

Sept. 26, 1944.

J. E. MARTIN

2,359,138

APPARATUS FOR CLEANING MATERIALS

Original Filed Aug. 16, 1940 7 Sheets-Sheet 1

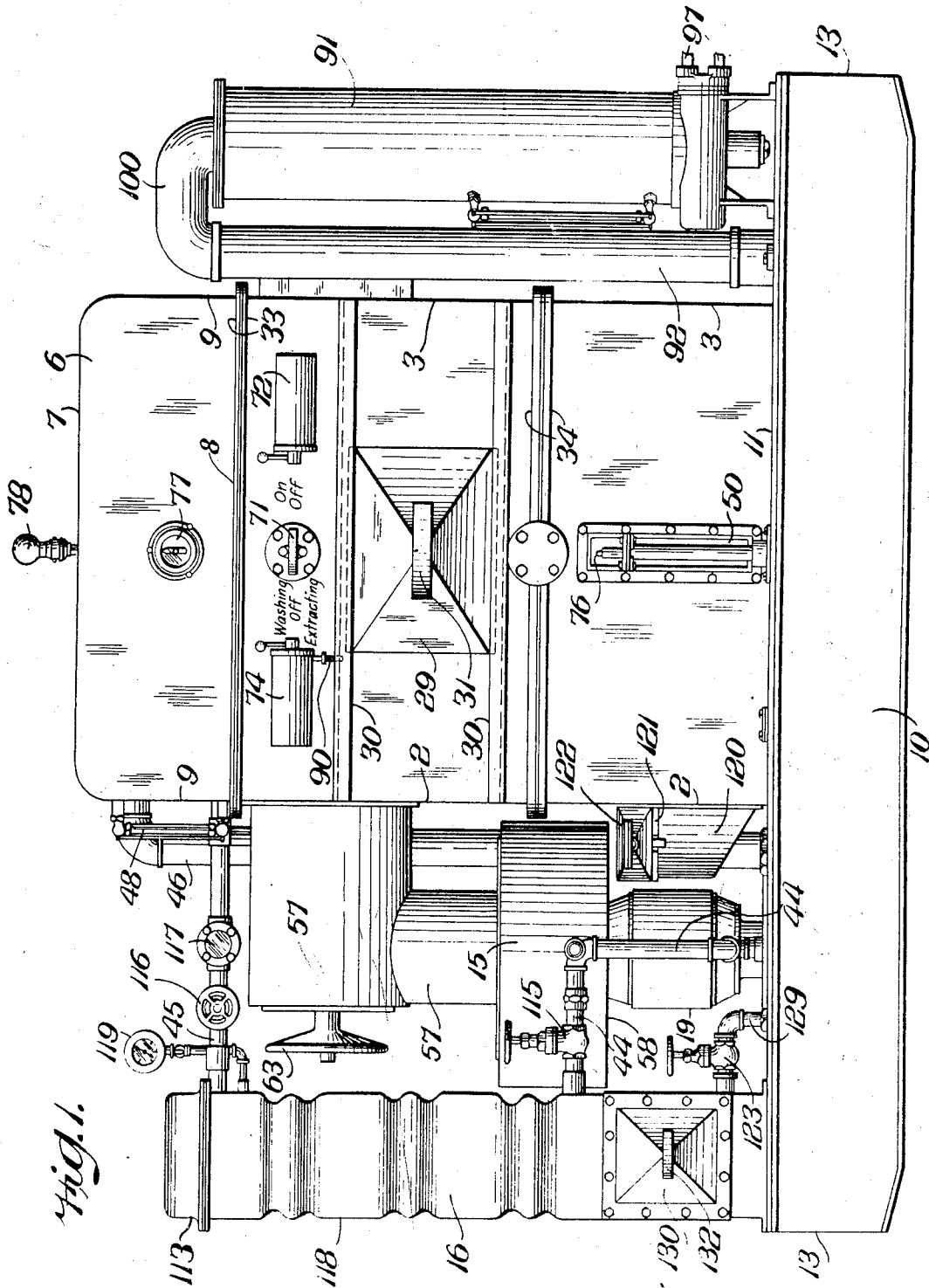


Fig. 1.

