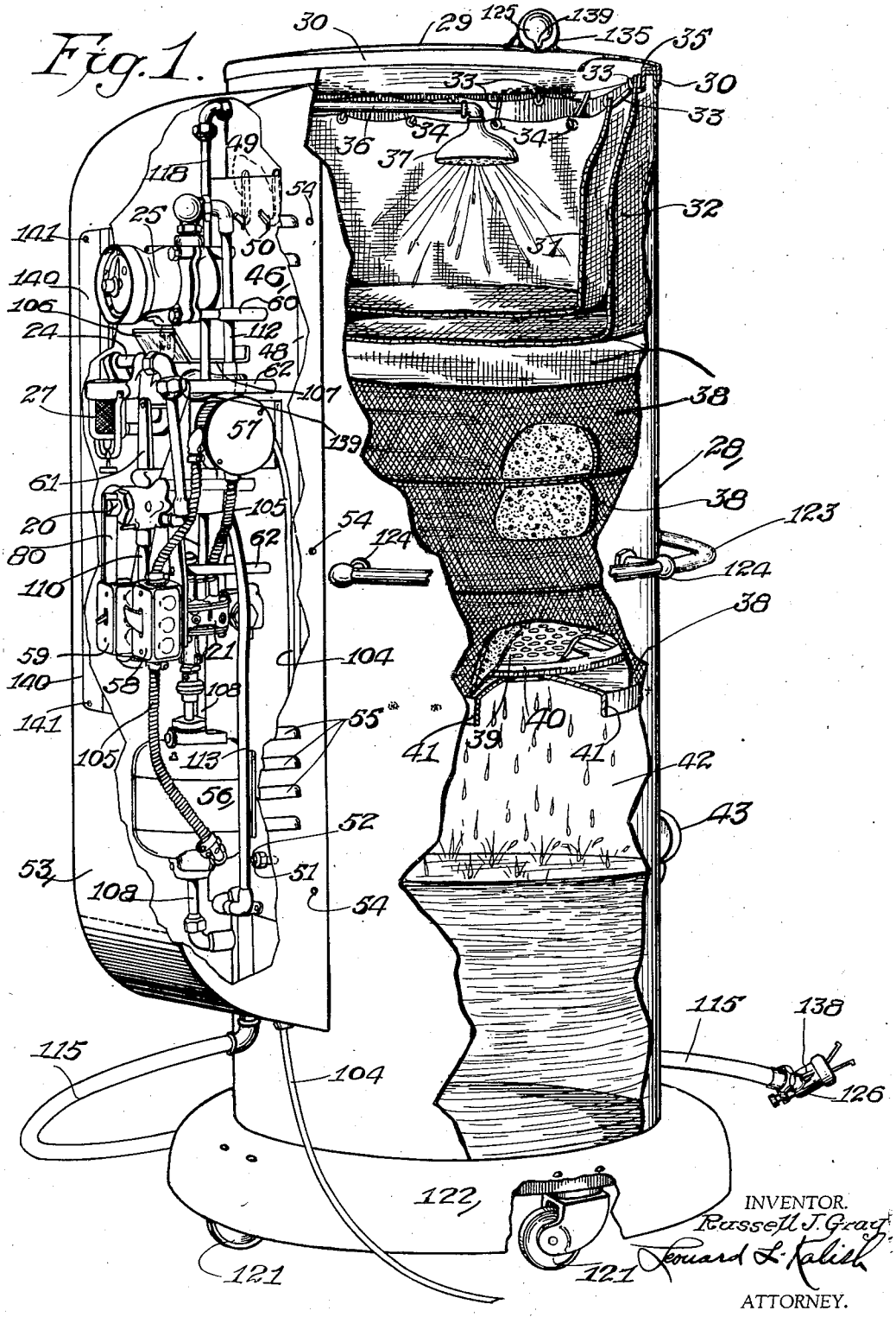
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APPARATUS FOR CLEANING AUTOMOBILE ENGINES

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Fig. 1.



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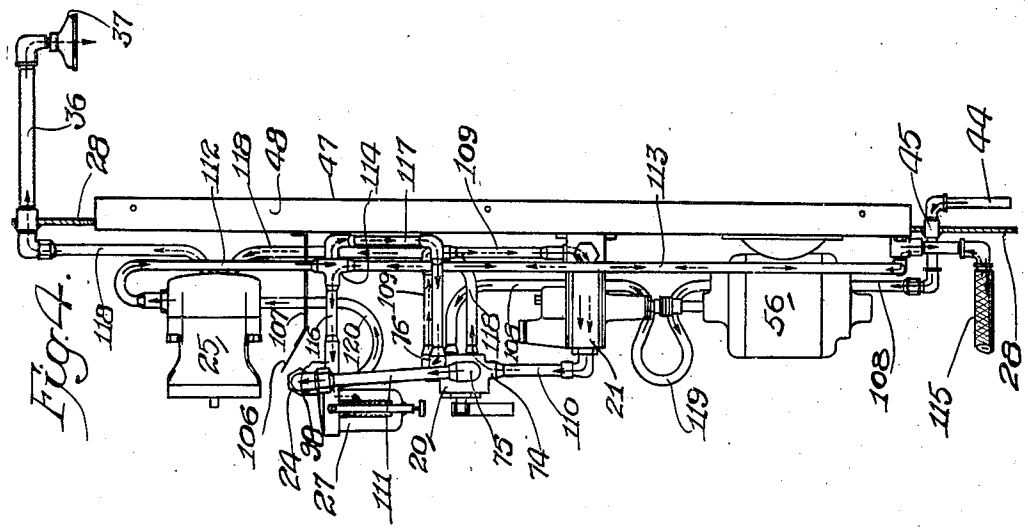


Fig. 4.

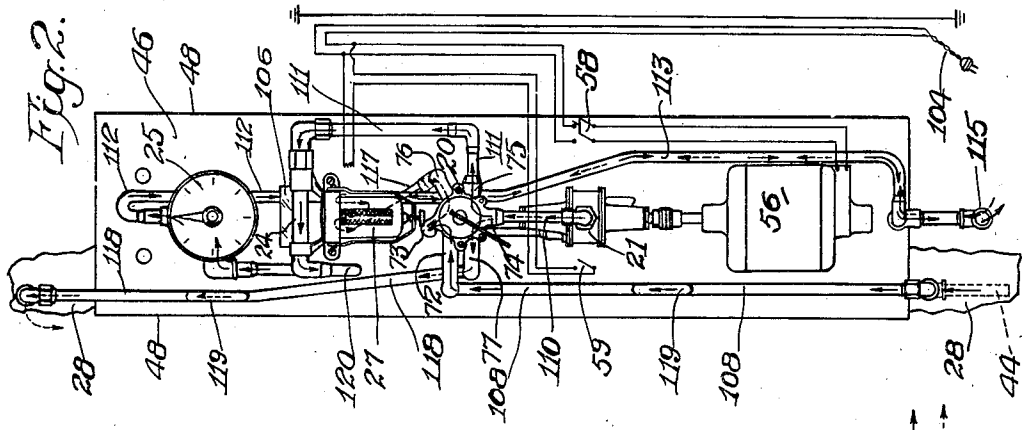


Fig. 2.

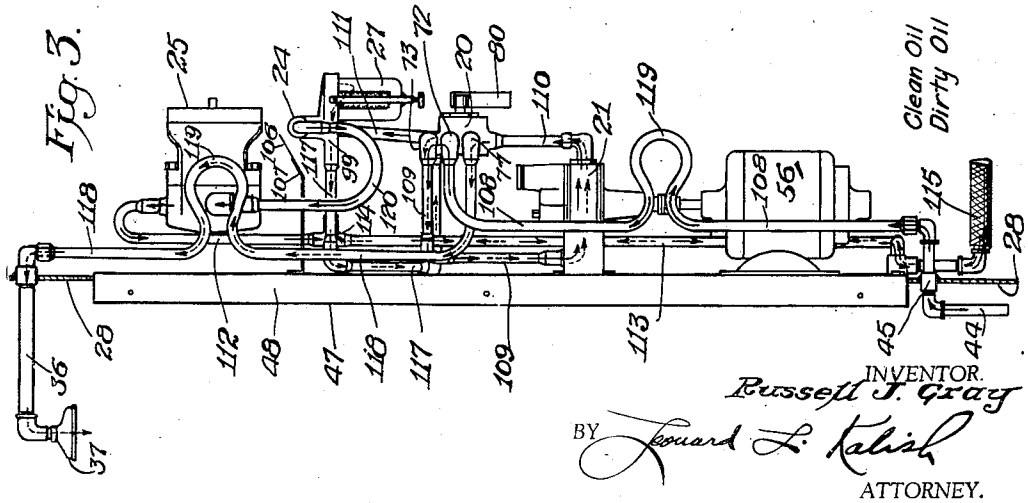


Fig. 3.

