Nov. 28, 1933. H. E. NEWELL 1,937,093

DRY CLEANING SYSTEM

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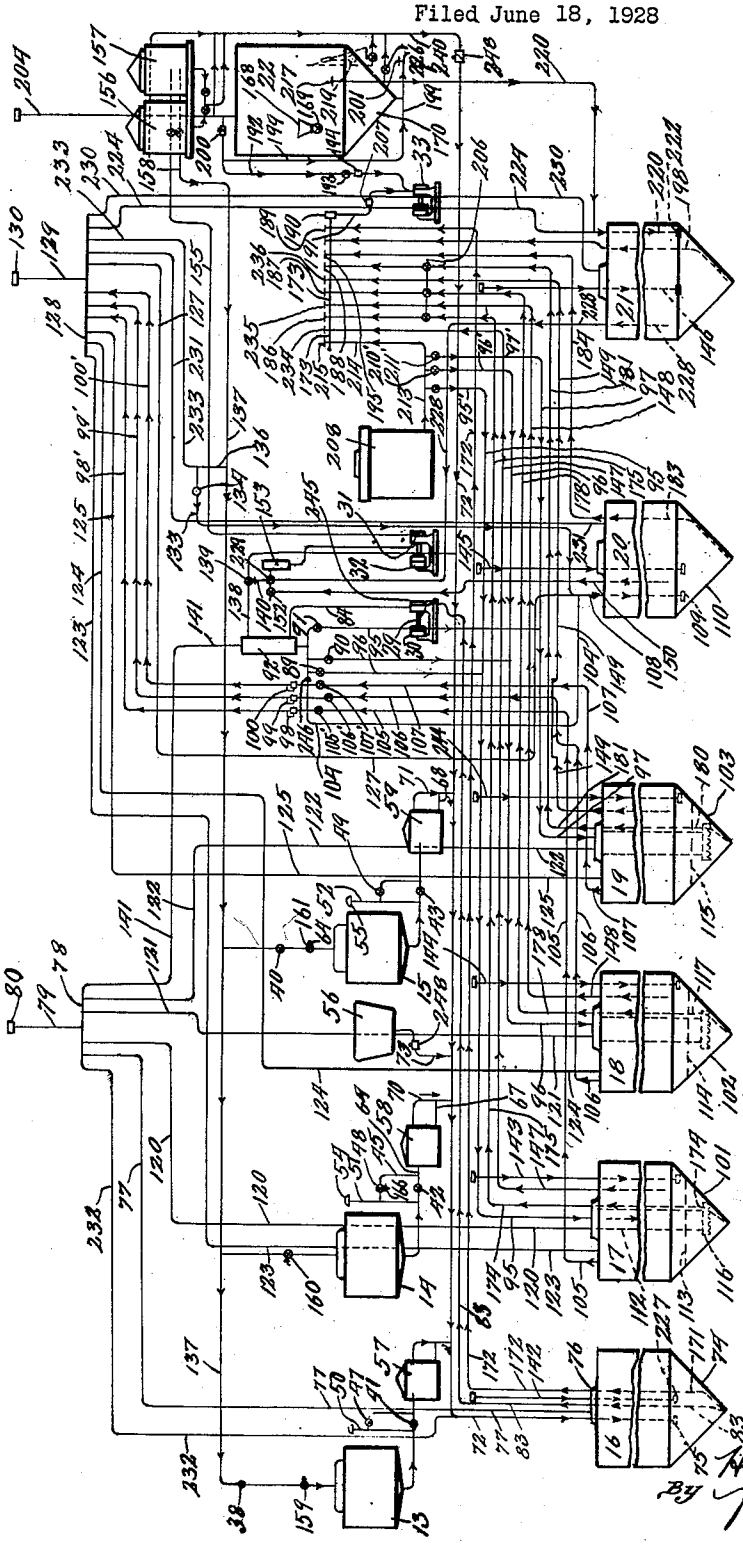


Fig. 1.

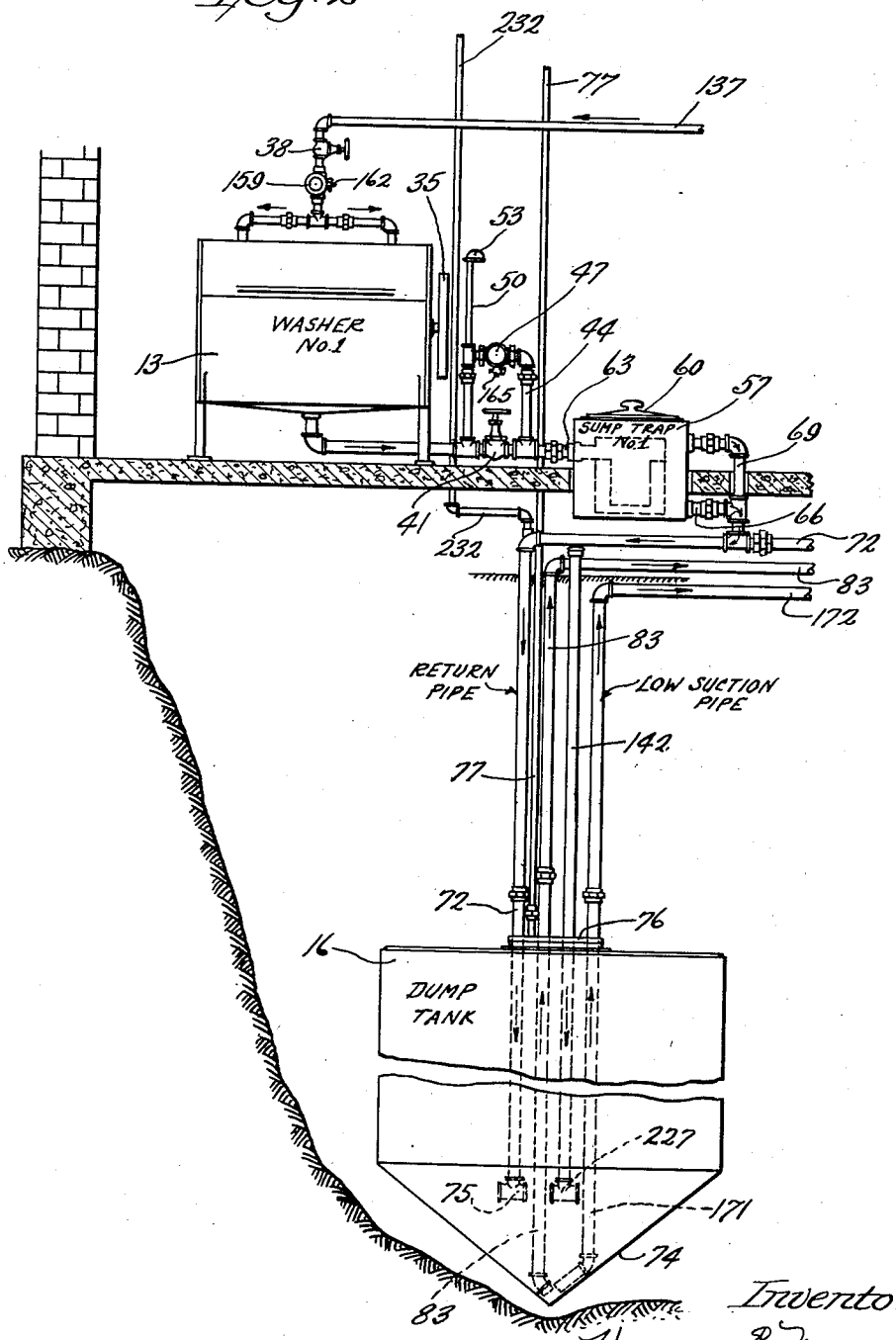
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DRY CLEANING SYSTEM