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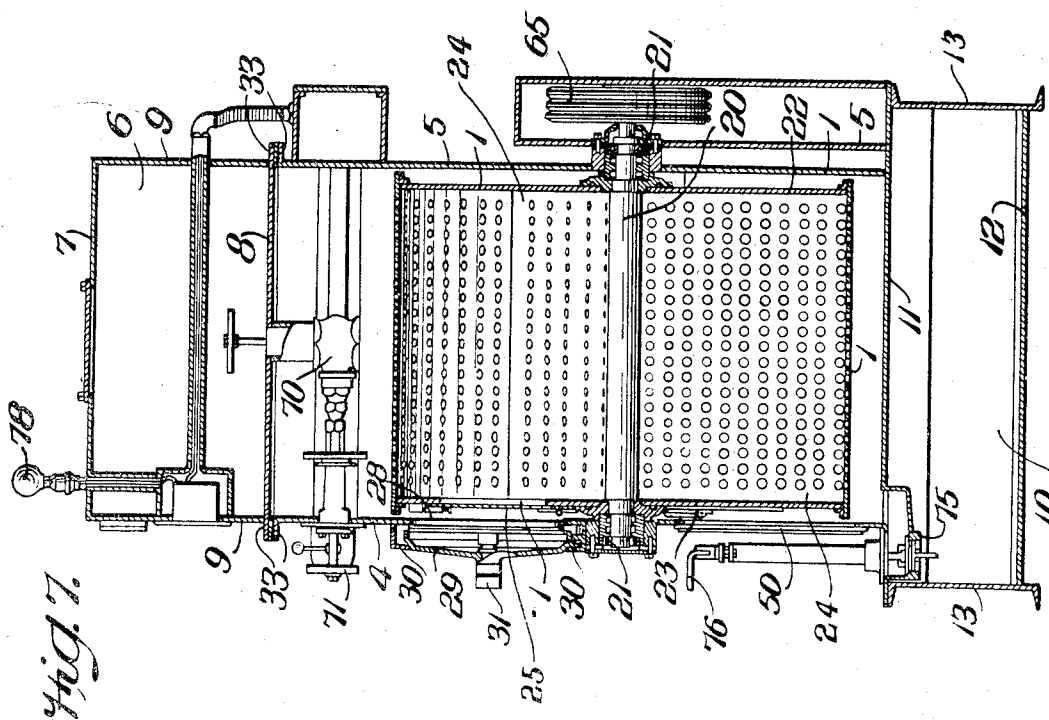
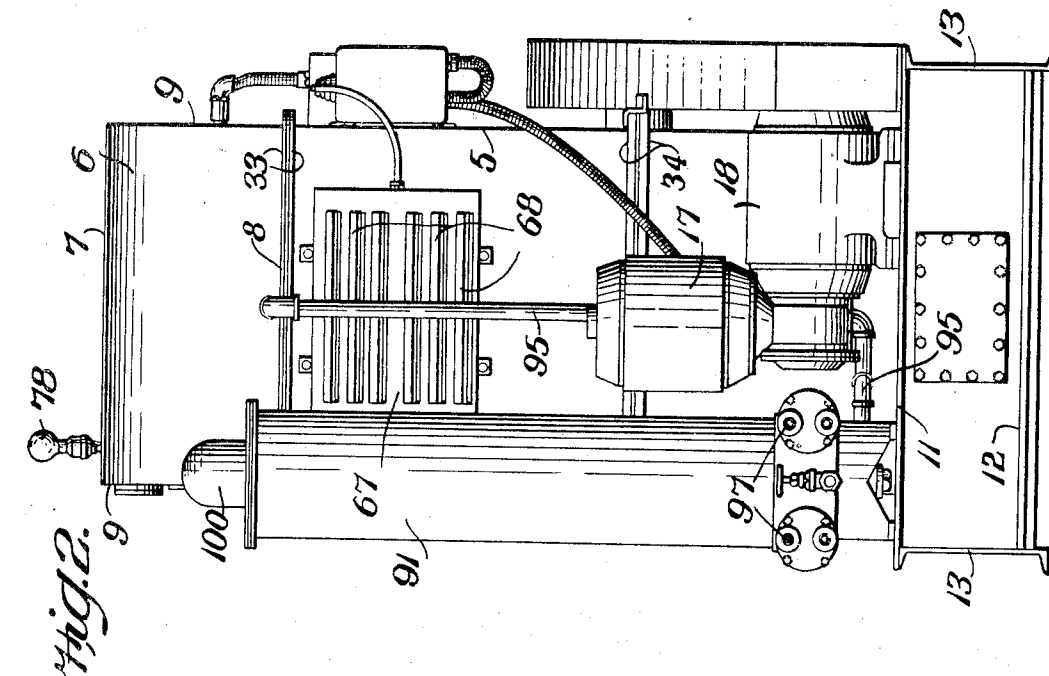
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APPARATUS FOR CLEANING MATERIALS

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7 Sheets-Sheet 2



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APPARATUS FOR CLEANING MATERIALS

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7 Sheets-Sheet 3

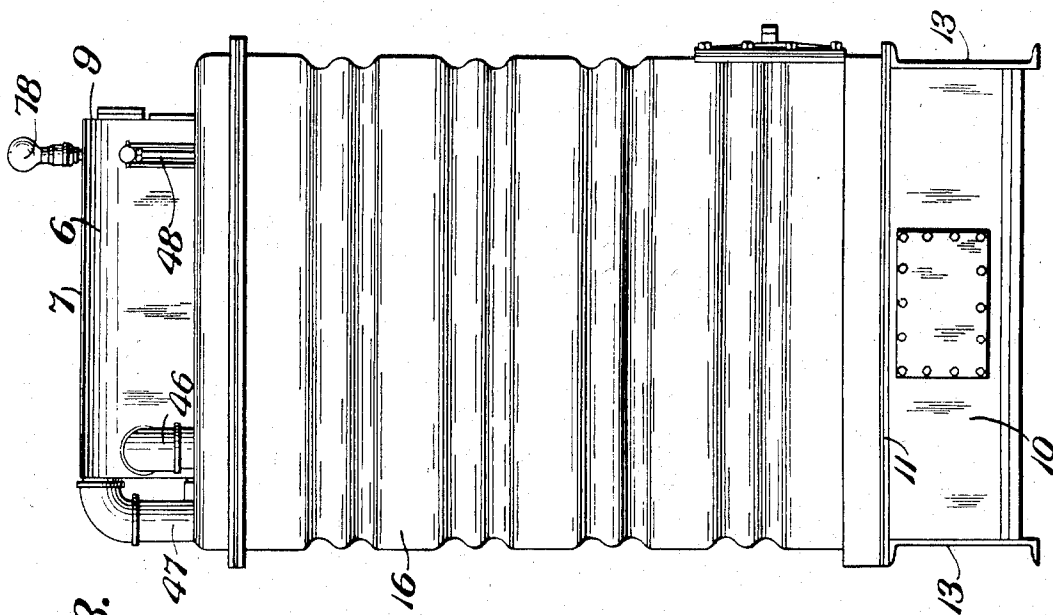


Fig. 3.

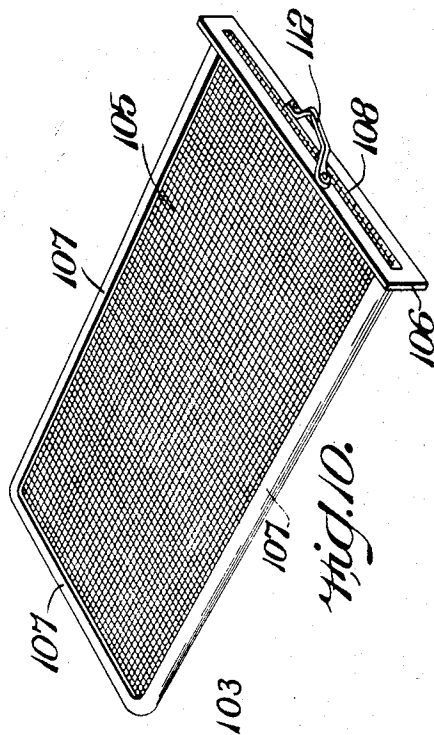


Fig. 10.