Clean Oil
Dirty Oil

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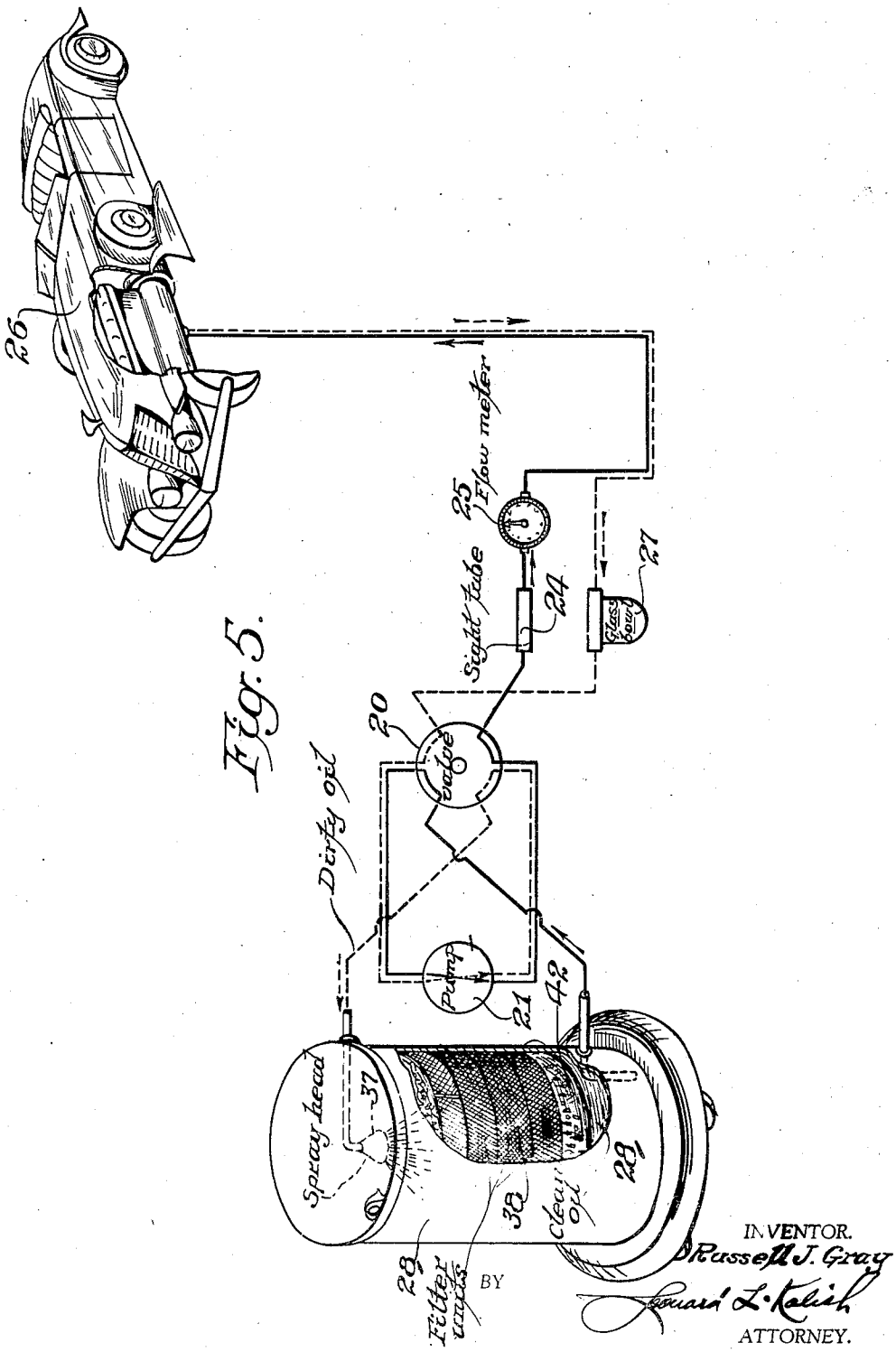


Fig. 5.

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APPARATUS FOR CLEANING AUTOMOBILE ENGINES

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Fig. 6.

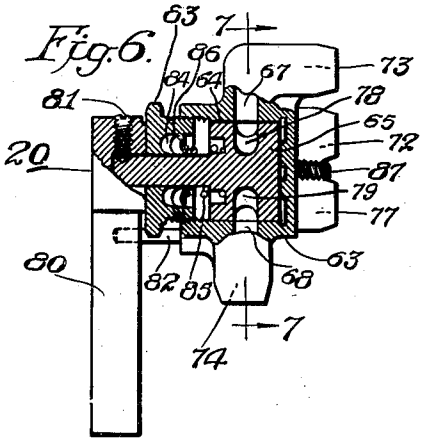


Fig. 7.

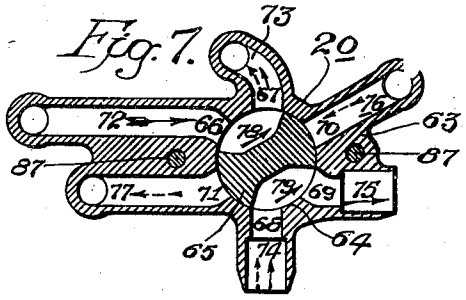


Fig. 8.

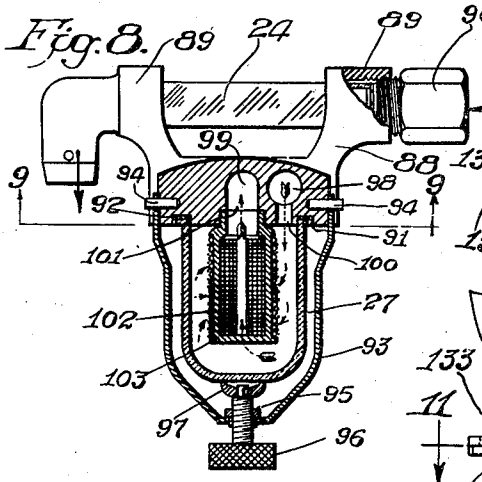
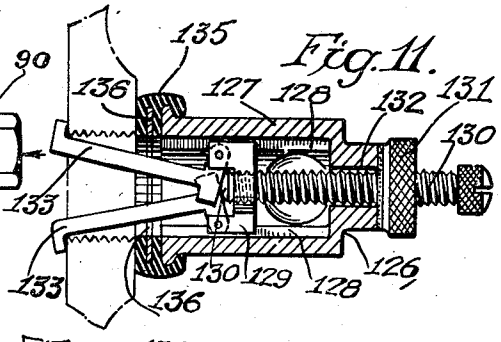


Fig. 11.



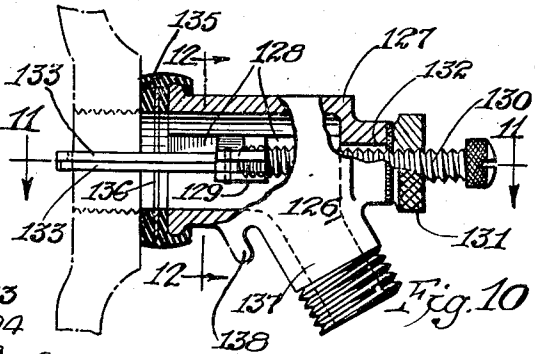
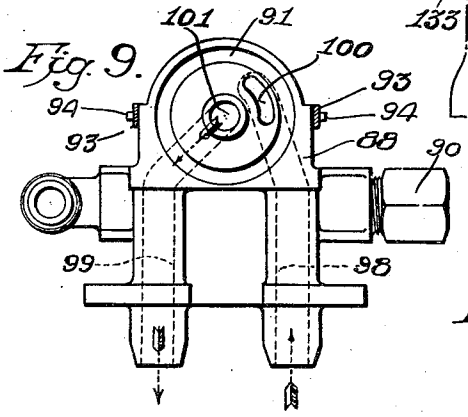


Fig. 10

Fig. 9.



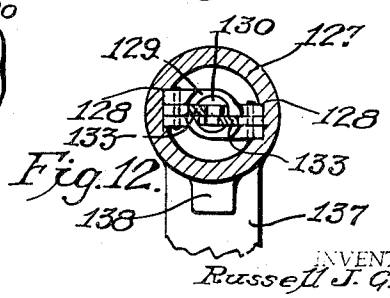


Fig. 12.

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Fig. 13.

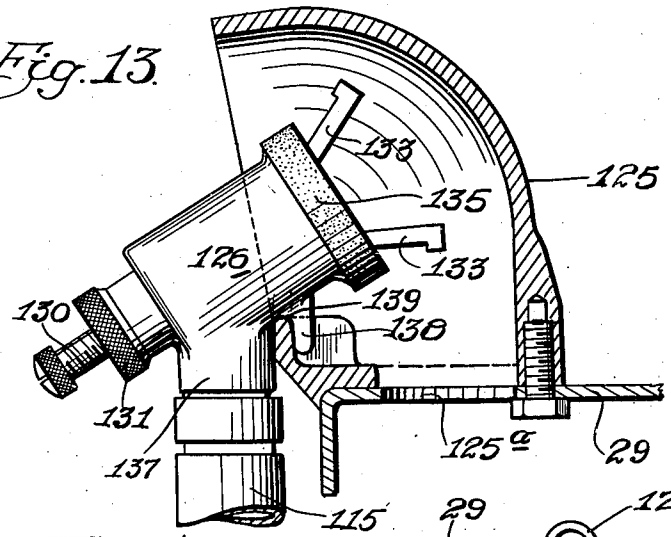
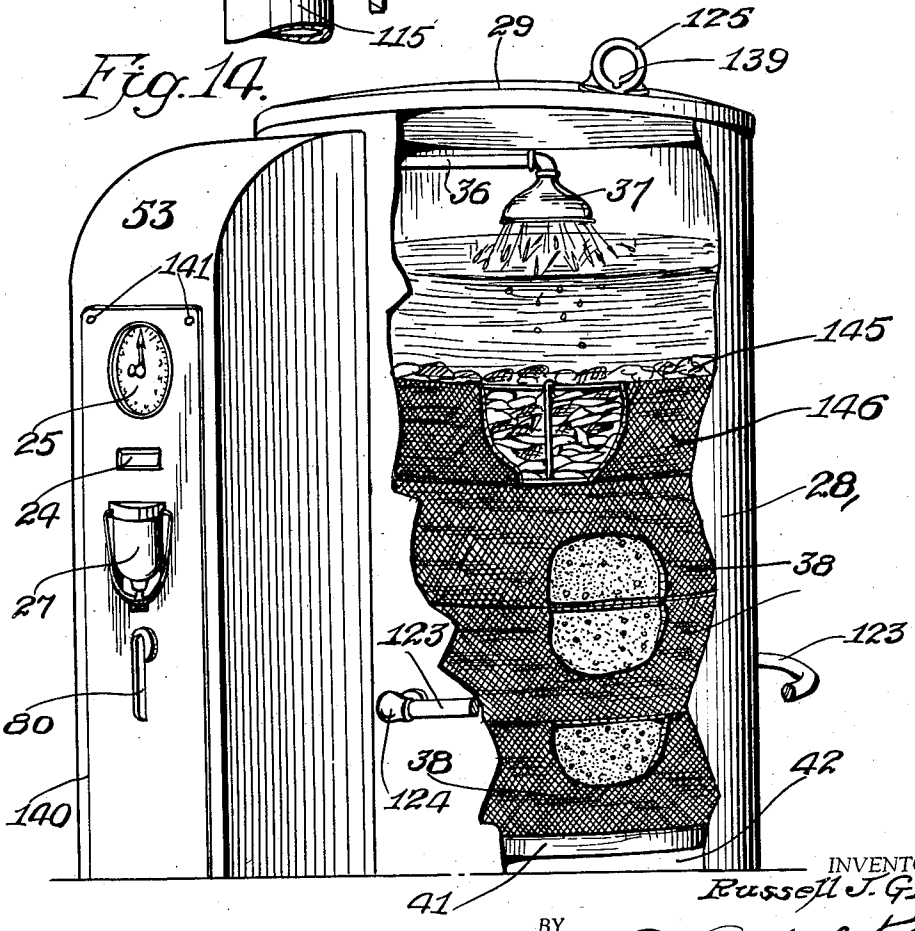


Fig. 14.