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Fig. 2



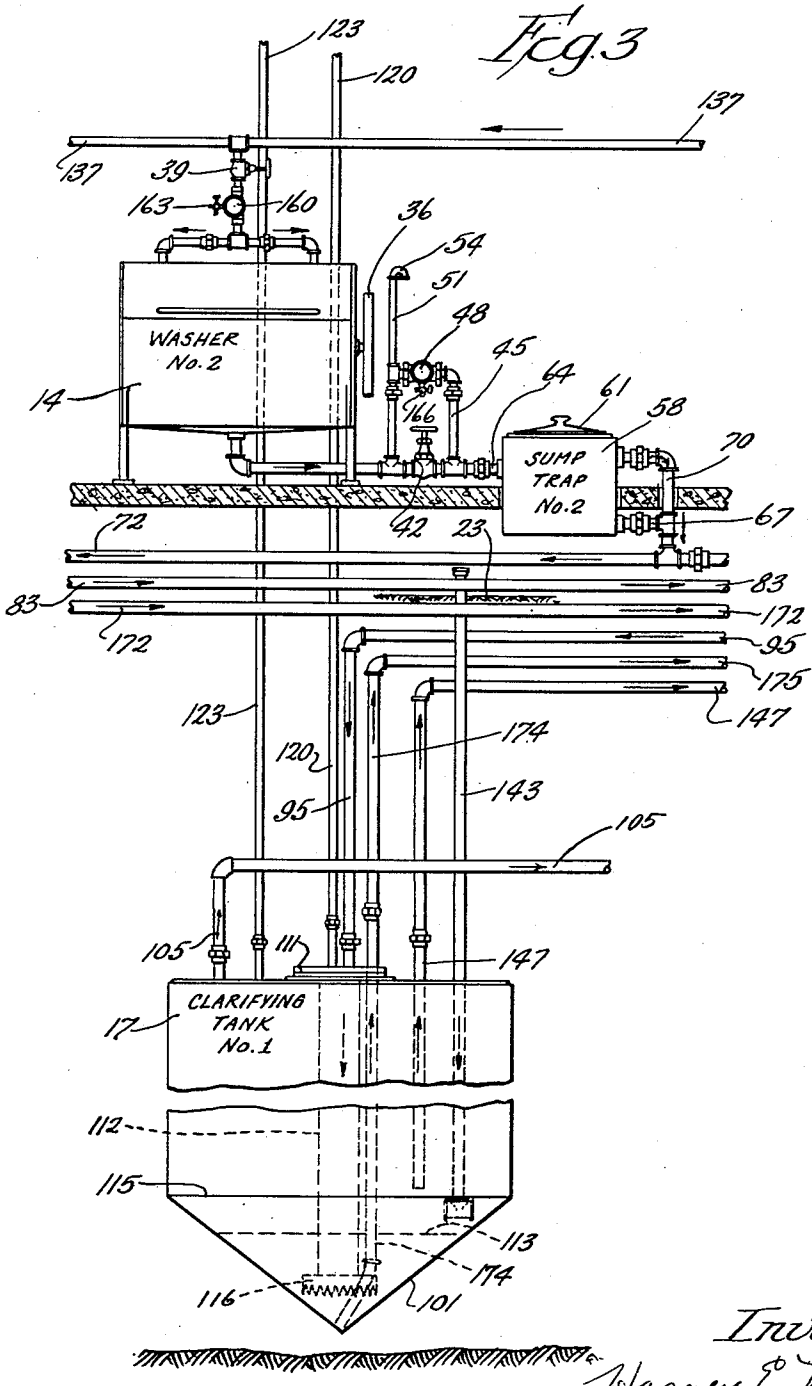
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DRY CLEANING SYSTEM

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Fig. 3



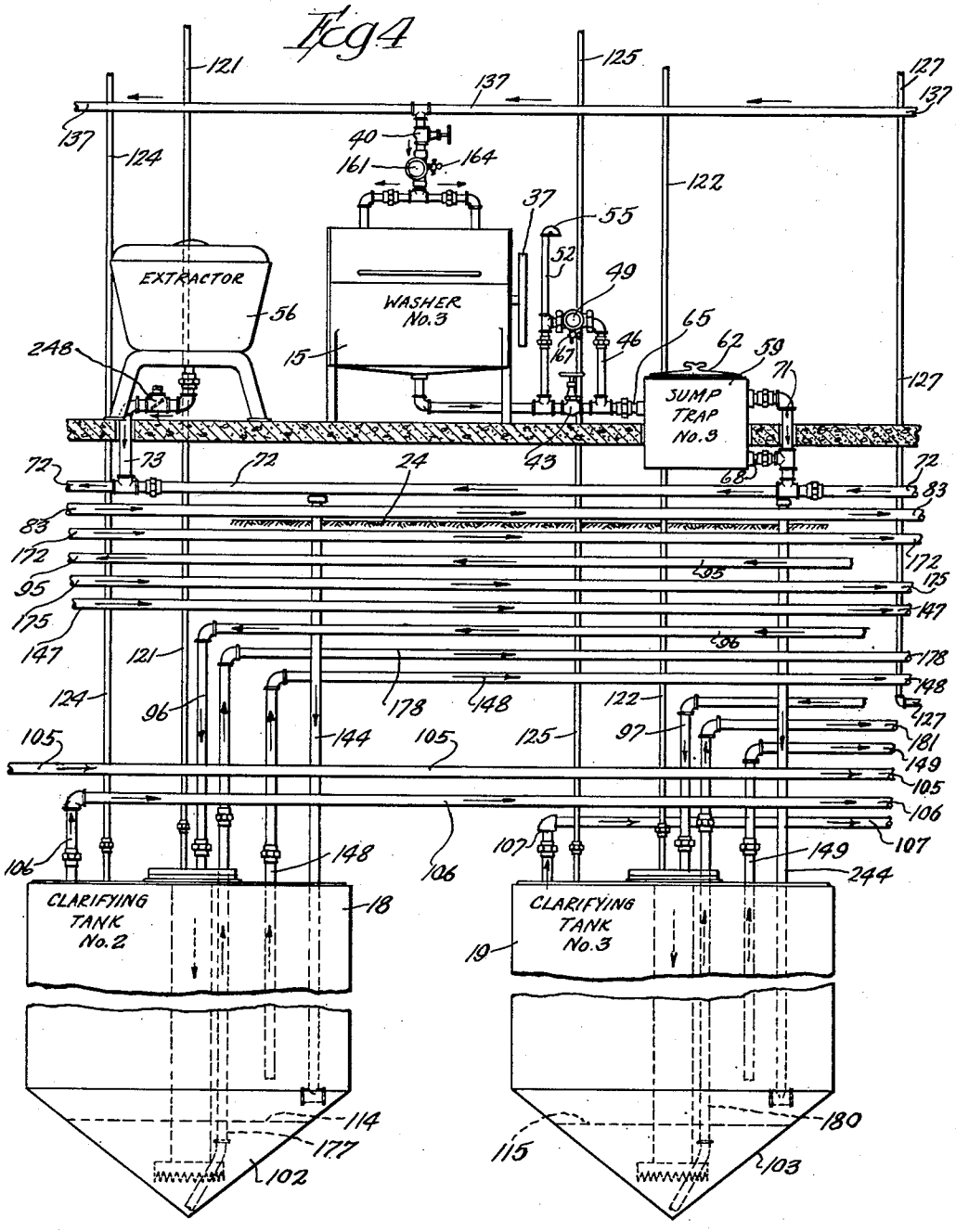
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DRY CLEANING SYSTEM