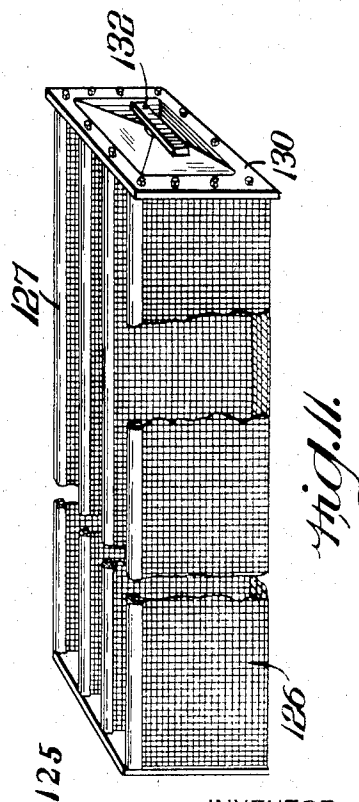


Fig. 11.

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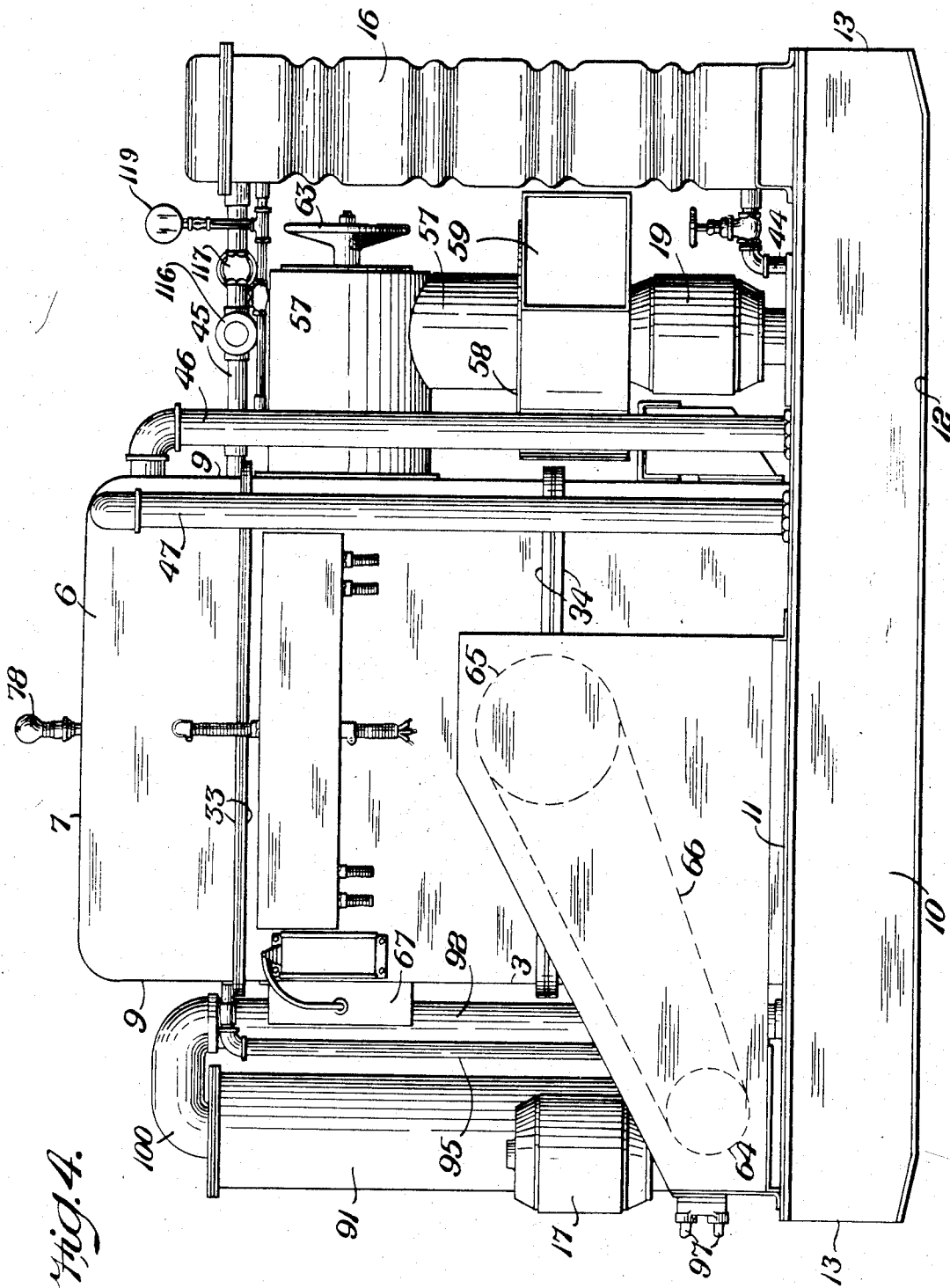
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APPARATUS FOR CLEANING MATERIALS