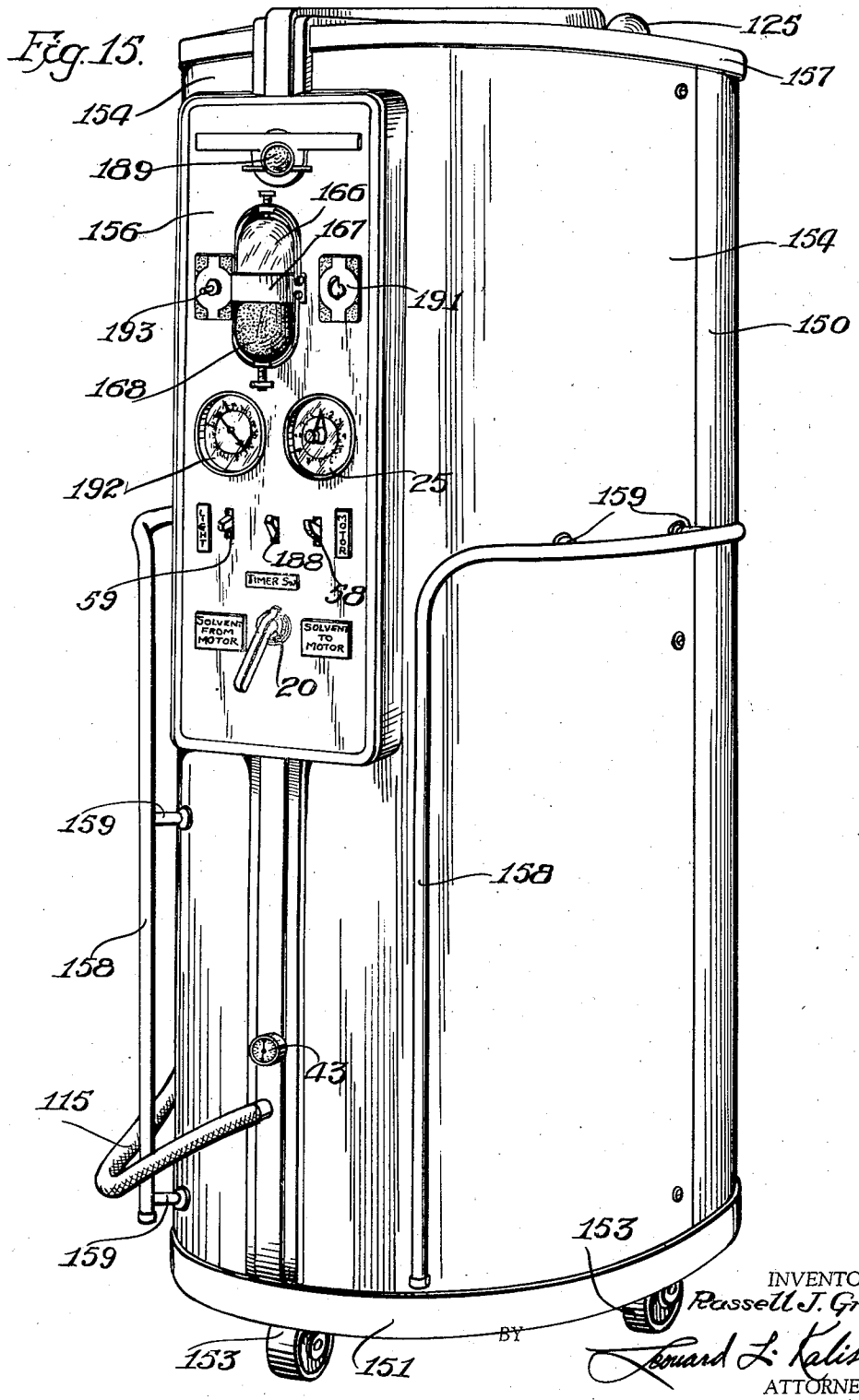
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APPARATUS FOR CLEANING AUTOMOBILE ENGINES

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Fig. 15.



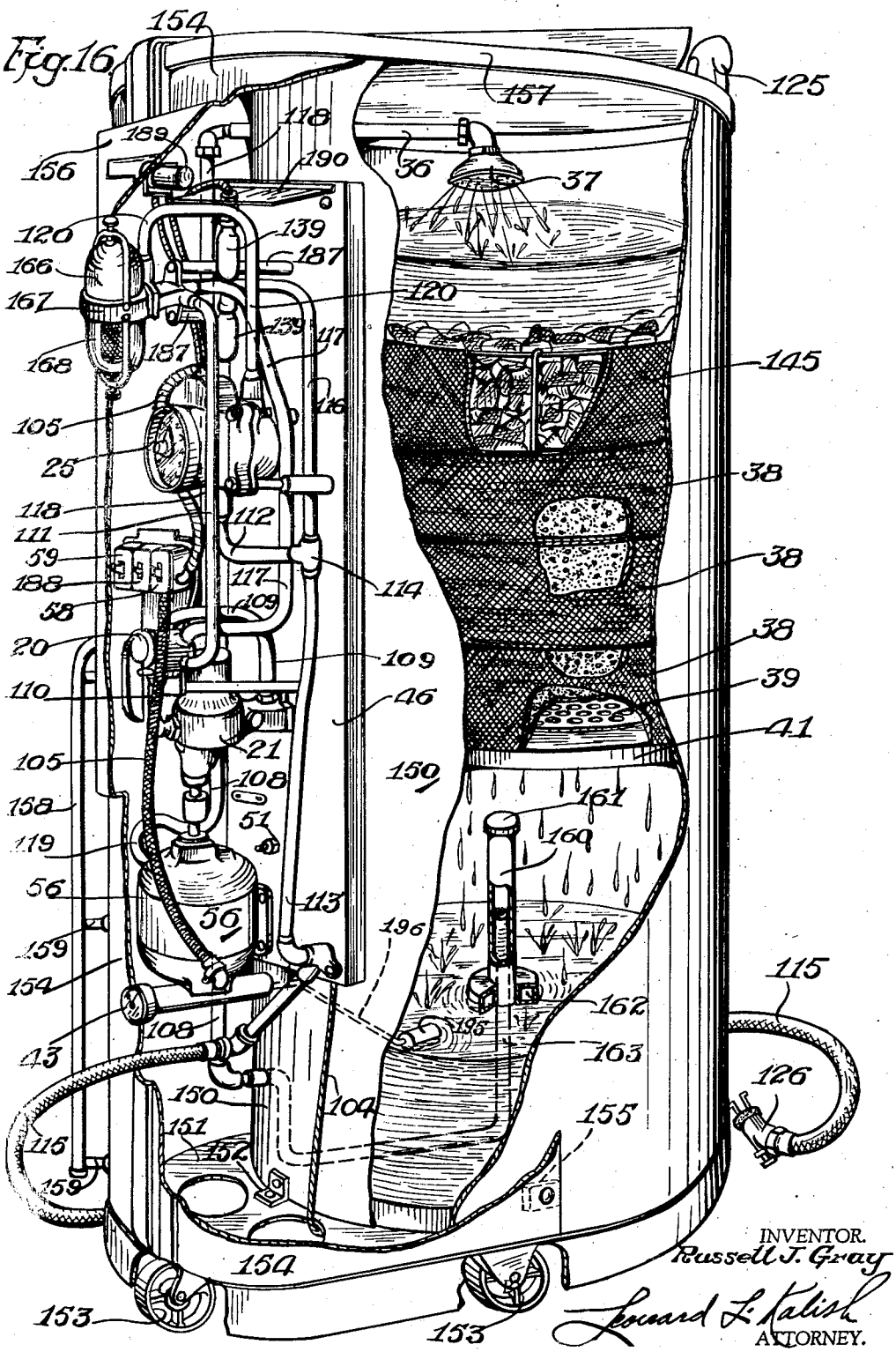
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APPARATUS FOR CLEANING AUTOMOBILE ENGINES

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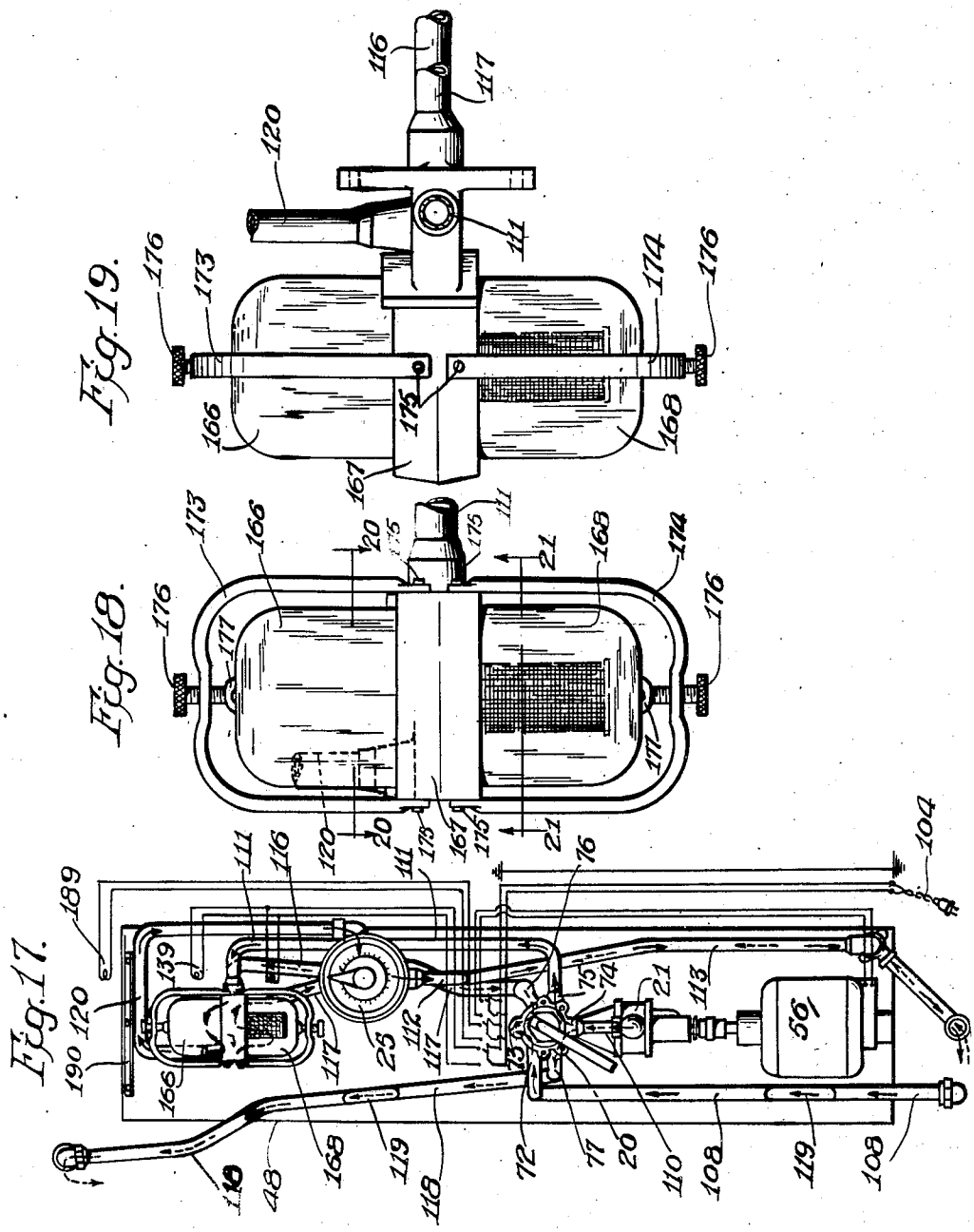
Fig. 16