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Fig 4



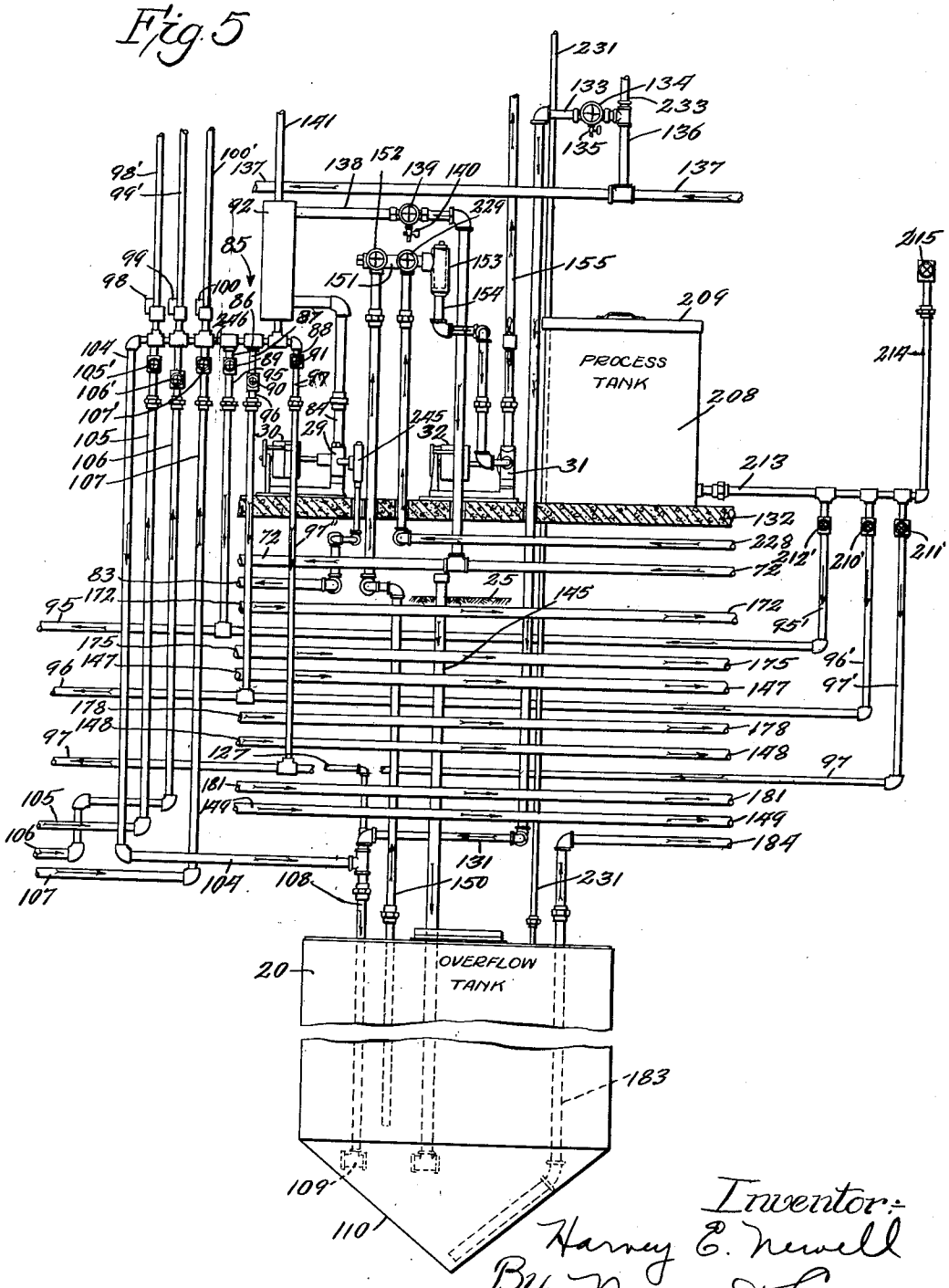
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DRY CLEANING SYSTEM

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Fig. 5



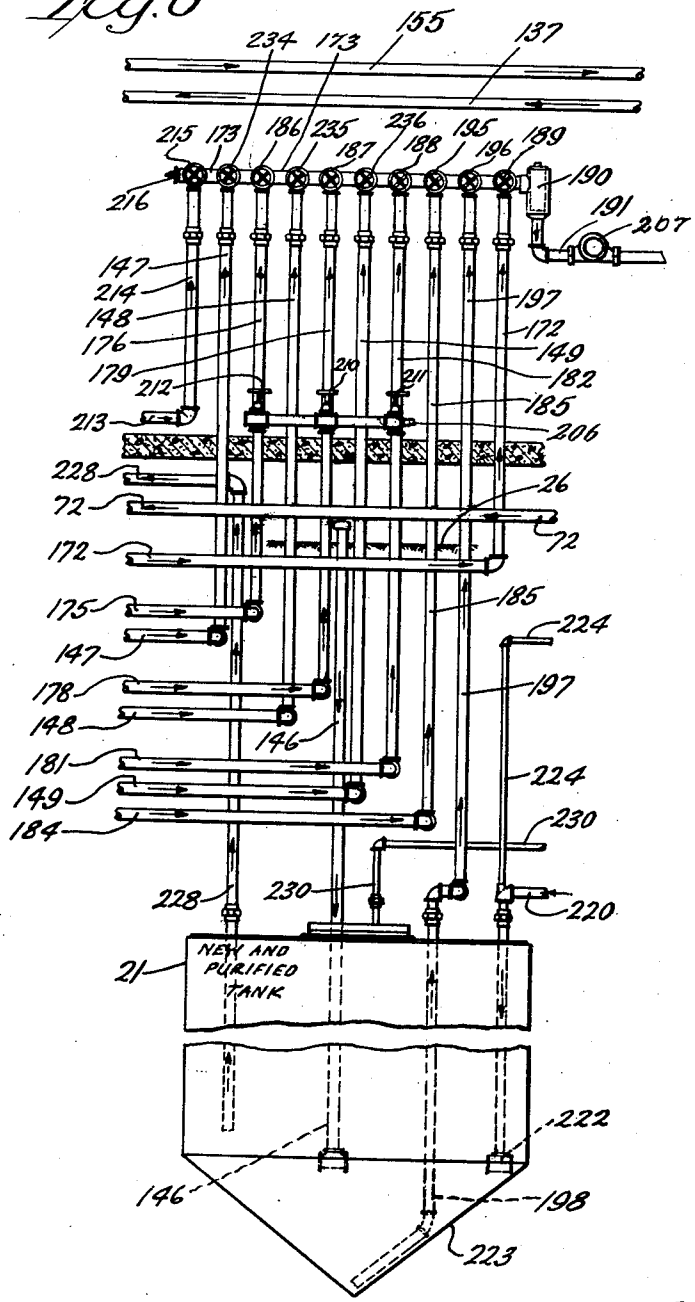
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Fig. 6