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7 Sheets-Sheet 4



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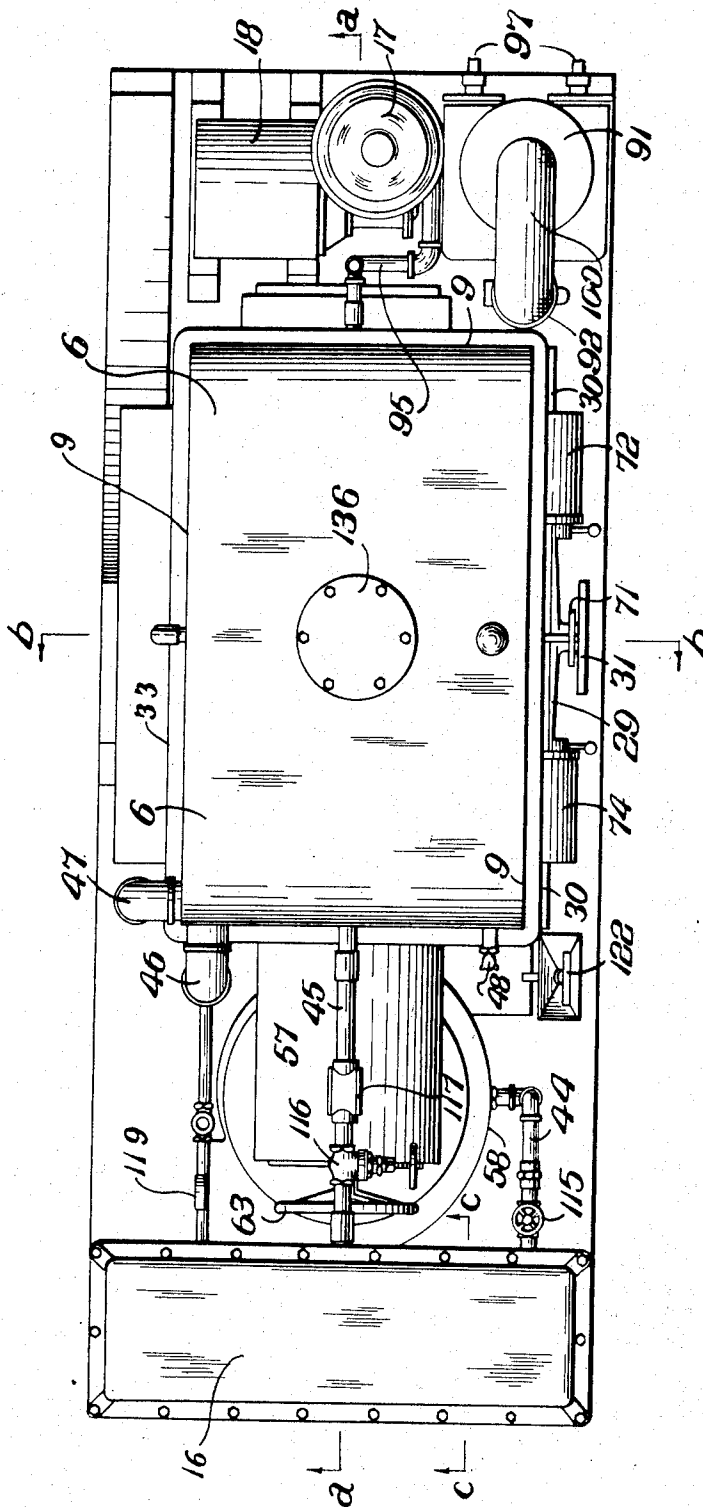
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Fig. 5.



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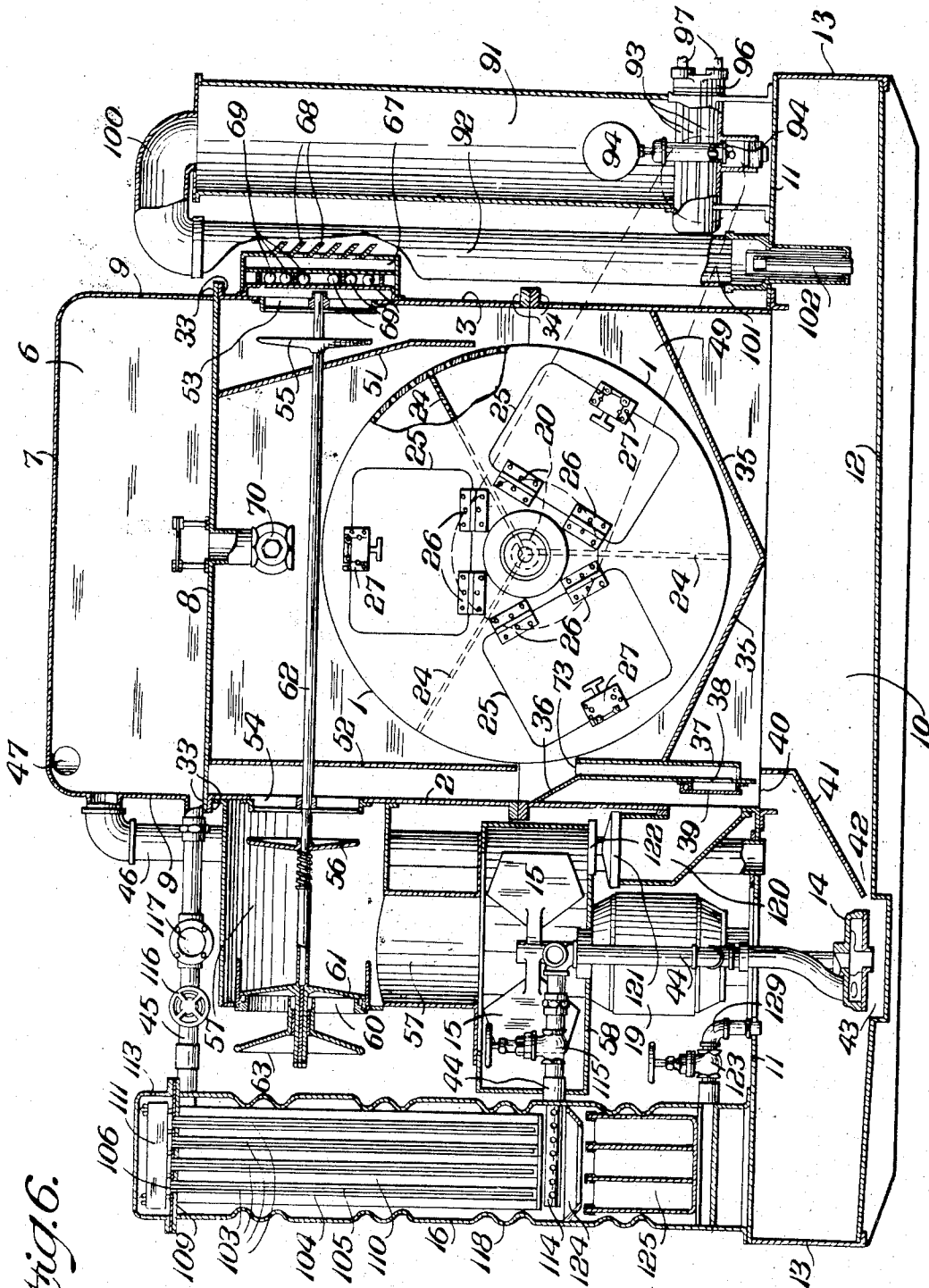