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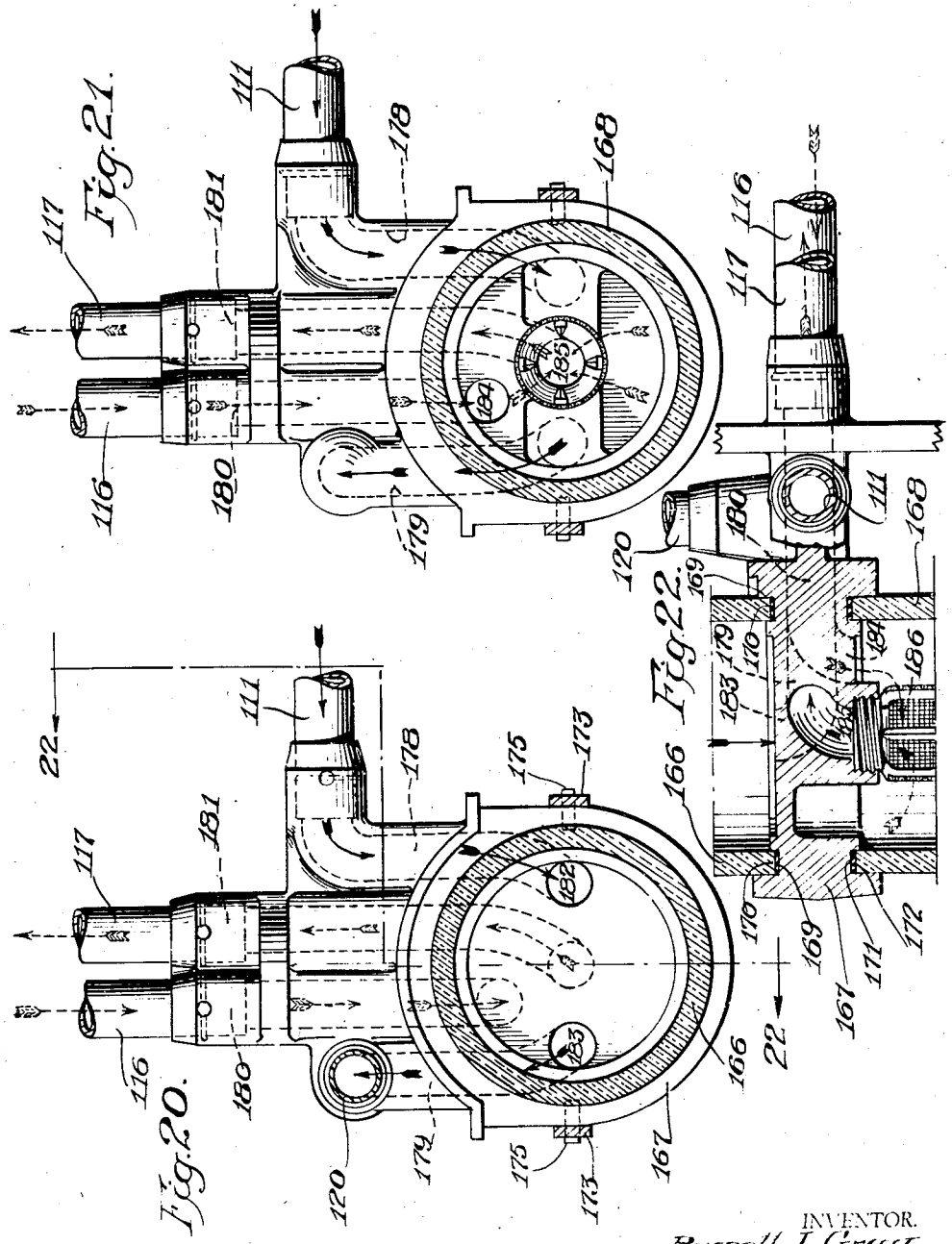


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UNITED STATES PATENT OFFICE

2,312,091

APPARATUS FOR CLEANING AUTOMOBILE ENGINES

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Application May 5, 1939, Serial No. 272,025

6 Claims. (Cl. 184—1.5)

The present invention relates to apparatus for use in the internal cleaning of automobile engines or the like, and it relates more particularly to apparatus having means for supplying a quantity of clean solvent to the crank-case of an automobile engine, means for withdrawing said solvent from the crank-case after it has been circulated through the engine, as for instance by running the engine with the solvent in it, and after it has dissolved or collected the synthetic resinous deposits produced in internal combustion engines and commonly referred to as "varnish" or "lacquer," and engine dirt, sludge, gum deposits, etc., and means for cleaning the dirt-laden solvent to restore it substantially to its original condition and color, for future use.

The present invention has among its objects the provision of a compact readily operable apparatus of simple and durable construction which efficiently performs the foregoing operations with ease and dispatch, which may be used generally continuously and which may be readily and easily disassembled or exposed for servicing or replacement of used-up parts.

Other objects will appear more fully from the following detailed description, accompanying drawings and appended claims.

For the purpose of illustrating the invention, there is shown in the accompanying drawings forms thereof which are at present preferred, since the same have been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized and that the invention is not limited to the precise arrangements and organizations of the instrumentalities as herein shown and described.

Referring to the drawings, wherein like reference characters indicate like parts,

Figure 1 represents a front elevational view of an apparatus constituting one embodiment of the present invention, with parts broken away to reveal the interior construction.

Figure 2 represents a front view of the chassis, and the mechanisms and piping mounted thereon, all of which are mounted exteriorly of the vertical tank and are concealed by a removal front shield, or cover, or hood, all as illustrated in perspective in Figure 1, and further includes a wiring diagram of the relatively few electrical connections used.

Figure 3 represents a left side elevational view of the chassis and associated mechanisms and piping illustrated in Figure 2.

Figure 4 represents a right side elevational view of the chassis and associated mechanisms and piping illustrated in Figure 2.

Figure 5 represents a simplified schematic view showing how component parts of the apparatus illustrated in the preceding figures function in relation to each other, jointly to establish two paths of flow for the solvent, one path (indicated in full lines) representing the flow of fresh clean solvent from the reservoir to the engine to be cleaned, and the other path (indicated in dotted lines) representing the return flow of the dirt-laden solvent from said engine back through the apparatus, and into the clean solvent reservoir.

Figure 6 represents an enlarged side view, partly in elevation and partly in section, of the two-position control valve which is mounted on the chassis, and which selectively establishes the two paths of solvent flow.

Figure 7 represents a sectional view of the control valve, taken on line 7—7 of Figure 6, looking in the direction of the arrows.

Figure 8 represents an enlarged front view, partly in elevation and partly in section, of the proximately related transparent sight-gauges which individually reveal the clean solvent and the dirty solvent; said gauges being supported by a common casting in proximity to each other for color-comparison of the dirty solvent with the clean solvent.

Figure 9 represents a bottom view of the gauge-supporting casting illustrated in Figure 8, such as would be seen on line 9—9 of Figure 8, looking in the direction of the arrows.

Figure 10 represents an enlarged view, partly in elevation and partly in section, of the crank-case adapter at the end of the flexible service hose operatively engaged with a crank-case (shown in dashed-dotted lines) at its drain opening.

Figure 11 represents a longitudinal sectional view of the operatively engaged crank-case adapter, taken on line 11—11 of Figure 10, looking in the direction of the arrows.

Figure 12 represents a transverse sectional view of the same adapter, taken on line 12—12 of Figure 10, looking in the direction of the arrows.

Figure 13 represents a fragmentary view showing how the crank-case adapter illustrated in Figure 10 may be operatively supported in a dripless manner by the hood which covers the ventilating opening at the top of the tank.

Figure 14 represents a fragmentary view of the

tank portion of an alternative embodiment of the present invention, with portions of the tank wall being broken away to reveal a modified pre-filtering arrangement.

Figure 15 represents a perspective view of the exterior of an apparatus constituting another embodiment of the present invention.

Figure 16 represents a perspective view of the apparatus illustrated in Figure 15, with parts broken away to reveal the interior construction.

Figure 17 represents a front view of the concealed chassis and its associated mechanisms and piping constituting part of the apparatus illustrated in Figures 15 and 16, and having a schematic wiring diagram superposed thereon showing the associated electrical circuits.

Figure 18 represents an enlarged front view of the proximately-related transparent clean and dirty solvent sight-gauges which are mounted on the chassis illustrated in Figure 17.

Figure 19 represents a right side elevational view of the sight-gauges illustrated in Figure 18.

Figure 20 represents an enlarged sectional view taken on line 20—20 of Figure 18, looking in the direction of the arrows.

Figure 21 represents an enlarged sectional view taken on line 21, 21 of Figure 18, looking in the direction of the arrows.

Figure 22 represents a side view, partly in section and partly in elevation, of the sight-gauge casting illustrated in Figure 20, such as would be seen for instance on broken line 22, 22 of Figure 20, looking in the direction of the arrows.

The particular embodiment of the present invention illustrated in Figures 1 to 4, inclusive, operates in the manner schematically illustrated in Figure 5. A two-position control valve 20 is provided which is arranged, in its one position, to establish two opposite paths of flow therethrough for clean solvent on its way to the engine to be cleaned, and which is further arranged, in its other position, to establish two opposite paths of flow therethrough for dirt-laden solvent returning from said engine.

When valve 20 is thrown into its "in" or "to motor" position, clean solvent is pumped from the apparatus, along the flow path indicated in full lines in Figure 5, out into the crank-case of the automobile engine. The pump 21 sucks the clean solvent (preferably oil) from the reservoir 42 in the bottom of the vertical tank 28, and through a passageway in valve 20, and the clean solvent is then pumped through a diametrically opposite passageway in valve 20, and through a transparent sight-tube 24 and a flow-meter 25, out into the crank-case of the automobile 26.

After the desired amount of solvent has been pumped into the automobile crank-case (which has theretofore been emptied of its oil content), the pump 21 is stopped, and the automobile engine is started and run, causing the clean solvent in the crank-case to be circulated internally through the automobile engine, where it collects varnish, sludge, gum deposits, carbon, dirt and the like.