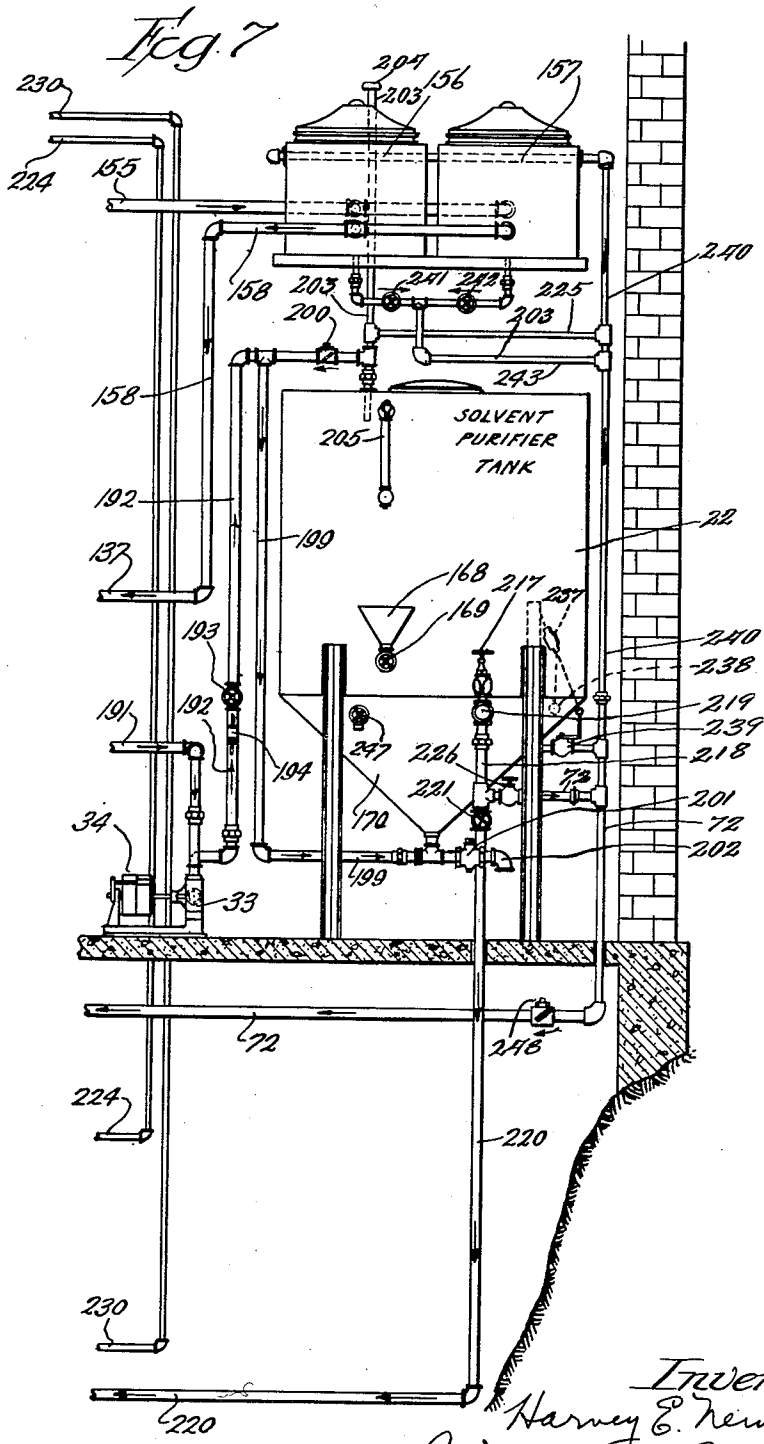
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Fig. 7



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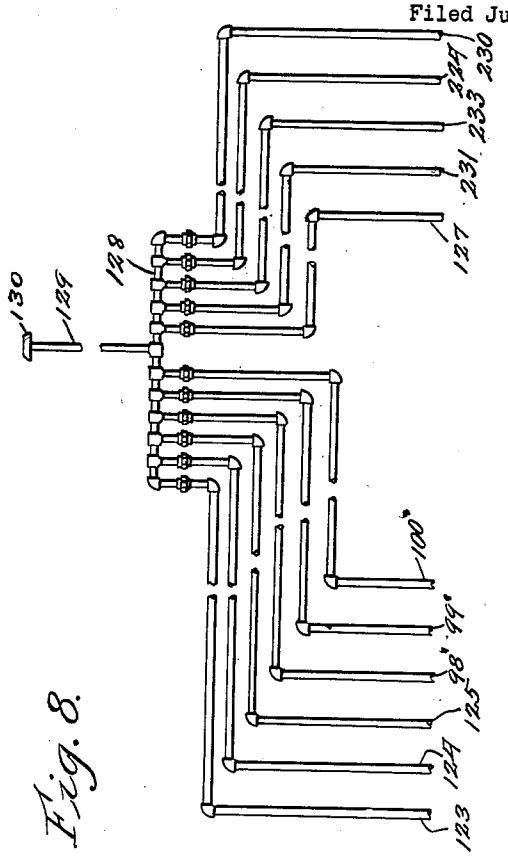


Fig. 8.

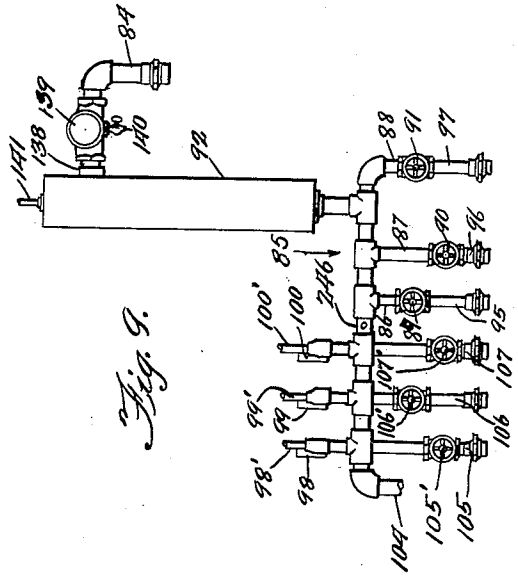


Fig. 9.

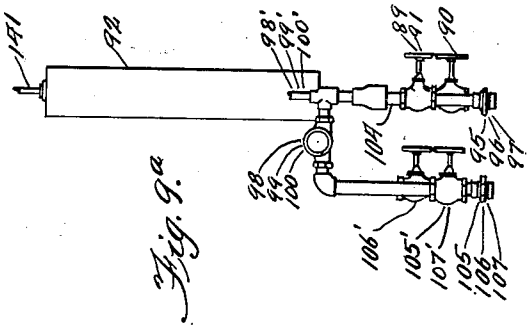


Fig. 9a.