Fig. 6.

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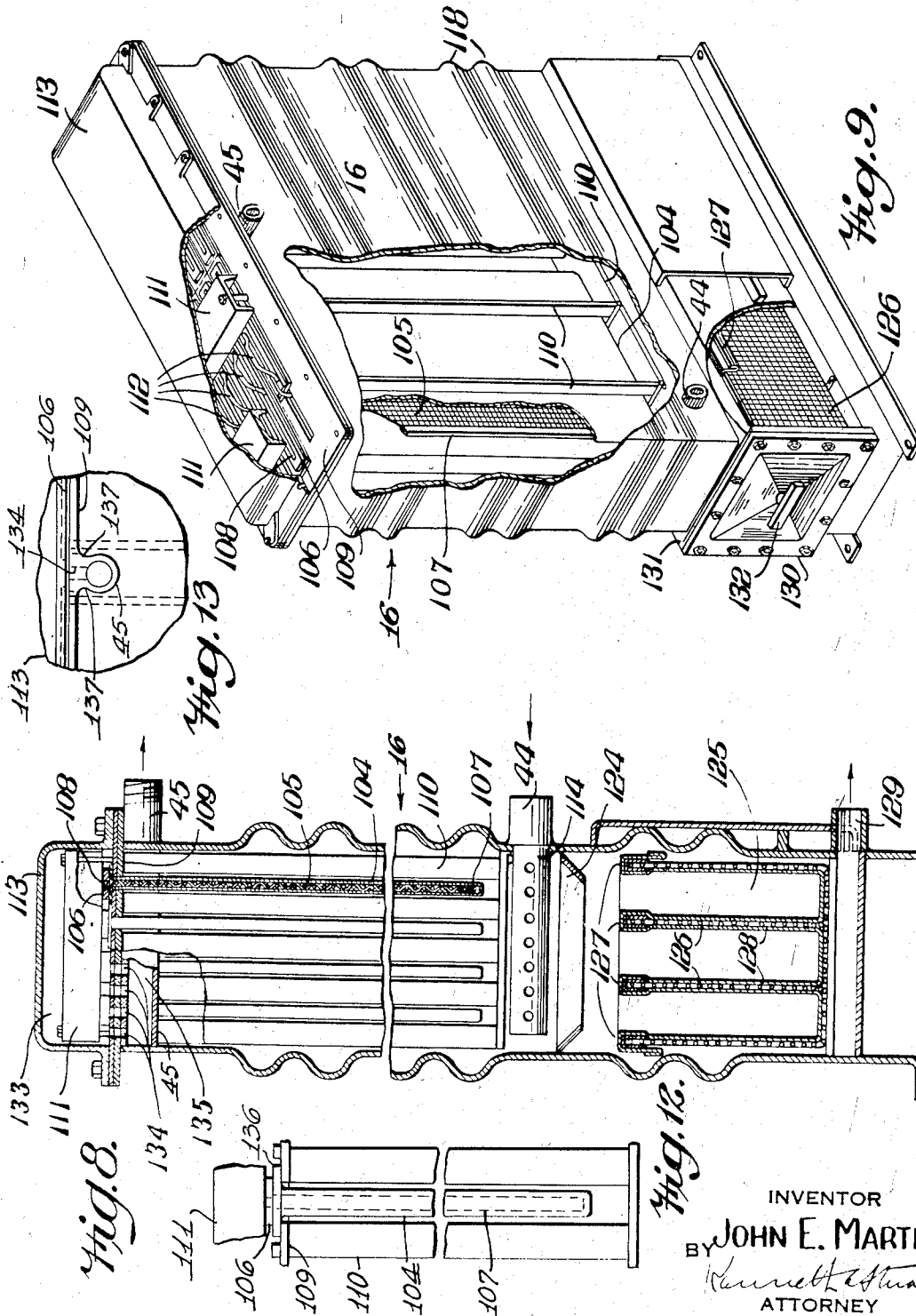
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APPARATUS FOR CLEANING MATERIALS

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UNITED STATES PATENT OFFICE

2,359,138

APPARATUS FOR CLEANING MATERIALS

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Original application August 16, 1940, Serial No. 352,923. Divided and this application November 22, 1941, Serial No. 420,137

4 Claims. (Cl. 68—18)

My invention relates more particularly to apparatus for cleaning fabrics, such as clothing, by subjecting them to the action of solvents such as volatile solvents.

The object of my invention is to provide a simple, compact, self-contained apparatus comprising a cleaning element, a drying element, a deodorizing element, and a filtering element for the solvent.

This application is a division of my application Serial No. 352,923, filed August 16, 1940 (later eventuating in Pat. No. 2,328,565, issued September 7, 1943).

Referring to the drawings:

Fig. 1 is a front elevation of my apparatus.

Fig. 2 is an end elevation of my apparatus seen from the distilling end or right side in Fig. 1.

Fig. 3 is an end elevation of my apparatus seen from the filtering end or left side in Fig. 1.