The automobile engine is then stopped, valve 20 is thrown into its "out" or "from motor" position, and the pump 21 is started up, rotating in the same direction as formerly, whereupon the dirt-laden and gummy solvent returns from the engine crank-case to the apparatus along the flow path indicated in dotted lines in Figure 5. Thus, the pump 21 sucks the dirt-laden solvent from the automobile crank-case, through a transparent glass bowl 27, preferably placed in proximity to the sight-tube 24 so that the returning dirt-laden solvent may be visually compared with the clean solvent in the sight-tube 24, and preferably through a metal screen or strainer in said bowl 27, and through a suitable passageway in valve 20, and is discharged into the top of the receiving tank 28. The dirty solvent then gravitationally filters through one or more filter units, or stages, which clean the solvent and preferably restore it to or near its original condition and color; the cleaned solvent collecting in the clean-solvent reservoir 42 constituted by the lower portion of the tank 28.

Referring now more particularly to Figure 1, the illustrated apparatus includes a generally vertical cylindrical metal tank 28 closed at the bottom and preferably open at the top. A removable cover 29, provided with a down-turned annular flange 30, preferably merely rests on the top rim of the tank 28 and preferably with the cover-flange 30 surrounding said rim.

The interior of the tank 28 preferably includes three vertically aligned compartments or chambers, the upper chamber constituting a receiving chamber for receiving the dirty solvent and possibly including a pre-filter arrangement for subjecting the solvent to a preliminary filtering process, the intermediate chamber constituting a filter chamber preferably provided with suitably-supported filtering means through which the dirty solvent must descend, and the lower chamber comprising a reservoir for collecting the cleaned solvent.

The pre-filtering arrangement disposed in the upper chamber of the cylindrical tank 28 may include a plurality of inner and outer sacks 31 and 32, formed from any suitable porous material, as for instance, fabric or the like. These pre-filter sacks 31 and 32 are preferably operatively suspended in the tank 28 in spaced relation from each other, in any suitable manner, as for instance by means of a series of circularly arranged supporting hooks 33, which project through suitable grommets or eyelets 34, 34 fastened to said sacks. These sack-supporting hooks 33 may be welded or secured to, or formed integrally with a removable annular flange 35, which may rest on the top rim of the tank 28 and which may be operatively concealed by the removable tank cover 29.

The returning dirt-laden solvent may be fed into the upper solvent-receiving chamber of the tank 28 through a short inlet pipe 36 which extends through the side wall of the tank. The discharge end of the pipe 36 may be provided with an ordinary downwardly-directed elbow fitting or, if desired, a sprinkler or spray head 37, possibly filled with a filtering substance, may be provided at the discharge end of the pipe 36. Indeed, if a sprinkler head 37 be provided, then the pre-filter sacks 31 and 32 may be dispensed with, if desired.

The filtering means disposed in the tank filter chamber, immediately beneath the pre-filter sacks 31 and 32, preferably consists of a plurality (as for instance three) vertically aligned and readily removable filter cartridges 38, 38. These filter cartridges may each comprise a cylindrically-shaped closed fabric bag filled with a suitable quantity of filtering material, as for instance fuller's earth, and are each preferably shaped to occupy substantially the entire cross-sectional area of the cylindrical tank 28. Each filtering unit 38 constitutes a complete cartridge, which may be readily removed and replaced when necessary.

The filter cartridges 38 may be supported with-

in the tank 28 by any suitable flow-permitting means as for instance by means of a grilled or perforated supporting disc 39 which may be welded to, or formed integrally with, a removable spider 40 extending transversely across the tank 28 and having its rim resting on an annular flange 41 welded against the inside of the tank wall 28.

The bottom chamber 42, provided by the lower portion of the tank 28, constitutes a clean-solvent reservoir, in which the solvent collects after it has filtered through the overhead filtering stages.

Any suitable gauge 43, which may be of the dial or of the glass-column type, may be secured exteriorly of the clean-solvent reservoir 42, and may indicate the quantity of solvent in said reservoir. A vertical breather tube is preferably provided for the generally enclosed reservoir 42 and this tube may have its lower end extend through the tank wall immediately below the filter-supporting flange 41 and may extend upwardly to any desired height exteriorly of, and preferably against, the outer wall of the tank 28. The solvent in the reservoir 42 may be operatively sucked out through a riser tube 44, whose lower inlet end may terminate in proximity to the bottom wall of said reservoir, and which may be extended through the side wall of the tank 28 by means of a coupling 45 welded in an opening in said wall.

The control instruments and gauges and related piping and wiring may be operatively supported in a compact manner exteriorly of the tank 28 by means of a chassis 46, whose horizontal cross-section is preferably channel-shaped, and which is preferably secured against the outer wall of the tank 28 with the edges 47 of the side flanges 48 thereof continuously contacting said tank wall. Thus, a pair of spaced hooks 49, 49, which may be welded or otherwise secured to the tank wall 28, may have their lower up-turned ends project through registering holes or slots 50 in the chassis 46. The lower end of the chassis may be secured against outward movement away from the tank wall by means of a nut 51 tightly screwed down over the projecting end of a bolt 52, said bolt being welded to the side wall of the tank 28 and projecting through the chassis 46.

The piping and wiring inter-connecting the control instruments and gauges, and the pump, motor and other members which need not be viewed in normal operation of the device, are preferably concealed from view by means of a removable trough-shaped cover or hood 53, which may fit snugly over the chassis side-flanges 48, 48, and which may be detachably secured thereto by suitable screws or bolts 54, 54. The hood 53 is preferably fenestrated at suitable points to reveal the faces of the control instrument and gauges, and is also suitably apertured so that control handles and other members requiring manipulation may project therethrough.

If desired, all the windows and apertures provided may be grouped on a single generally rectangular removable plate 140 secured over a corresponding opening in the face of the hood 53 in any suitable fashion, as for instance by means of the screws 141, 141 or the like.

If desired, ventilating louvers 55 may be stamped out of the side walls of the hood or cover 53, thereby to ventilate the space therebeneath.

The chassis 46 may support a flow meter 25, a transparent clean-solvent sight-tube 24 and a proximately-disposed dirty-solvent transparent bowl 27, a two-position multi-port control valve 20, a rotary pump 21 and its electric driving-motor 56, an electrical junction box 57, motor and light switches 58 and 59 respectively, and miscellaneous piping and electrical cable operatively interconnecting the foregoing. The flow-meter, sight gauges, control valve and electrical switches are preferably operatively supported by the chassis 46 in suitably spaced relation therefrom, so that these items will extend up to, or through, their respective windows or openings in the face of the hood 53, or in the plate 140, and will thus be visually and manually accessible.

In the illustrated embodiment of the present invention some of the foregoing instruments, as for instance the flow-meter 25, are supported by the chassis 46 at their proper distances therefrom by means of outwardly extending posts 60 against whose outer ends these members may be bolted. Other of the foregoing instruments, as for instance the control valve 20 and the electric switches 58 and 59, may be bolted to a saddle or bracket 61, itself supported by the chassis 46 in suitably spaced relation therefrom by suitable posts 62, 62 or the like. Still other members, such as the electric motor 56 and the rotary pump 21, may be bolted directly against the chassis 46.

The single control valve 20 is of unique construction, and affords simple readily-operable means for changing the setting of the apparatus from a clean-solvent "in" to a dirty-solvent "out" condition, and vice versa, and avoids a confusing multiplicity of controls. Furthermore, the control valve 20 makes it possible for the rotary pump 21 to rotate in the same direction when pumping clean-solvent into the crank-case as when pumping dirty-solvent out of said crank-case, i. e. the pump has constant inlet and outlet openings and this even though the clean and dirty solvents follow the same paths in opposite directions and flow through the same conduits over a substantial portion of their routes, irrespective of the particular setting of the apparatus.

As more particularly illustrated in Figures 6 and 7, the control valve 20 includes a valve-body 63, having a cylindrical recess 64 therein, closed at one end, for rotatably receiving a valve-stem 65. Six circularly-arranged port openings 66 to 71, inclusive, are formed in the inner cylindrical wall defining the recess 64, and communicate with corresponding inlet and outlet passageways 72 to 77, inclusive, extending through the valve-body 63.

The rotatable stem 65 has formed therein, in the plane of the port openings 66 to 71, inclusive, two diametrically-opposed flow-conducting slots or recesses 78 and 79 respectively, each of a length sufficient to span, and thereby establish operative communication between, adjacent port openings.

A valve-cap 83 encircles the reduced shank of the valve stem 65, and is screw-threadedly engaged with the outer end of the valve-recess 64. A plurality of annular leather packing glands 84, 84 may surround the shank of the valve stem 65 and may be pressed or crowded into a seal-establishing position by a coiled compression spring 85, whose one end may rest against the valve-stem 63, and whose opposite end may bear against a protective brass or metallic packing gland 86 positioned against the leather packing glands 84.

The valve-stem 65 may be operatively rotated by means of a control handle 80 fitted over the outer end of the reduced shank portion of the valve-stem 65 and keyed thereto in any suitable

manner, as for instance, by means of a set-screw 81 whose inner end may project into a suitable recess in the side of said shank portion.

Two stop-pins 82, 82, extending outwardly from the valve-body 63, may be disposed one on either side of the valve-handle 80, thereby to limit the throw of the valve-handle. These stop-pins 82 are preferably so located that when the valve-handle 80 meets the right-hand stop-pin, the port-connecting valve-stem recesses 78 and 79 will be positioned as shown in Figure 7, thereby establishing hydraulic communication between the port-openings 66 and 67 on the one hand and the generally diametrically-opposed port-openings 68 and 69 on the other hand, and when the valve-handle 80 is positioned against the left-hand stop-pin 82, the port-connecting valve-stem recesses 78 and 79 will be rotated sufficiently to close off communication between the aforesaid port-openings 66—67 and 68—69, and to establish hydraulic communication between the port-openings 67 and 70 on the one hand and the generally diametrically-opposed port-openings 68 and 71 on the other hand.

The position wherein the control handle 80 rests against the right-hand stop-pin 82 may be identified as the "in" or "to motor" position, for in this position clean solvent will be pumped into the engine crank-case. Conversely, the position wherein the control handle 80 rests against the left-hand stop-pin may be referred to as the "out" or "from motor" position, for in this latter position the dirty solvent will be sucked out of the engine crank-case and returned to the apparatus.

The hydraulic control-valve 20 may be operatively secured to the valve-supporting means by a plurality of bolts 87, 87, which may extend through suitable openings in the valve-body 63.

The present invention preferably includes a pair of proximately-disposed transparent sight-gauges 24 and 27, for comparatively indicating the color and condition of out-going (clean) solvent and incoming (dirty) solvent, respectively. These sight gauges are each arranged to constantly "hold" a quantity of solvent therein, so that neither one is ever empty, thereby permitting a comparison to be made at all times.