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DRY CLEANING SYSTEM

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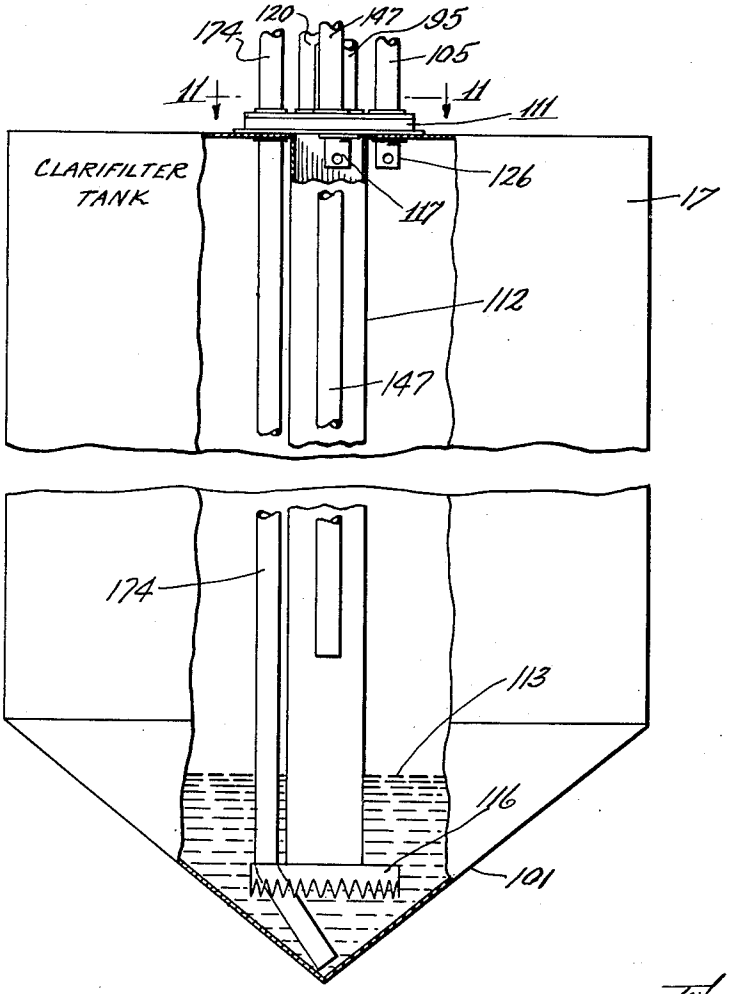


Fig. 10

Fig. 11

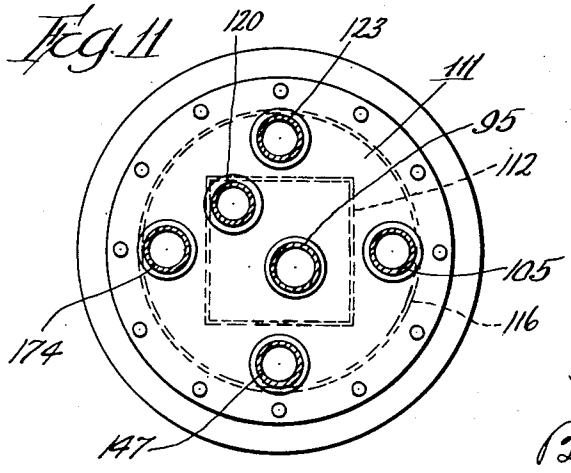
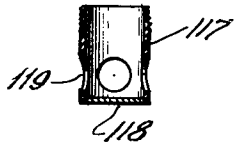


Fig. 12



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UNITED STATES PATENT OFFICE

1,937,093

DRY CLEANING SYSTEM

Harvey E. Newell, Fort Wayne, Ind., assignor to S. F. Bowser & Company, Inc., Fort Wayne, Ind., a corporation of Indiana

Application June 18, 1928. Serial No. 286,350

5 Claims. (Cl. 68—38)

This invention relates to dry cleaning systems employing gasoline or other solvent for washing or cleaning fabrics or other articles, and one of the objects of the invention is to improve and to increase the efficiency of a continuous dry cleaning system.

A further object of the invention is the provision of improved means for renovating the gasoline or other solvent used in the dry cleaning system for washing or cleaning fabrics or other articles.

Another object of the invention is the provision of an improved dry cleaning system embodying a plurality of washers to which other washers may be added, together with apparatus for increasing the capacity of the dry cleaning system.

A further object of the invention is the provision in a dry cleaning system of improved means for more rapidly and more efficiently renovating the solvent.

Another object of the invention is the provision of improved means for introducing used or dirty solvent into a receiving tank with a minimum disturbance of the contents of the tank so as to increase the efficiency of renovation of the solvent.

Another object of the invention is the provision of an improved method of clarifying gasoline or other solvent in a dry cleaning system by removing the odor other than the natural odor of the solvent and also the color from used gasoline in a continuous system so that the gasoline may be used over and over again, and further in the provision of improved apparatus for carrying out such method.

A further object of the invention is the provision in a dry cleaning system of a separate dump tank into which used solvent may be rapidly drained from the washers.

Another object of the invention is the provision in a dry cleaning system of one or more clarifying tanks into which used solvent may be introduced slowly with a minimum amount of disturbance of the liquid in such clarifying tank or tanks.

Another object of the invention is the provision of improved apparatus and method for purifying the solvent in a dry cleaning system.

A further object of the invention is the provision of a continuous dry cleaning system in which the operation is automatic in that the solvent may flow continuously through the washer or washers, clean solvent being continuously introduced into the washer or washers while the dirty or used solvent is flowing therefrom during the washing period.

More particularly it is the object of the present invention to provide an automatic system of dry cleaning by providing a circulating pump for the dirty or used solvent and a separate circulating pump for the clean solvent, each pump being adjusted in its capacity in accordance with the flow of solvent desired through the washer or washers, whereby the dry cleaning system is rendered "fool-proof" and operable by less skilled labor.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawings—

Fig. 1 is a diagrammatic view showing all of the parts of my improved dry cleaning system including the washers, the receiving tanks, pumps, filters, traps, extractor and piping connections;

Figs. 2, 3, 4, 5, 6 and 7 show sections of the dry cleaning system shown in Fig. 1;

Fig. 8 shows the upper portion of the piping shown in Fig. 1, the complete dry cleaning system being shown by placing Figs. 2, 3, 4, 5, 6 and 7 successively side by side and Fig. 8 above the same, Figs. 2 to 8, inclusive, showing sectionally the complete dry cleaning system of Fig. 1;

Fig. 9 is an enlarged view of the equalizing header for control of distribution of the solvent;

Fig. 9ª is a side view of Fig. 9;

Fig. 10 shows in detail my improved means for slowly introducing used or dirty solvent into a clarifying tank with a minimum disturbance of the liquid in such tank;

Fig. 11 is an enlarged sectional plan view taken on the line 11—11 of Fig. 10 to show the connections to the manhole cover of the clarifying tank shown in Fig. 10; and

Fig. 12 is an enlarged sectional view of a screw-threaded perforated cap adapted to be connected to the inlet pipe for introducing solvent into the clarifying tank; also to the overflow pipe for the egress of the solvent from the clarifying tank.

Referring more particularly to the accompanying drawings, 13, 14 and 15 respectively designate washers Nos. 1, 2 and 3 of the dry cleaning system. The separate dump tank is shown at 16 in Fig. 2. In Figs. 3 and 4, 17, 18 and 19 designate respectively clarifying tanks Nos. 1, 2 and 3 each having therein the slow liquid flow directing means shown in Fig. 10. In Fig. 5, 20 designates the overflow tank. In Fig. 6, 21 designates the new and purified solvent tank. In Fig. 7, 22 designates the solvent purifier tank. The

dump tank 16, the clarifying tanks 17, 18 and 19, the overflow tank 20 and the new and purified solvent tank 21 are adapted to be placed underground, as illustrated at 23 in Fig. 3, 24 in Fig. 4, 25 in Fig. 5, and 26 in Fig. 6. The tanks 16 to 21, inclusive, and certain piping leading thereto may be arranged underground or below the surface, while certain other parts and piping connections may be located above ground.