Fig. 4 is a rear elevation.

Fig. 5 is a plan view.

Fig. 6 is a front elevation in section along line a-a of Fig. 5.

Fig. 7 is an end elevation in section along line b-b of Fig. 5, seen from the right end in Fig. 1.

Fig. 8 is a sectional elevation of the filter along the line c-c of Fig. 5.

Fig. 9 is a perspective view of the filter assembly, partly broken away to show the interior construction.

Fig. 10 is a perspective view of one of the filter leaves.

Fig. 11 is a perspective view of the sludge drawer which forms part of the filter element.

Fig. 12 is an elevational view, to an enlarged scale, of one of the filtering units, comprising a filter leaf and its enclosing filter bag, in position in the housing, with the front wall of the housing removed to reveal the unit.

Fig. 13 is a side elevation of a part of the filter housing, showing the exit pipe and its relation to the rest of the filter element.

Referring to Figs. 1 to 7:

The cleaning and drying assembly comprises washing cylinder 1 in its housing 2, 3, 4, 5; overhead solvent reservoir 6 comprising top 7, bottom 8 and walls 9; underneath solvent receiving and storage tank 10, comprising top 11, bottom 12 and walls 13; solvent pump 14; blower 15; filter 16; motors 17 and 18 which drive washing cylinder 1 at low and high speed respectively, and motor 19, which drives pump 14 and blower 15.

Washing cylinder 1 is mounted on shaft 20, extending transversely of the housing, i. e., front

to rear, and supported at its ends by bearings 21, which are carried by front and rear walls 4 and 5 of the housing. Between the ends of washing cylinder 1 and walls 4 and 5 the clearance is sufficient to avoid rubbing but not to permit free flow of air to the blower 15. The cylindrical shell of washing cylinder 1 is perforate. Its rear end is closed by plate 22. Its front end is closed by plate 23, through which openings are provided for introduction and withdrawal of the materials to be cleaned. The interior of the washing cylinder is divided by radial partitions 24 into compartments, preferably three in number. An opening is provided in end plate 23 to give access to each compartment. These openings are normally closed by doors 25, hinged at 26 and provided with means 27 for securely locking them. Registering with doors 25, one at a time, when the door is in the position of the uppermost door shown in Fig. 6, is an opening 28 through front wall 4 of the housing. Opening 28 is normally closed by door 29, sliding in guides 30. Door 29 may be securely locked by turning its handle 31, so as to form a vapor tight closure with front wall 4 of the housing.

Reservoir 6 is secured to housing 2, 3, 4, 5 by flanges 33. The housing is divided by flanges 34 into upper and lower sections, the latter of which is preferably welded to top plate 11 of tank 10. Housing 2, 3, 4, 5, is provided with a V bottom formed by plates 35, making an obtuse angle with each other. The apex of the V lies directly beneath the axis of the washing cylinder and is parallel therewith. At the left side of the lower section of the housing are two vertical baffles 36, 37, parallel with each other and with side wall 2. The space between baffles 36 and 37 forms a passage which is open at the top but closed at the bottom except for passage 38. Solvent may flow freely outward through passage 38, but reverse flow is prevented by check valve 39. Solvent issuing through check valve 39 is delivered through passage 40 into tank 10. Tank 10 is divided by baffle 41 into two compartments, which however are in free communication with each other through passage 42. The compartment to the left of baffle 41 houses pump 14, the intake of which dips into sump 43. Pump 14 delivers through pipe 44 to filter 16. The filtered solvent returns through pipe 45 to reservoir 6 from which overflow pipe 46 permits excess solvent to return to tank 10. Reservoir 6 is also vented to tank 10 above the liquid level in both tanks by means of pipe 47. Reservoir 6 is provided with sight glass 48 (Fig. 3) by means of

which the level of the solvent within it can be noted.

The upper edge of baffle 37 stops short of the level of flange 34. From the level of the upper edge of baffle 37 the lower section of the housing forms a vat 49 for solvent, into which the washing cylinder dips for about one-third of its diameter.

Glass window 50 is provided for observation of the liquid level and circulation within housing 2, 3, 4, 5 and more particularly within vat 49 just referred to.

The upper section of housing 2, 3, 4, 5 is provided with baffles 51 and 52, one at each side of washing cylinder 1. Between the lower edges of these baffles and the cylinder the clearance is sufficient to avoid rubbing, but insufficient to permit free flow of air.

Through walls 2 and 3 of the housing are circular openings 53 and 54, adapted to be closed by dampers 55, 56 respectively. Opening 54 communicates through air duct 57 with the intake of blower 15, this blower being housed in scroll 58 and delivering air through discharge opening 59 (Fig. 4) which is preferably of rectangular cross section.

Opposite opening 54, in the wall of air duct 57 is a similar opening 60, adapted to be closed by damper 61. Movement of dampers 55, 56 and 61 to the right in Fig. 6 closes passages 53 and 54 and opens passage 60. These dampers are mounted on a common shaft 62 actuated through a screw thread (not shown) by hand wheel 63.

Registering with opening 53 in wall 39 of the housing is ozonizer 67, which is provided with inlet shutters 68 and ozonizer tubes 69.

Washing cylinder 1 is driven through driving pulley 64, driven pulley 65 and belt 66 at high speed by motor 18, or, alternatively, at low speed by motor 17, which drives through motor 18 and an overdrive clutch. When motor 18 is driving, motor 17 is disconnected by the overdrive clutch and does not turn.