Both sight-gauges may be operatively supported by a common casting 88 provided with suitable inlet and outlet passageways respectively leading into and out of said transparent gauges. Thus, the common casting 88 may include a pair of spaced aligned tube-supporting hollow brackets 89, 89, which may house the ends of the transparent sight-tube 24. This tube may be operatively clamped in position by means of an exteriorly threaded hollow nut 90 whose forward end is screw-threadedly engaged with the right-hand bracket 89 and bears against an end of said sight-tube. Suitable washers or sealing members may be provided at the opposite ends of the sight-tube 24 to avoid leakage of solvent at these points.

The underside of the common-casting 88 may be of generally circular contour, and is preferably provided with an annular groove 91 within which the top rim of the transparent bowl 27 may bear against any suitable annular sealing member or gasket 92. The bowl 27 may be detachably clamped against the casting 88 by means of a swivellable yoke 93, whose upper ends are pivotally supported by pivot pins 94, 94 extending transversely from the casting 88. An aperture in the lower end of the yoke 93 may receive an internally threaded bushing 95 through which may be screwed a thumb-screw 96. The upper end of the thumb-screw 96 may project into and bear against a cupped-shaped thrust-transmitting member 97, which, itself, is adapted to bear against the bottom of the glass bowl 27. Thus, by merely advancing or retracting the thumb-screw 96, the bowl 27 may be operatively clamped against, or loosened relative to, the casting 88.

The casting 88 is preferably provided with an inlet passageway 98 for conducting the returning dirt-laden solvent into the transparent bowl 27, and an outlet passageway 99 through which the solvent may leave the bowl.

These passageways 98 and 99 terminate in port-openings 100 and 101, respectively, each communicating with the interior of the transparent bowl 27, with the port-opening 101 preferably being disposed concentrically relative to said bowl.

A wire screen may be provided in the bowl 27 for straining the larger particles of dirt from the solvent. Thus, a wire screen 102 may surround the mouth of the outlet port-opening 101, and this screen may be welded or soldered onto a supporting cage or spider 103 which may be screw-threadedly retained in the port-opening 101. Accordingly, all the dirt-laden solvent entering the transparent bowl 27 through the inlet port-opening 100 must pass through the wire screen 102 before leaving the bowl 27 through the outlet port-opening 101. The solvent is thereby strained, depositing the larger particles of dirt, grit and the like in the bowl 27. This bowl 27 may be periodically removed, and emptied of the collected dirt.

The solvent pump 21 is preferably of the rotary type, and is provided with constant inlet and outlet openings, so that irrespective of whether it is pumping clean solvent into the automobile crank-case or sucking the dirt-laden solvent therefrom, the solvent will flow through said pump in only one direction. The electric motor 56 which drives the rotary pump 21 may be directly coupled thereto in vertical alignment therewith, and is preferably disposed below the pump and at the lower end of the supporting chassis, so that it will operate in a vapor-free position. Electrical current may be led to the electrical junction box 57 by an insulated electrical cord 104, and from thence it may be distributed to the electrical switches and other points through armored electrical cables 105, 105.

The electric motor-switch 58 is preferably provided with means whereby the motor will become automatically disconnected upon removal of the operator's hand from the control button or lever. Thus, the lever or button is preferably automatically thrown into its open-circuit position, when released, by spring-pressed means, or in any other suitable manner. This feature will insure against an operator's starting the apparatus and then leaving it unattended.

The switch 59 controls the flow of electrical current through an electric light-bulb 139, which is preferably arranged to illuminate the transparent sight-gauges 24 and 27. If desired, a reflector 106 may be disposed behind the sight-gauges 24 and 27, and this reflector may be operatively supported in any suitable manner, as for instance by means of a bracket 107 secured to the chassis 46.

The piping which interconnects the hereinabove described elements has been illustrated in detail in Figures 2 to 4, inclusive, wherein solid arrows have been used to indicate the directions and paths of flow of the clean solvent or oil, and wherein dotted arrows have been used to indicate the direction and paths of flow of the dirty solvent or oil.

The piping which conducts the clean oil may include a generally vertical branch 108 which interconnects the riser-tube 44 in the clean solvent reservoir with the clean-solvent inlet passageway 72 of the control valve 20. Assuming the control valve to be set in the "in" position indicated in Figure 7, the solvent passes through port-opening 66, stem-passageway 78, port-opening 67, outlet passageway 73, and then into and through the pipe 109, which connects said valve outlet passageway 73 with the inlet end of the rotary pump 21. The clean solvent is then driven through the pump 21 and enters the inlet passageway 74 of the control valve 20 through the connecting pipe 110. From there, the solvent flows through the port-opening 68, stem-passageway 79, port opening 69 and communicating clean-solvent outlet passageway 75, all in the control valve 20, and then through the pipe 111 into and through the sight-tube 24. Upon leaving the sight-tube 24, the clean solvent flows downwardly through the loop 120 and then upwardly into and through the flow-meter 25. From there, the clean solvent flows downwardly through the pipes 112 and 113, connected together by a T fitting 114, and then out through the flexible service-hose 115 into the crank-case of the automobile engine.

For the return flow of the dirt-laden solvent, the setting of the control valve 20 is changed to the "out" position, and the returning solvent follows the following course. It is first sucked through the service-hose 115 and upwardly through the pipe 113 until it reaches the T connection 114, the path thus far being identical with that followed by the clean solvent after it leaves the T fitting 114, except for the direction. At this T fitting 114, the dirty solvent leaves the common path and enters the transparent bowl 27 through a short connecting pipe 16 which communicates with the dirty-solvent inlet passageway 98 of its bowl-supporting casting 88. The dirt-laden solvent enters the bowl 27 through the inlet port 100, and then flows through the wire-mesh strainer 102 and departs through the outlet port 101 and communicating discharge passageway 99. The strained solvent is then conducted through the piping 117 and enters the control valve 20 through the dirty-solvent inlet passageway 76. From there it flows through the port-opening 70, stem-passageway 78, port-opening 67, and into and through the same outlet passageway 73 and pipe 109 formerly traversed by the clean solvent, and enters the inlet passageway of the rotary pump 21. The dirty solvent is then driven through the pump 21, and passes upwardly through the pipe 110 and into the control valve 20 through the inlet passageway 74, still along the same path formerly traversed by the clean solvent. Here the dirty solvent departs from said path, and flows through the port-opening 68, stem-passageway 79, port-opening 71, and departs from the control valve through the dirty-solvent outlet passageway 77. A pipe 118 connects the outlet passageway 77 with the discharge tube 36 which extends into the tank 28, and the dirty solvent is therefore discharged onto the filtering units.

If desired, expansion loops 119, 119 may be provided midway along the pipes 108 and 118, respectively.

The hereinabove described apparatus is preferably mounted on a plurality of caster wheels 124, 121, which may be concealed by an outer depending guard skirt 122. A curved handrail 123 may be secured to the outside of the tank 28 by brackets 124, 124, each welded to the tank 28, thereby providing means whereby the apparatus may be readily wheeled into desired positions.

The tank cover 29 is preferably provided with a marginally-disposed ventilating opening 125—*a* and if desired a small hood 125 may be secured thereover, said hood being adapted to have coupled thereto a crank-case adapter 126 at the end of the sevice-hose 115, when the apparatus is not in use. The end of the service-hose may thus be retained in an elevated position when inoperative, causing the solvent in said hose to drain back downwardly therethrough and preventing any drip. Furthermore, even should the end of the sevice hose drip slightly, the drippings will be collected by the hood 125 and will be conducted thereby down through the ventilating opening 125—*a* in the tank cover 29 and into the interior of tank 28.

The crank case adapter 126, illustrated more particularly in Figures 10 to 12, is preferably generally permanently secured to the end of the flexible service-hose 115, and is preferably provided with means whereby it may be readily adjusted to hold the end of said hose in sealed communication with differently-sized crank-case openings. The adapter 126 may include a generally tubular body portion 127 having opposed longitudinal grooves 128, 128 formed in the face of the inner cylindrical wall thereof. A nut-like member 129, having portions projecting into said opposed grooves 128 to prevent it from rotating, is slidably disposed within the tubular body 127. An elongated thumb-screw 130, having mounted thereon a knurled thumb nut 131, extends slidably through a somewhat reduced opening 132 at the rear of the body 127, and screw-threadedly engages the slidable non-rotatable member 129. A pair of L-shaped crank-case-engaging hooks 133, 133 are pivotally secured to the slidable member 129 by pivot pins 134, 134. The nose of the thumb-screw 130 is preferably rounded and bears against portions of these pivoted L-shaped hooks, thereby adjustably limiting the degree to which the hooks may approach each other. An annular resilient gasket 135, which may be formed of any suitable oil-resistant material, preferably "neoprene" or the like, may surround the outlet mouth of the body portion 127, and may seal around the crank-case drain opening when the adapter is attached thereto. If desired, a metallic washer 136 may be imbedded within the resilient gasket 135.

The end of the service-hose 115 may be generally permanently secured to a hollow stud 137 extending from the adapter 126. The adapter 126 may be provided with a hook which may cooperate with a suitable slot or recess 139 in the hood 125 on the tank cover 29 to provide anchorage means for the end of the service-hose when not in use, all as shown in Figure 13.

The hereinabove described apparatus preferably dispenses an engine-cleaning liquid which exerts a solvent action on the synthetic resinous

deposits formed in internal combustion engines, and on sticky carbon, sludge, gum deposits and the like. Such liquid may consist of equal quantities (as for instance 25 or 30 gallons) of low cold test pale neutral flushing oil having a viscosity of 100 at 100° F., and of No. 1 prime white or straw colored distillate (furnace or stove oil), and if desired, approximately two gallons of a concentrated gum solvent liquid (which may include a solvent for the gummy engine deposits and a constituent for affording lubrication while the solvent is performing its function) may be added thereto. The resultant liquid acts as a solvent inside the automobile engine and has been found to be a very effective cleansing agent.

If the quantity of solvent should become depleted in use, it may be replenished by the addition of prime white or straw colored distillate, to which may be added one pint of the concentrated solvent liquid for every three gallons of distillate. It is not necessary to add neutral oil to the apparatus, because in actual operation the solvent liquid becomes thickened by the addition of small amounts of motor oil from the automobile engines being cleaned. Thus, the occasional addition of solely the distillate and the concentrated solvent liquid, will offset such thickening and maintain a solvent having nearly constant viscosity.

In operation, the end of the electric cord 104 is plugged into a suitable outlet socket, and if a ground lead be supplied, then such lead is screwed against, or otherwise secured to, the socket plate. The light switch 59 is then closed, thereby illuminating the transparent sight-gauges 24 and 27, respectively.