In Fig. 5, at 29 is shown the circulating pump for pumping dirty or used solvent. This pump 29 may be connected to pulleys 30 for operation by a belt from a counter-shaft, the pulleys 30 comprising a loose pulley and a tight pulley so that the counter-shaft may be connected or disconnected whenever desired to the pump 29 to start or stop the latter. Also, in Fig. 5 is shown the circulating pump 31 connected to pulleys 32 for operation from a counter-shaft. The circulating pump 31 is for the purpose of pumping clean solvent. In Fig. 7, a service pump is shown at 33 connected for operation to the pulleys 34. This service pump 33 is for the purpose of pumping from the bottoms of the underground tanks to the solvent purifier tank 22, as hereinafter more fully explained. It should be understood that while I prefer to connect the pulleys 30, 32 and 34 to the same counter-shaft which may be run at a predetermined constant speed, the pumps may be operated by independent and separate motors, such as electric motors, one connected to each of the pumps 29, 31 and 33. While each pump may be started and stopped when desired, I prefer to predetermine the maximum speed at which each pump may be operated so that the speed at which the liquid is pumped by each pump will be predetermined and limited, thus taking the control of the system to that extent out of the hands of the operator or attendant, while leaving the system otherwise automatic and subject to control by less skilled labor.

The washers 13, 14 and 15 may each be of the usual type operated by power applied at 35, 36 and 37 respectively. The washers are operated separately and independently and each may be of that type which is operated by oscillation or tumbling. A proper amount of solvent, such as gasoline, cleaners' naphtha, benzol, benzine, "Energine", Stoddard specification solvent, etc., or other similar solvent, may be used in the system shown in the drawings and directed into the washers by opening the valves 38, 39 and 40 in a manner hereinafter more fully described. Cleaning agents, such as soap, ammonia, etc., may be added to the solvent in the washers. The garments or other articles to be cleaned are immersed in the mixture in the washers and the latter operated for the prescribed time which is determined by the experience of the operator. It should be understood that the dry cleaning system shown in the drawings is a continuous circulating system but in handling an unusually dirty batch of clothes it is best to use soap more freely for mixture with the solvent in the washers and in order to get the best action from the soap for the first five minutes of the wash the continuous inflow and outflow from the washer should be shut off and the clothes washed by operation of the washer for a short period so that the soap can thoroughly saturate and act upon the dirty garments. After such initial period of operation of the washers with the mixtures of soap and solvent confined thereto the continuous inflow and outflow of the solvent may be effected while the washers are being mechanically operated.

When the desired amount of gasoline or other solvent has been directed into the washers by the opening of the valves 38, 39 and 40, the latter may be closed and the cleaning agent added to the solvent in the washers. Of course, during the running in of the clean solvent, the valves 41, 42 and 43 shown in Figs. 2, 3 and 4 are closed. The amount of solvent run into each washer is limited by the overflow by-passes 44, 45 and 46 which are respectively provided with sight-glasses 47, 48 and 49. The by-passes are also provided with vent pipes 50, 51 and 52, the upper ends of which are provided with U-shaped connections 53, 54 and 55 open to the atmosphere while preventing foreign particles from entering into the by-passes.

If desired, the washers may be operated initially by the continuous circulating method; that is to say, immediately after the garments are put into the washers the solvent may be directed into the upper sides of the washers and kept continuously flowing through the washers during the oscillation of the latter. During the entire washing and rinsing operation there is a continuous flow of the solvent through the washers. The clean solvent flows continuously into the washers and the dirty solvent flows out while the valves 38, 39 and 40 are opened and the valves 41, 42 and 43 are opened slightly. This is kept up until the solvent flowing from each washer is an clean as the solvent going into it. This may be determined by closing the valve 41, 42 or 43 so as to cause overflow through the respective by-passes so that the color and nature of the solvent may be observed in the sight-glass or sight-window 47, 48 or 49.

After the garments are washed they are transferred to the extractor 56, a large-sized centrifugal, by means of which the solvent is thrown out of the garments and the latter are then transferred to the drying tumbler where they are subjected to a current of hot air. During this process the last traces of the solvent are dried out of the garments and they are then ready to be finished and pressed.

The solvent after having been used in the deterging process contains dirt, greases, oils and color. This dirty solvent may be a combination of many substances, such as solvent, dirty soap, mineral fats, animal fats and greases, vegetable fats, dye-stuffs, alkali and textile fibers. Nearly all of these particles are hardly visible, such as dirt particles and textile fibers, while a large part of the soap is actually invisible to the naked eye. The animal, mineral and vegetable fats and oils go into a chemical solution with the solvent, while the dye-stuffs are so fine that they are invisible even with a microscope. The dirt is usually in two forms, heavy particles which will readily settle out of the solvent by gravity and small particles of colloidal dimensions which are so light that the liquid has to be almost quiescent to allow them to settle at all. The color in the dirty or used solvent is due to grease or oil in the solvent, to the dye taken out of the fabrics which have been washed and to the dirt which has been washed out of the fabrics or other articles. The color exists in particles of colloidal dimensions and cannot be filtered out of the solvent nor will it settle out of the solvent by gravity. As hereinafter more fully explained, all of the impurities in the solvent are removed by filtration, clarification and purification and the solvent is rendered soft, transparent and free from color and rancid odor before being directed into the tops of the washers. No dirt rings will form in the light trimmings or linings in dark garments,

because there is no dirt in the solvent being continuously directed into the tops of the washers. Loose lint is immediately carried out of the washers with the stream of dirty solvent and there is therefore no set-back of dark lint on light garments, or vice versa, and consequently the true color of each garment is brought out. In reclaiming the solvent used in my improved automatic circulating dry cleaning system, the solvent before it is directed back into the washers is so clarified and purified, as hereinafter explained, that the solvent will be white, soft, dry, free from traces of chemicals, and odorless, so that the most delicate white garments may be washed in the washers. The rancidity of used solvent is sometimes due to the oleic acids in soaps, but this rancidity is entirely removed so that there will be no "lingering smell" on cotton or other goods.

Each washer is provided with a sump trap and numbered according to the number of the washer, as shown in Figs. 2, 3 and 4 of the drawings. These sump traps are respectively 57, 58 and 59, and each is provided with a cover 60, 61 and 62 for access to the respective sump trap. Each sump trap is provided with a series of nested basket screens into the center one of which the dirty solvent flows by means of the pipes 63, 64 and 65. The sump traps may also be provided with waste in the screen baskets, but whether provided with waste or not the foreign material, such as buttons and the heavier articles, including visible lint, are trapped and may be removed manually. The used solvent after passing through the screens in the traps flows out by the lower connections 66, 67 and 68. It should be noted that the inlets to the sump traps at 63, 64 and 65 are below the bottoms of the washers 13, 14 and 15. By-passes are provided at 69, 70 and 71 so that if the sump traps 57, 58 and 59 should become clogged so as to retard the flow of the dirty solvent from the sump traps to such an extent as to nearly fill the sump traps, they will overflow into the by-passes 69, 70 and 71. Therefore, even through the sump traps are not taken care of by removal of the foreign material as often as they should be, the automatic circulating system may nevertheless be continued and not interfered with. All of the dirty solvent in the plant in which the automatic dry cleaning system shown in the drawings is installed may be run into the dump tank 16. This dump tank serves as a receptacle for dirty solvent from the washers, extractor, or other machines and is capable of receiving the dirty solvent at whatever speed the operator can direct it thereto. The dirty solvent is conveyed to the dump tank 16 from a main drain line shown at 72 in Figs. 2, 3, 4, 5, 6 and 7, and also diagrammatically illustrated at 72 in Fig. 1. The sump traps 57, 58 and 59 are connected directly to the main drain line 72 and so also the bottom of the extractor 57 by means of the pipe 73, as shown in Fig. 4. The dump tank 16 serves simply as a reservoir for the storage of the dirty solvent between the time it comes from the washers, extractor, or other machines, and the time it is pumped out and into the clarifying tanks 17, 18 and 19.