The operation of the apparatus is as follows:

When door 29 has been slid back to the open position the compartments of the washing cylinder are opened one by one and each compartment loaded with material to be cleaned, care being exercised to load all the compartments with approximately equal weights. Door 29 is then closed and locked and valve 70 opened by turning handle 71. With the dampers 55, 56 and 61 in the alternative position to that shown in Fig. 6, in which position openings 53 and 54 are closed and opening 60 open, motor 19 is started by moving switch 72 to the "on" position as in Fig. 1. This causes pump 14 to raise solvent from tank 10 through filter 16 to reservoir 6, whence it flows by gravity through valve 70 into housing 2, 3, 4, 5, delivering against the perforate shell of the cylinder and passing through it to the vat 49 at the bottom of the housing. Vat 49 becomes quickly filled with solvent which overflows by passage 73 to tank 10. Motor 17 is then started by moving switch 74 into the "washing" position shown in Fig. 1. This causes washing cylinder 1 to revolve at slow speed (preferably about 28 revolutions per minute). During this operation the materials in the compartments of cylinder 1 are alternately immersed in solvent in vat 49 and then, as the compartment moves to the top position, rinsed by a heavy flow of clean filtered solvent flowing through valve 70. The materials are therefore soaked and rinsed with freshly filtered solvent

many times a minute and thus cleaned more effectively, and in a shorter time, than if merely soaked in the solvent without rinsing or rinsed without soaking, in accordance with the practice of the prior art.

When the materials to be washed have been subjected to this treatment for a sufficient time, which usually amounts to about 5 minutes, valve 70 is closed and valve 75, Fig. 7, opened, by shifting handle 76, draining all the solvent from vat 49 back into tank 10. Motor 17 is then stopped by moving switch 74 into the "off" position and motor 18 started by moving switch 74 into the straight down or "extracting" position. The washing cylinder is thus spun at high speed (e. g., about 860 revolutions per minute) and the materials within it centrifuged, thus extracting from them in about 5 minutes all the solvent that can be removed in this way. Dampers 55, 56 and 61 are then shifted to the position shown in Fig. 6 and air drawn through the ozonizer, passage 53, the materials in the cylinder, passage 54, and air duct 57, to blower 15, whence it is discharged through opening 59, which is connected through air ducts not shown to the outer atmosphere. With the blower drawing air through the materials in the washing cylinder, these materials are dried in about four minutes.

It should be noted that the solvent is continuously filtered during the washing operation.

During intermissions in the washing operation, as for example during the lunch hour or after a day's work, the solvent may be distilled, by means illustrated in Figs. 1, 2 and 4 to 6. For this purpose the solvent is first pumped up by means of pump 14, operated as before described, until reservoir 6 is filled to the level of the overflow, at which level it holds about one-half of the entire charge of solvent. From reservoir 6 the solvent is allowed to return by gravity through pipe 95 and float valve 94, to still 91, where it is vaporized by the heat of steam admitted to coils 93 through pipes 97, the vapors passing through pipe 100 to condenser 92 and condensed in condenser tubes 101, the condensate returning through trap 102 to tank 10, all of which takes place without supervision.

Make up solvent is introduced to the apparatus by removing hand hole cover 136 (Fig. 5).

The mechanical details of the washer, ozonizer, and still and their cooperation and method of use form no part of the present invention, but, in so far as they are novel, are claimed in the parent application above referred to, and divisional application Serial No. 420,138, filed simultaneously herewith.

Referring to Figs. 6, 8, 10, 11, 12 and 13:

These figures illustrate the filter and its accessories. The filtering unit 103 removed from the rest of the assembly is illustrated in perspective in Fig. 10. This comprises a filter bag 104 of woven fabric, preferably cotton, adapted to be slipped over a steel supporting structure. The latter consists of a rectangular sheet of wire screen 105, heavy enough to be fairly rigid. The edge of the screen at one end is let into a slot extending through a plate 106, to which the screen is welded. Plate 106 is wider than the screen and longer than the screen is wide, so that it forms a flange at one end of the screen. The other three edges of the screen are capped by a thin strip of metal 107 which is folded over the edges of the screen and extends a short distance down each side. The purpose of this strip is to protect the filter bag from being punctured

by the ends of the wires of the screen. The mesh of the screen itself affords passage for liquid that has passed through the filter bag. The liquid thus finds its way to the flange end of the filter unit, where it passes out through slot 108. Eight of these filter units are mounted in two banks of four each. The units of each bank are parallel to each other. They are supported by plate 109 which is slotted to permit each unit to drop into its position. The filter elements are spaced by steel frame 110. Filter bag 104 is flared outward beneath plate 106 so as to form a gasket 136 (Fig. 12) between it and plate 109. The plates 106 of the filter units are clamped against plate 109, with the flare of the filter bag between, so as to make a liquid tight joint therewith, by yokes 111. In Figs. 8 and 9 yoke 111 is partly broken away better to show adjacent parts. Each filter unit 103 is provided with a handle 112 by which it may be lifted out when yokes 111 are removed. The whole assembly of filter units is covered over by cover member 113. The flow of solvent is therefore through slots 108 to the space 133 beneath cover 113. From here the solvent returns through holes 134 to compartment 135, with which exit pipe 45 is in communication. Compartment 135 is preferably placed between the two banks of filter units, which is not the plane of the section of Fig. 8. The intervening parts are therefore broken away to show some of the holes 134, as well as a part of compartment 135, in longitudinal section compartment 135 is formed by merely extending pipe 45 through one wall of the filter housing, welding it tangentially to the lower surface of plate 109 along seams 137, closing off its end and drilling holes 134 through plate 109 and the contiguous wall of pipe 45, between the two welded seams, as shown in Fig. 13.

It should be noted that because of the fact that exit pipe 45 is connected to housing 118 below the flange of cover 113 this cover can be removed without disconnecting the pipe. The inflow of solvent is through pipe 44, which terminates in perforated nozzle 114. The discharge from the filter is through pipe 45. Shut-off valves 115 and 116 are provided in pipes 44 and 45 respectively for use when it becomes necessary to disassemble the filter. Sight glass 117 is provided in pipe 45 in order that the flow of solvent from the filter may be observed.

The side walls of the filter housing 118 are made corrugated, as these walls are liable to be subjected to a pressure of as much as 15 pounds per sq. in. However, cover 113 and the flanged joint which it makes with filter housing 118, being on the low pressure side of the filter elements, is never subjected to a pressure of more than 3 pounds per sq. in. Gauge 119 is provided in order to show by the back pressure when the filter needs cleaning.