The car engine may then be started and run until the oil in its crank-case has been thoroughly warmed. The car motor is then stopped, and the crank-case drain plug removed, permitting the old motor oil to drain out. The car motor is then preferably turned over once or twice with the starter in order to bring down what little oil may remain in the crank-case and oil lines, thereby minimizing subsequent thickening of the solvent by the motor oil. The crank-case adapter 126 on the end of the flexible service hose 115 may then be operatively engaged with the crank-case of the engine by inserting the hooks 133 into the crank-case drain opening, the thumb-screw 130 being preliminarily retracted, if necessary, to permit the hooks to be brought sufficiently close together to enter the drain opening. The thumb-screw 130 is then screw-threadedly advanced through the non-rotatable nut 129 until the hooks 133 have been spread apart sufficiently to prevent their being pulled back through the drain opening. The knurled thumb nut 131 is then tightened, thereby advancing the adapter body 127 and compressing the adapter gasket 135 around the crank-case opening to establish an effective seal therearound.

The control valve handle 60 is then thrown to the "in" position, and the control lever of the motor-switch 58 is depressed and held down until the meter 25 indicates that an amount of solvent preferably twice the normal rated oil capacity of the crank-case has been dispensed. The flow of fresh solvent may be observed in the sight-tube 24. The control lever of the motor-switch 58 is then released, and the flow meter 25 hand re-set to zero. The automobile engine is then started and may be run at idling speed for about three minutes, thus heating the clean-solvent, and further improving the cleansing action thereof by virtue of the turbulence set up within the crank-case. If desired, an electrical heater may be associated with the clean-solvent reservoir 42 to heat the solvent preliminary to supplying it to the engine crank-case, thereby improving the cleaning operation. The motor is then stopped, the control valve handle 60 is thrown to the "out" position, and the control lever of the motor switch 58 is again held down until all the dirt-laden solvent has been pumped out of the car motor back into the apparatus. The return flow of dirty solvent can be observed through the glass bowl 27, which should be periodically removed and cleaned of accumulated sludge and the like. The screen in this bowl prevents the returning larger particles of dirt and the like from entering the pump 21, thereby protecting the same. The returning dirty oil is discharged into the receiving chamber at the top of the vertical tank 28, from whence it gravitates through the filter-units 38 into the clean-solvent reservoir 42, meanwhile being cleaned and restored to its original color and condition.

The foregoing operation is repeated until the solvent flowing through the glass bowl 27 is as clean as the solvent in the sight-tube 24. The engine crank-case is then completely emptied of solvent, the hose adapter 126 disengaged from the crank-case opening, and the crank-case drain plug reinserted therein, whereupon the engine is ready to be refilled with new oil.

The hereinabove described apparatus is preferably initially supplied with approximately fifty or sixty gallons of solvent, so as to permit the apparatus to be used generally uninterruptedly, and without having to wait for the dirty solvent, which has last been returned into the top of the tank 28, to filter through the filter units and collect in the clean solvent reservoir.

It will be noted that the filtering process is a generally continuous one, and does not require any interruption either when clean-solvent is being dispensed to the automobile engine, or when dirt-laden solvent is being withdrawn therefrom.

In actual operation, a filtering arrangement which provides an average filtration speed of approximately forty gallons per hour has been found to be quite satisfactory, although filtering arrangements having higher or lower filtration rates may also be used.

In the particular embodiment of the present invention illustrated in Figure 14, a pre-filter cartridge 145 has been placed on top of the column of main filter cartridge 38, 38. This pre-filter cartridge 145 may comprise a suitable pad of cotton or cloth waste encased, if desired, in a porous fabric sack or casing 146. The cartridge 145 replaces the pre-filter sacks 31 and 32 shown in the embodiment illustrated in Figure 1. In actual operation, this pre-filter pad of waste on top of the main filter cartridges removes the heavier dirt particles from the descending dirty oil or solvent, thereby easing the load on the secondary or main filter units 38, and adding to their useful life. Occasionally, this cartridge or pad of cotton waste 145 may be shaked, swabbed-off, and turned over.

It will be noted that the dirty-solvent receiving chamber above the filter cartridge is of ample capacity and is preferably large enough to permit a substantial quantity of dirty solvent to collect rapidly in said dirty-oil receiving chamber without overflowing. Accordingly, the dirty

solvent may be discharged into this receiving chamber at a faster rate than that with which it filters through the cartridges, thereby obviating delay and permitting generally continuous operation of the apparatus.

The embodiment of the present invention illustrated in Figures 15 to 22, inclusive, is the preferred embodiment, and resembles in most respects the hereinabove-described embodiments. It includes a generally vertical cylindrical tank 150 which is closed at the bottom and open at the top. This tank 150 is eccentrically mounted on an oval-shaped portable base or dolly 151, and may be fastened or keyed thereto by any suitable means, as for instance by means of angle-brackets 152 or the like. As more particularly illustrated in Figure 16, the dolly 151 may be supported on four caster wheels 153, one pair of opposite wheels being relatively fixed or non-pivotable, and the other pair of opposite wheels being of the free-trailing or freely pivoting type. A curved shield or false front 154, whose curvature is matched by the rim of the oval-shaped base 151 may be affixed over the front side of the tank 150, thereby to conceal the chassis piping and mechanisms. The opposite vertical marginal portions of this shield 154 meet the cylindrical wall of the tank 150 at opposite sides, and preferably merge with the tank wall to create an illusion of continuity. These marginal portions of the curved shield 154 may be detachably secured to the tank walls at their meeting points by any suitable means, as for instance, by being bolted or screwed to brackets 155 welded or otherwise secured to the tank wall 150.

A generally rectangular suitably fenestrated instrument panel 156 may be stamped or pressed out of the top central portion of the shield 154, or, if desired, this instrument panel 156 may be formed separately from the shield 154 and may be affixed thereto.

The open top of the tank is preferably closed by means of a readily removable cover 157 whose outline corresponds to the oval-shaped outline of the base 151, and which may rest on the upper edges of the open tank 150 and associated shield 154. In the preferred embodiment, this removable cover 157 is preferably provided with a hose-supporting drain-back casting 125 (see Figure 13) which is mounted over a ventilating aperture in the cover 157.

A curved hand-rail or hand-rails 158 may be secured to the shield 154 by brackets 159 to provide means whereby the apparatus may be easily maneuvered into any desired position.

The interior of the tank 150 is provided with a filtering arrangement similar to that illustrated in Figure 14, including a top pre-filter pad or cartridge of cloth waste 145 and main or secondary filter cartridges 38 preferably filled with fuller's earth, the lowest one of said cartridges 38 resting on an apertured filter support 39, in turn supported by an annular flange 41 welded or otherwise secured to the tank wall 150.

In this embodiment of the present invention, a dial type oil-level gauge 43 is mounted at the front side of the apparatus, and indicates the level of the clean solvent or oil in the receiving chamber at the bottom of the tank 150 by means of a float 195 which is connected to the gauge 43 by an arm 196.

The apparatus illustrated in Figure 16 includes an oil-skimming arrangement in the clean-oil reservoir at the bottom of the tank 150, whereby only the cleanest and clearest oil or solvent in said reservoir may be pumped to the automobile engine. This oil-skimming arrangement may comprise a vertical floating tube 160, closed at its top end by a cap 161, and mounted over an upwardly extending hollow outlet stem 163. An air-tight float 162 is secured to the lower end of this tube and causes the same to rise and fall with the level of the liquid in the bottom of the tank 150.

If desired, the hollow stem 163 may extend upwardly for more or less approximately half the height of the clean oil reservoir, and in any event the floating tube 160 is preferably of sufficient length to prevent its riding clear or free of the stem 163 as the clean solvent reservoir fills up. Thus, the height of the floating tube 160 is preferably such that the upper cap 161 thereof will encounter the overhead filter support 39 in the tank 150 before the lower end of said tube 160 can ride clear of the upper end of the outlet stem 163.

In actual operation, the only solvent which enters the outlet stem 163 is drawn from the liquid in the vicinity of the float 162. Therefore, once the level of the solvent in the reservoir has descended sufficiently to float the skimmer tube 160, the only solvent which enters the mouth of the outlet stem 163 is drawn off from the top level of the body of solvent in the reservoir. In use, when the control valve 20 is set for the "to-motor" position and the pump 21 is started up, the resultant suction produced in the outlet stem 163 is communicated to the space inside the floating tube 160, and the pressure therein accordingly decreases. The atmospheric pressure acting upon the body of the solvent in the reservoir therefore forces the solvent in the vicinity of the open mouth of tube 160 to rise in the cylindrical space intermediate the overlapped inner stem 163 and the outer tube 160, and when this solvent reaches the open mouth of the stem 163, it is drawn thereinto and pumped out to the automobile engine. Thus, once the tube 160 is floated, the only solvent which rises in the space between the overlapped inner and outer tubes 163 and 160 is drawn from the top level of the solvent in the reservoir, rather than from the lower or bottom levels where sediment and the like might possibly collect. This insures that only the very cleanest and clearest oil or solvent in the reservoir will be supplied to the automobile engines being cleaned. As the level of the oil in the reservoir descends, the floating skimmer-tube 160 descends with it, so that the liquid which is dispensed is at all times taken from the top level of the liquid in the reservoir.

If the solvent in the reservoir should ever reach a level higher than the highest level to which the float 162 may rise (due to the upper cap 161 encountering the overhead filter support 39) then only clean solvent would still be dispensed by the apparatus. Thus, even though at this stage the solvent would not be drawn from the very top of the body of the liquid in the reservoir, yet the solvent drawn off would still be free of sediment for there is very little likelihood that in normal use sediment in the reservoir could ever rise as high as the inlet level of tube 160 when the float 162 is at its highest level.

Referring more particularly to Figure 17, it will be seen that the piping and mechanisms mounted on the tank chassis 46 are similar to those shown in the hereinabove described embodiment illustrated in Figure 2. However, in

the preferred embodiment illustrated in Figure 17, the flow meter 25 has been positioned below the transparent flow-revealing sight-gauges and the particular gauges used (illustrated in enlarged detail in Figures 18 to 22, inclusive) are of somewhat different construction.

The connecting pipes shown in Figure 17 bear the same numerals applied to those pipes illustrated in Figure 2 which perform like functions. Thus, although the particular form and shape of the pipes illustrated in Figure 17 in some instances do not conform precisely with the form and shape of the pipes illustrated in Figure 2, nevertheless those pipes which conduct fluid from one related point to another have in both instances been identified by the same numerals.