The bottom of the dump tank 16 is preferably cone-shaped, as shown at 74 in Fig. 2. The dump tank 16 is to some extent a sedimentation tank in that the heavier particles in the dirty solvent which have not been removed by the sump traps collect at the cone bottom 74 by sedimentation and in order not to stir up this sediment the lower end of the pipe 72 is provided with a T-connection 75 with opposite lateral openings. This T-connection should, however, be at the lower portion of the tank so as to form a liquid seal to the return pipe 72.

Connected to the top of the dump tank 16 through the manhole cover 76 is a vent pipe 77, as shown in Fig. 2, and this vent pipe is connected to the vent header 78, as shown in Fig. 8, and thence to the vertical pipe 79 which communicates to the atmosphere at its upper end under the air vent protector 80. Therefore, as the used solvent with the impurities therein which have not been removed by the sump traps, flows into the dump tank the air or gases in the upper portion of the dump tank may be freely vented to the atmosphere, thus permitting free flow of the used solvent into the dump tank.

The dump tank is entirely closed at its top as well as at its bottom and the top is provided with a manhole cover to which several pipes are connected and through which all of the vertical pipes for this tank extend except the vent pipe 77, the latter communicating merely with the inner top portion of the tank.

As shown in Fig. 2, a suction pipe 83 extends through the manhole cover 76 to the bottom of the dump tank 16. The suction pipe 83 extends, as shown in Figs. 2, 3, 4 and 5, to the constantly running circulating pump 29 which directs the dirty solvent pumped from the dump tank through the pipe 83 and suction strainer 245 to the vertical pipe 84, as shown in Fig. 5, and thence to an equalizer header 85, a view of which is shown in Fig. 9.

Branching from the equalizer header 85 are elbow pipes 86, 87 and 88 which are respectively provided with hand-operated valves 89, 90 and 91. Connected respectively to the valves 89, 90 and 91 are pipes 95, 96 and 97 which are respectively connected to the clarifying tanks 17, 18 and 19, as shown in Figs. 3 and 4. On top of the equalizer header is a standpipe 92 to equalize the flow in the pipes 95, 96 and 97 and to assist any entrained air in the solvent to escape through the vent 141 attached to the top of the standpipe and to the vent header 78. This equalizer header is divided into two parts by a solid nipple 246 which prevents communication between the clean and the dirty sides of the header. It will thus be seen that when dirty solvent is pumped from the dump tank by means of the dirty circulating pump 29, the air or gas in the pipes 95, 96 and 97 may escape to the atmosphere, thereby permitting free flow of the dirty solvent from the dirty distributing part of the header 85 to the pipes 95, 96 and 97 which are connected to the clarifying tanks.

The clarifying tanks may be of any size or number that will suit the work to be done by the plant. The system shown, however, is such that when the capacity of the plant is desired to be increased by the addition of one or more washers, one or more clarifying tanks may also be added. In the drawings there are shown three clarifying tanks and in each of these tanks is placed a solution in the proportion of one and one-half pounds of what is known in the trade as Huron alkali to one gallon of water. The amount of this solution in this proportion will vary with the size of the clarifying tank. For instance, if the clarifying tank is of two thousand gallon capacity, the solution will consist of one-hundred and twenty-one pounds of Huron alkali and eighty-one gallons of water. Huron alkali

consists approximately of 85% sodium carbonate and 15% of sodium bicarbonate.

The dirty solvent is carried to the bottom of each clarifying tank where it is passed through the alkaline solution. Through the action of this alkaline solution the grease in the dirty solvent is saponified or changed into a so-called soft soap. This saponification or the formation of soft soap collects the particles of dirt in the solvent and as this combination of collected dirt and soft soap is heavier than the solvent, it remains near the bottom of the tank, while the solvent after it has been freed from this weight, rises to the top of the clarifying tank.

The condition in each clarifying tank varies according to the depth of the material therein. In the cone bottoms 101, 102 and 103 of the clarifying tanks 17, 18 and 19 there will be a solution of the alkali and water. Floating on this solution will be the soft-soap and dirt, sometimes called "sludge" or "muck". Above this layer of sludge or muck is a comparatively thin layer or strata approximately two or three inches in depth of dirty solvent and above the strata of dirty solvent extending to the top of the tank is comparatively clean solvent, that at the very top of the tank being cleaner than that near the strata of dirty solvent. The cleaner solvent at the top of each of the clarifying tanks 17, 18 and 19 respectively rises up through the pipes 105, 106 and 107, passing through the control valves 105', 106' and 107' and the sight-glasses 98, 99 and 100, each pipe being furnished with a vent 98', 99' and 100' attached to the vent header 128. Leaving the sight-glasses, the clean solvent empties into the clean part of the equalizer header 85, and enters the operating overflow pipe 104. As shown in Fig. 5, the operating overflow pipe 104 is connected to the vertical pipe 108 which extends through the top of the overflow tank 20 to the T-discharge connection 109 for discharging the overflow from the clarifying tanks laterally into the upper portion of the cone bottom 110 of the overflow tank 20. The clean solvent from the tops of the clarifying tanks flows through the operating overflow pipe 104 into the overflow tank 20 as fast as the dirty solvent is pumped into the clarifying tanks.

One of the most important features of my improved dry cleaning system is the means for introducing the dirty solvent into the clarifying tanks in a large volume, but with reduced velocity, so as to reduce the disturbance of the contents of each clarifying tank to a minimum. The details of the construction for this purpose are shown in Figs. 10, 11 and 12. A manhole cover 111 is securely and, if desired, removably attached to the top of the tank with a liquid-tight connection and a plurality of pipes are connected to the manhole cover 111 both above and below the same, those extending into the tank being suspended from the manhole cover 111.

A spray pipe 112 of comparatively large cross-sectional area of any shape desired such as circular, or square in cross-section as shown in Fig. 11, is securely attached to the bottom of the manhole cover 111 so as to be suspended therefrom and extend down to the cone bottom 101 of the tank so that the lower end of the pipe 112 will be immersed in the solution of alkali and water, the upper level of which is approximately at 113 in Fig. 10. Approximately the same level of the alkaline solution is maintained at 114 and 115 in the clarifying tanks 18 and 19, as shown in Fig. 4. On the lower end of the spray pipe 112 is an inverted crown or serrated distributor 116. This crown distributor may be flat on top with an opening therein for connection to the lower open end of the spray pipe 112, the vertical portion of the distributor being cylindrical and the serrations extending in a circle.

At the top of the spray pipe 112 and inside of the same is an inlet pipe 117 closed at its bottom 118, as shown in Fig. 12, and provided with lateral perforations 119. The short perforated pipe 117 is open at its upper end and adapted to be screw-threaded to the bottom of the manhole cover 111 in position for communication with the return pipe 95. The construction shown in Figs. 10, 11 and 12 is provided for each of the clarifying tanks 17, 18 and 19 so that when the dirty or used gasoline is pumped by means of the dirty circulating pump 29 through the dirty distributing header the used solvent will flow through the pipes 95, 96 and 97 by first flowing into the short pipes 117 and through the four lateral perforations 119 and thence into the large spray tube 112 and finally down to the bottom or cone portions of the clarifying tanks where the serrated crown distributors 116 spread the dirty solvent directly into the alkaline solution and substantially below the levels 113, 114 and 115 thereof.

Connected to the top of the manhole cover 111 so as to be in communication with the upper end of the spray tube 112 is an air vent pipe 120 which, as shown in Figs. 3 and 8, extends upwardly to the dirty vent header 78 and thence to the atmosphere through the vent pipe 79. A similar vent pipe is provided for each clarifying tank, that for the clarifying tank 18 being designated 121, as shown in Figs. 4 and 8, and that for the clarifying tank 19 being designated 122, as shown in the same views. The vent pipe in communication with the upper end of the spray pipe allows any air which enters the spray pipe to escape and also allows the air to enter the spray pipe, when necessary.