Filter bag 104 is not the filtering medium but only the support for it. The actual filtering medium is a layer of finely divided inert material, such as infusorial earth or "filter-aid," with which the bag becomes coated. This material is introduced into the solvent through hopper 120, by opening cover 121 which is normally locked by handle 122. Through hopper 120 the filtering material is delivered to the stream of solvent at the intake to pump 14. In this way it is quickly deposited on the filter bag.

When the filter has become much clogged with foreign matter this fact is evidenced by a rise in back pressure, as shown by gauge 119. To

remedy this situation, during an interval between washing operations the solvent is pumped up into reservoir 6. Valve 115 is then shut off and valve 123 opened. The solvent flowing in the reverse direction through the filter by gravity then dislodges the cake of filter-aid or other filtering material which carries the foreign matter. This cake breaks off from the surface of the filter bags in pieces. These are caught by hopper 124 and directed into sludge drawer 125. This drawer is illustrated in perspective in Fig. 11. It is constructed in the form of an elongated box, with four side walls and two longitudinal partitions. The side walls are of a construction similar to that of filter element 103. That is to say, they are of wire screen 126 with edges covered by strips of metal 127, the whole being covered with fabric 128 similar to that used in the filter bags themselves. Therefore when the flow is reversed, the pieces of filter cake are caught in the sludge drawer, while the solvent passes through and returns by pipe 129 to tank 10. The purpose of the longitudinal partitions is to increase the surface through which the solvent may percolate in its reverse flow. During the normal operation of the apparatus the sludge drawer is closed, its flange 130 being bolted to flange 131 of the main filter body 118 so as to make a liquid-tight joint therewith. After the filter cake has been dislodged and caught in sludge drawer 125, and all the solvent returned to tank 10, the sludge drawer is unbolted, withdrawn by means of handle 132 and emptied.

It should be noted that in the normal operation of the filter just described, the solvent first fills sludge drawer 125 and the liquid level then rises until the entire housing below cover 113 is completely filled and every part of the filter surface is utilized; whereas if the flow were downward by gravity, which is common practice, the lower parts of the filter surface would be the most active and the upper parts would never become properly coated with filter-aid nor properly cleansed when the flow was reversed.

Many modifications of my apparatus within the scope of the invention will suggest themselves to any person skilled in the art. I do not, therefore, wish to be limited to the exact mechanical details illustrated.

I claim as my invention:

1. A cleaning apparatus comprising a vat adapted to receive materials to be cleaned and provided with an overflow, a reservoir adapted to deliver cleaning liquid by gravity to the vat, a tank adapted to receive by gravity cleaning liquid overflowing from the vat, a pressure tight filter for cleaning liquid, a pressure tight compartment beneath the filter adapted to receive and trap solids dislodged therefrom and to empty filtrate therefrom into the tank, a valve adapted when closed to prevent flow from the compartment to the tank, conduit and pump means adapted when the valve is closed to deliver cleaning liquid from the tank to and force it through the filter, normally unobstructed conduit means adapted to deliver the cleaning liquid from the filter to the reservoir and alternatively drain the reservoir back through the filter, and means for removing from the compartment solids dislodged from the filter by gravity flow of cleaning liquid therethrough from the reservoir to the tank when the valve is open and the pump inoperative.

2. In a filter comprising top, bottom and side

walls adapted to constitute a pressure-tight housing, one of the walls being flat and provided with an elongated opening therethrough; a plate adapted to form a closure for the opening and having a narrow slot extending therethrough; a flat rectangular sheet of woven wire screen constituting a filter leaf and having one of its edges projecting into the slot and affixed thereto and its other three edges covered by a molding presenting a smoothly rounded surface, the molding being butted against and affixed to the surface of the plate; a bag of filter fabric adapted completely to cover and enclose the molding and filter leaf, constituting therewith a filter unit, the bag having its mouth provided with a flange adapted to bear against the inner surface of the plate; means for demountably clamping the inner surface of the plate against the outer surface of the wall, with the filter unit projecting through the opening into the housing and the flange of the filter bag forming a gasket between the plate and wall; means for supplying liquid to be filtered to the housing and forcing it through the filter fabric and mesh of the filter leaf and out through the slot; and means for conveying away the filtered liquid issuing through the slot.

3. A filter comprising top, bottom and side walls adapted to constitute a pressure-tight housing, one of the walls being flat and provided with an elongated opening therethrough; a filter unit adapted to project into the housing through the opening and having a flanged delivery end adapted to form a closure for the opening external to the housing; a passage through the wall having an inlet adjacent the flanged delivery end of the filter unit; a cover adapted to

be clamped against the wall and form a pressure-tight enclosure for the inlet and flanged delivery end of the filter unit; means for supplying liquid to be filtered to the housing and forcing it through the filter unit and out through its flanged delivery end into the enclosure; and a pressure-tight conduit entering the housing through another wall thereof and communicating with the inner end of the passage and adapted to convey away filtered liquid issuing from the filter unit into the enclosure and thence through the passage to the conduit.

4. A filter comprising top, bottom and side walls adapted to constitute a pressure-tight housing, one of the walls being flat and provided with an elongated opening therethrough; a filter unit adapted to project through the opening into the housing and having a flanged delivery end adapted to form a closure for the opening external to the housing; a passage through the wall having an inlet adjacent the flanged delivery end of the filter unit; a cover adapted to be clamped against the wall and form a pressure-tight enclosure for the inlet and flanged delivery end of the filter unit; means for supplying liquid to be filtered to the housing and forcing it through the filter unit and out through its flanged delivery end into the enclosure; a compartment within the housing communicating with the inner end of the passage; and a pressure-tight conduit communicating with the compartment through another wall of the housing and adapted to convey away filtered liquid issuing from the filter into the enclosure and thence through the passage and compartment to the conduit.

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