opening of the circuit to the solenoids 64 and closing of the shut-off valve 63. This closes the latter at once, so that the hazard to the operator of rapidly expanding air is obviated. The closure 32 and switch 77 are operatively connected by the arcuate arm 58. This feature permits insertion and removal of the various devices N by merely closing the valve 50 and reopening it after exhausting selected devices N, while permitting washing in any other devices N without interruption.

From the foregoing it is clear that there is more than a mere flow of cleaning fluid thru the device N, and even more than a recycling of the fluid, since the fluid is introduced under pressure and with turbulence, and is associated with air (so as to take advantage of the oxygen therein) under pressure. The air is not introduced in a steady flow, but in jets, and this tends to cause numerous

momentary changes in the direction of flow of the fluid thru the device N as the fluid is surged thus causing the dislodgment of scale, rust and similar adhering matter. This is, of course, accomplished without the use of mechanical means to rock or agitate the device N and the device is, at all times, flat and immovable during cleaning. If the device were inclined during cleaning, air pockets would be apt to develop, preventing thorough cleaning.

As may be seen, particularly in Figs. 3 and 5, the air jets are not impeded as they leave the opening 57 because of the coinciding axes mentioned, and the full force of the jet is utilized to urge the fluid forward. In fact, the air jets blow the cleaning fluid clear of the interior of the devices N momentarily at each jet impulse.

By providing for the cleaning of a plurality of devices at the same time, there is an economy of time effected and, since there is a wide selectivity of control of the volumes of cleaning fluid and force of the jet impulse to any selected device, devices of various capacities may be accommodated at the same time within the same apparatus.

Various changes may be made to the form of the invention herein shown and described without departing from the spirit of the invention or scope of the claims.

What is claimed is:

1. In a cleaning system for a hollow device having intake and exhaust ports, an open-mouthed housing constructed and arranged to contain a body of cleaning liquid partly filling the chamber of said housing; a hinged closure for the mouth of said housing; means for supporting said device within said housing in a substantially horizontal position; means for cycling and recycling a cleaning liquid thru said device while within said housing and within said liquid and while said closure is open or closed, including a cleaning liquid conduit wholly within said housing and opening into one of said ports; means for injecting a pressure fluid into said conduit at a location within said housing and in the direction of the normal flow of cleaning liquid therethru; means for discontinuing operation of said means for cycling and recycling; electro-mechanical means for intermittently stopping and starting the flow of pressure fluid into said conduit; and electro-mechanical means responsive to the opening of said closure to stop the flow of pressure fluid into said conduit upon opening said closure and while said closure is open.

2. In apparatus for simultaneously cleaning a plurality of hollow devices, each having an intake port and an exhaust port, a housing defining an open-mouthed chamber constructed and arranged to contain a body of cleaning liquid, said housing having a pivoted closure for the mouth of said chamber, said housing including a bottom wall, said bottom wall being provided with means to support a plurality of said devices in a row; means for cycling and recycling said body of cleaning liquid thru said devices while said closure is open or closed, including a horizontally-disposed main liquid supply conduit below said closure, a pump, a lateral extending from the exhaust side of said pump and opening into said conduit and a plurality of spaced-apart, downwardly-extending conduits opening into said main conduit and extending downwardly to said hollow devices; means carried by each of said downwardly-extending conduits to detachably secure a hollow device to its adjacent downwardly-extending conduit; an air-jet nipple for each downwardly-extending conduit, with the discharge mouth of said nipple within its downwardly-extending conduit; an air-pressure conduit extending from the intake end of each nipple; means to inject pressure fluid into said air pressure conduit; means responsive to the opening of said closure to place said last named means out of operation when said closure is being opened or is open; and selective means to render said means for cycling and recycling inoperative, whereby cleaning liquid ceases to flow through a selected device within said apparatus.

3. Apparatus for simultaneously cleaning a plurality of hollow devices, each having an intake port and an exhaust port, a housing defining an open-mouthed chamber constructed and arranged to contain a body of cleaning liquid, said housing having a pivoted closure for the mouth of said chamber, said housing including a bottom wall, said bottom wall being provided with means to support a plurality of said devices in a row; means for cycling and recycling said body of cleaning liquid thru said devices while said closure is open or closed, including a horizontally-disposed main liquid supply conduit below said closure, a pump, a lateral extending from the exhaust side of said pump and opening into said conduit and a plurality of spaced-apart, downwardly-extending conduits opening into said main conduit and extending downwardly to said hollow devices; means carried by each of said downwardly-extending conduits to detachably secure a hollow device to its adjacent downwardly-extending conduit; an air-jet nipple for each downwardly-extending conduit, with the discharge mouth of said nipple within its downwardly-extending conduit; an air-pressure conduit extending from the intake end of each nipple; means to inject pressure fluid into said air pressure conduit; means responsive to the opening of said closure to place said last named means out of operation when said closure is being opened or is open; and means to selectively open and close the passageway through each of said downwardly-extending conduits, whereby cleaning liquid ceases to flow through a selected device within said apparatus.

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