In this last embodiment of the present invention, the transparent sight-gauge arrangement which reveals the outgoing flow of clean oil or solvent and the incoming flow of dirt-laden oil or solvent (see Figures 18 to 22) is of somewhat different construction than that described in connection with the foregoing embodiments (see Figures 8 and 9). Thus, in lieu of the clean oil sight-tube 24, an inverted glass bowl 166 has been provided which is operatively clamped down against the top of a common brass casting 167. This gauge casting 167 is provided with suitable inlet and outlet passageways respectively leading into and out of the upper clean-solvent bowl 166 and the lower dirty-solvent bowl 168.

The top side of the common casting 167 is provided with an annular groove 169 within which the rim of the transparent clean-solvent bowl 166 rests against an annular sealing member or gasket 170, and the bottom side of this same casting 167 is provided with a corresponding annular groove 171 within which the rim of the transparent dirty-solvent bowl 168 rests against an annular sealing member or gasket 172. These juxtaposed bowls 166 and 168 are each preferably detachably clamped against the intermediate casting 167 by any suitable means, as for instance by means of oppositely extending swivellable yokes 173 and 174, respectively, each pivotally secured to said casting by transversely extending pivot pins or screws 175. Knurled or slotted clamping screws 176 may be screw-threadedly engaged with the yokes 173 and 174, or with suitable bushings associated therewith, and the forward ends of these clamping screws 176 may bear against cup-shaped thrust transmitting members 177 which bear against the domes of the bowls 166 and 168. These bowls may be individually operatively clamped in position or loosened for removal from the common casting 167 by merely advancing or retracting the clamping screws 176.

The casting 167 is provided with four flow-conducting passageways therethrough, passageways 178 and 179 respectively comprising inlet and outlet passageways for the flow of clean solvent to and from the upper clean-solvent bowl 166, and passageways 180 and 181 respectively comprising inlet and outlet passageways for the flow of dirt-laden solvent to and from the lower dirty-solvent bowl 168. The clean-solvent passageways 178 and 179 terminate respectively in inlet and outlet port-openings 182 and 183 in the top side of the casting 167, each port-opening being in communication with the space inside of the upper clean-solvent bowl 166. The dirty-solvent passageways 180 and 181 terminate respectively in inlet and outlet port-openings 184 and 185 in the bottom side of the casting 167, these last two port-openings being in communication with the space inside of the lower dirty-solvent bowl 168, with outlet port-opening 185 preferably being disposed concentrically relative to said bowl 168. A screen-bearing cage or spider 186 is screw-threadedly engaged with the outlet port-opening 185 with the screen completely surrounding said opening, whereby all the dirt-laden solvent which enters the lower transparent bowl 168 through the inlet port-opening 184 must pass through the wire screen before leaving said bowl through the outlet port-opening 185. The dirt-laden solvent is thereby strained, and the larger particles of dirt, grit and the like will be deposited in the bowl 168, which may be periodically removed and cleaned of its collected dirt.

The bowl-supporting casting 167 may be operatively secured to the chassis 46 in any suitable manner, as for instance by means of posts 187 to whose outer ends the casting may be affixed by screws or bolts, or the like.

A timing device may be provided to notify the operator when to shut off the automobile engine after it has been started. Such device may include an electrically or spring driven clockwork mechanism which will automatically shut itself off after it has run for any predetermined period, as for instance for two minutes. The clock-work mechanism may be started by throwing an electric control switch 188 mounted intermediate the switches 58 and 59 (see the wiring diagram superposed over the piping illustrated in Figure 17), and in the preferred embodiment, this switch 188 preferably also completes an electrical circuit including a signal-bulb 189, which may be mounted at the top of the instrument panel 156, and which is preferably automatically open-circuited by the clock-work mechanism at the end of the predetermined time interval. Thus, when the automobile engine has been started to circulate the clean-solvent therethrough, the timer switch 188 is depressed by the operator, thereby lighting the signal-bulb 189 and starting the clock-work mechanism. At the end of the pre-determined time interval, the signal will be automatically turned off by the clock-work mechanism, thus notifying the operator to shut off the automobile engine and withdraw the dirt-laden solvent therefrom.

The signal lamp 189 is positioned behind a suitable aperture or window in the instrument-panel 156, and this aperture or window may be shielded from rays of light coming from the sight-gauge-illuminated lamps 139, 139, by an intervening shade 190. In this manner, the only illumination visible through the instrument-panel opening or window in front of the signal lamp 189 will be illumination originating from the lamp 189.

A manually-operable counter 191 may be secured to the instrument-panel 156 to provide means for keeping track of the number of times that fresh cleaning-solvent has been supplied to the automobile engine. Thus, each time fresh solvent is supplied to the automobile engine, the counter pointer or marker may be manually advanced one point, so that at any instant during the cleaning of the automobile engine the operator may, by reading the counter 191, be instantly apprised of the number of times that cleaning solvent has been pumped into the automobile engine. In actual operation, four or five times have been found to be sufficient for the average engine.

However, this number may be varied to suit individual requirements.

A dial-type vacuum gauge 192 may be affixed to the instrument-panel 156 to indicate the performance of the automobile engine both before and after cleaning. This gauge 192 may be connected to the intake manifold of an automobile engine by means of a flexible hose extending from the intake manifold of said engine to a gauge inlet stud 193 projecting outwardly from the instrument panel 156 and itself connected to the vacuum gauge 192. When thus connected, the vacuum gauge 192 will indicate the inches of vacuum produced in the automobile engine, which in a properly performing engine should lie somewhere between 18 and 21 inches at idling speed. In this fashion the performance of the automobile engine may be noted before and after cleaning, and a ready comparison may be made to determine the improvement in engine performance.

It is to be expressly understood that the control instruments and gauges need not be positioned precisely as illustrated in the accompanying drawings. Thus, the instruments and gauges may be variously arranged and organized, and indeed may even be supplemented by other instruments and meters, or the like, respectively indicating or controlling other correlated phases of operation of the device.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and it is therefore desired that the present embodiments be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

What is hereby claimed as new and desired to be secured by Letters Patent is:

1. Apparatus for cleaning the insides of internal combustion engines or the like, including a generally cylindrical vertical tank having filtering means operatively supported therein in spaced relation from either end thereof, said filtering means occupying substantially the entire cross-sectional area of said tank, space in said tank above said filtering means constituting a dirty-solvent receiving chamber and space in said tank below said filtering means constituting a clean-solvent storage reservoir, a spray-head disposed within said receiving chamber for spraying dirty-solvent onto said filtering means, a flexible conduit having an adapter at the end thereof operatively engageable with the engine to be cleaned, divergent piping operatively associated with said flexible conduit, one branch of said divergent piping constituting means for conducting outgoing clean solvent and the other branch of said divergent piping constituting means for conducting incoming dirty solvent, a flow meter and a flow-indicating through-flow sight-gauge both operatively interposed in the branch of divergent piping which conducts outgoing clean solvent, a return-flow-indicating sight-gauge operatively interposed in the branch of divergent piping which conducts incoming dirty solvent, a strainer in said return-flow-indicating sight-gauge for removing particles of dirt from the incoming dirty solvent, said sight-gauges being disposed in proximity to each other and being always filled with solvent, means for pumping clean solvent from said storage reservoir into the clean-solvent branch of said piping, means for pumping dirty solvent from the dirty-solvent branch of said piping into the receiving chamber, and valve means operatively associated with both the aforesaid means and selectively controlling the flow of outgoing clean solvent and incoming dirty solvent respectively.

2. In apparatus for supplying clean solvent to, and for removing dirty solvent from, the crank-cases of automobile engines or the like, and having a reservoir for storing clean solvent, a receiving chamber for receiving dirty solvent, a solvent pump, discharge conduit means for leading clean solvent into the crank-case to be cleaned, and return conduit means for leading dirty solvent back into said apparatus, a flow-control valve having adjustable two-position means so constructed and arranged as to establish, in its one position, two separate passageways through said valve for outgoing clean solvent, and to establish, in its other position, two separate passageways through said valve for incoming dirty solvent, the two valve passageways for outgoing clean solvent being operatively interposed one between the storage reservoir and the pump inlet and the other between the pump outlet and the discharge conduit means, and the two valve passageways for incoming dirty solvent being operatively interposed one between the return conduit means and the pump inlet, and the other between the pump outlet and the solvent-receiving chamber, the passageway between said valve and said storage reservoir being wholly separate and distinct from the passageway between said valve and said receiving chamber.

3. In a crank-case cleaning apparatus having a clean-solvent reservoir, a dirty-solvent receiving-chamber, a solvent pump, and conduit means for connection with the crank-case to be cleaned, a multi-port two-position control valve operatively connected to said reservoir, chamber, pump and conduit means, said valve being constructed and arranged, in its one position, to establish operative communication between the inlet of said pump and said clean-solvent reservoir on the one hand, and between the outlet of said pump and said conduit means on the other hand, and in its other position, to establish operative communication between said pump inlet and said conduit means on the one hand, and between said pump outlet and said dirty-solvent receiving chamber on the other hand, the line of communication between said pump and said clean-solvent reservoir being wholly separate and distinct from the line of communication between said pump and said receiving chamber.

4. In a crank-case cleaning apparatus of the class described having means for restoring dirty solvent substantially to its original condition, a solvent pump and flow-conducting means interconnecting the inlet and outlet ends of said pump with the crank-case and with said solvent-restoring means respectively, a sight-gauge operatively associated with said flow-conducting means intermediate said pump and said crank-case for revealing the flow of dirty solvent, said sight-gauge including a readily removable transparent bowl, inlet and outlet passageways communicating with the interior of said bowl, and a strainer inside said bowl completely surrounding the mouth of said outlet passageway.

5. Apparatus for supplying clean solvent to, and for withdrawing dirty solvent from, the insides of internal combustion engines or the like, said apparatus including a clean-solvent supply reservoir, solvent-filtering means disposed above said reservoir, means for pumping solvent from

said supply reservoir to the engine to be cleaned, a flow-meter interposed in the path of flow of outgoing clean solvent, means for conducting dirt-laden solvent from said engine onto said filtering means along the path by-passing said flow-meter, and proximately-related illuminated transparent flow-revealing members respectively interposed in the paths of flow of outgoing clean solvent and returning dirty solvent, for indicating the color and condition of each.

6. In engine-cleaning apparatus of the class described having means for supplying clean solvent to, and for withdrawing dirty solvent from, the crank-cases of internal combustion engines or the like, means for revealing the flow of outgoing clean solvent and incoming dirty solvent respectively, comprising a common casting, juxtaposed transparent bowls detachably clamped to opposite sides of said casting, said casting being provided with four separate inlet and outlet passageways, one pair of inlet and outlet passageways being operatively connected in the path of flow of outgoing clean solvent and terminating in port-openings communicating with one of said bowls, and the other pair of inlet and outlet passageways being operatively connected in the path of flow of incoming dirty solvent and terminating in port-openings communicating with the other one of said bowls, and solvent-straining means inside said latter bowl surrounding its associated outlet port-opening.

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