In operation, after a suitable chemical solution of heavier specific gravity than and not miscible with the solvent, is run into the clarifying tank by way of the pipe from the process tank, the chemical solution fills the cone of the clarifying tank until the crown distributor is submerged to a depth of several inches, or to the level indicated at 113 in Fig. 10. The tank is then filled with clean solvent whereupon air in the tank will escape through a vent pipe to the atmosphere. Such vent pipes for the clarifying tanks 17, 18 and 19 are shown at 123, 124 and 125 in Figs. 3 and 4. The connections of the vent pipes 123, 124 and 125 to the clean vent header 128 are shown in Fig. 8.

When the dirty solvent is pumped into the short pipe 117 from the pipe 95, as shown in Fig. 10, it will strike the bottom 118 and then spread laterally through the four perforations 119 and thereby prevent a direct downward current into the spray pipe. The spray pipe is made large in cross-section so as to increase the volume of the received dirty solvent and decrease the velocity of flow and therefore when the dirty solvent emerges from the bottom of the spray pipe in large volume the velocity will be materially decreased and therefore the disturbance of the chemical solution in the cone bottom of the tank will be greatly reduced. The serration of the crown distributor will also distribute the currents of the introduced dirty solvent over a wider area and in various directions so as to not only reduce the disturbance of the liquid in the tank

to a minimum, but also to distribute the dirty solvent thoroughly in the chemical solution at the bottom of the tank.

By virtue of the difference in the specific gravity of the incoming dirty solvent and the chemical solution at the bottom of the tank and owing to their non-miscibility, the solvent rises up through the chemical solution. As the tank is full of liquid, an amount of clean solvent equal to the amount of dirty solvent entering the tank will flow out through the operating overflow pipe 104 into the overflow tank 20. By the time that the dirty solvent has reached the upper level 113 of the chemical solution at the bottom of the tank it has relieved itself of the dirt and grease and some of the color it has been carrying. The solvent will therefore leave the clarifying tank in a clarified condition fit for re-use without any more conditioning.

The arrangement shown in Figs. 10, 11 and 12 for introducing the dirty solvent into the clarifying tank decreases the velocity of flow of the solvent to such an extent that any air entrained with the solvent can readily escape by means of the vent pipe 120. The velocity downward in the spray pipe 112 is so slow that the air cannot be carried with it. It is desirable to eliminate the air in this manner, because if carried into the chemical solution it would rise from the bottom of the tank and cause an agitation that would stir up any dirt that would be there. Some of the dirt taken out of the dirty solvent is so light that bubbles of air passing through the solvent containing such light particles of dirt cause sufficient disturbance to carry such light particles of dirt to the top of the clean solvent.

With the velocity of the incoming solvent further decreased and broken up or distributed by the crown or serrated distributor 116, the introduction of the dirty solvent into the chemical solution is made so quietly that there is not sufficient agitation to disturb the light particles of dirt in the chemical solution or in the strata of dirty solvent just above the upper level 113 of the dirty solvent. For instance, in a two thousand gallon clarifying tank seventy-six inches high above the cone bottom or on the shell and with a cone bottom twenty-four inches deep, the dirty solvent has been found to be practically clarified by the time it has reached a point forty-five inches above the serrated edge of the crown distributor 116, and by the time the solvent reached the overflow connection at 126 the solvent was completely clarified.

By introducing the dirty solvent into the clarifying tanks with very much reduced velocity and splitting up the solvent into small portions it rises through the alkaline solution without any appreciable disturbance thereof. Some of the dirt in the dirty solvent is of such a light weight that a slight disturbance in the bottom of a clarifying tank will cause it to rise and contaminate the clean solvent above it. It is for this purpose that the spray pipe and distributor are made so as to reduce the velocity of the incoming dirty solvent to a minimum and split it up into small portions. It will thus be seen that with the solvent rising slowly up through the clarifying tanks with practically no distrubance thereof substantially all of the dirt that the solvent has been carrying will drop out of it or precipitate before it reaches the top of the tank. In practice, with large capacity clarifying tanks there is a period of several hours time between the entrance of the dirty solvent at the bottom of the clarifying tank and its clean exit at the top. It is the combination of chemical action by the alkaline solution, the absence of appreciable disturbance and the time permitted for the sedimentation of the fine particles of dirt in the solvent while rising through the clarifying tank, that clarifies the dirty solvent before it passes through the risers 105, 106 and 107 to the operating overflow pipe 104 and thence into the overflow or storage tank 20.

Connected to the top of the return pipe 108 which extends into the overflow tank 20, is an air vent pipe 127, as shown in Figs. 4 and 5. As shown in Fig. 8, the air vent pipe 127 is connected to the auxiliary header 128 from which rises the air vent pipe 129 with its upper end open to the atmosphere under the air vent protector 130.

It should also be noted that, as shown in Fig. 5, to the operating overflow pipe 104 and the upper end of the return pipe 108 is connected a pipe 131 which extends above the ground level 25 and also above the floor level 132 to a substantial elevation to afford a clean summit by-pass 133 having therein a sight-glass 134 below which is a pet cock 135. The clean summit by-pass also comprises the pipe 136 which extends downwardly and communicates with the clean solvent supply pipe 137 which extends to the tops of all of the washers. When all of the valves 38, 39 and 40 at the washers are closed the clean solvent may be delivered from the pipe 137 up through the by-pass pipes 136 and 133 into the pipe 131 and back into the overflow tank 20, thus preventing stalling of the pump 31 hereinafter described for supplying clean solvent to the washers.

Connected to the standpipe 92 shown in Fig. 9 and in elevation in Fig. 5, is a dirty summit by-pass 138 having therein a sight-glass 139 and below the latter a pet cock 140. The dirty summit by-pass is connected between the common drain pipe 72 and the distributing header 85. If during the operation of the dirty circulating pump 29 all of the valves 89, 90 and 91 should be closed or nearly so the excess dirty solvent would be pumped through the dirty summit by-pass 138 and the condition of the solvent observed at the sight-glass 139 or a sample of the dirty solvent obtained from the pet cock 140 for testing purposes. It will also be seen that even when the valves 89, 90 and 91 are individually and independently adjusted or regulated for the supply of dirty solvent to the clarifying tanks and the dirty circulating pump 29 is supplying more dirty solvent than is required by the clarifying tanks the excess will flow back through the main drain pipe 72 into the dump tank 16, thereby maintaining the automatic continuous circulation of the dry cleaning system.

The upper side of the standpipe 92 is provided with an air vent pipe 141, as shown in Fig. 5, and this air vent pipe is connected to the air vent header 78, as shown in Fig. 8.

Each of the underground tanks, clarifying tank excepted, may be provided with a fill pipe, the upper end of which extends a short distance above ground and provided with removable protecting caps. Such fill pipes are shown so arranged for the respective tanks 16, 20 and 21 at 142, 145 and 146 respectively. Each fill pipe may extend down into the tank with its T-discharge in the upper part of the cone bottom.

For the sake of clearness Figs. 3, 4, 5 and 6 show the pipes extending into the tops of the tanks at various points, but I prefer to have all

of the pipes attached to the manhole cover 111, as shown in Fig. 2, and also in Figs. 10 and 11 with the exception of the fill pipe which has been omitted for the sake of clearness. It should also be observed that connection shown at 126 in Fig. 10 is the exit for clean solvent from the top of the clarifying tanks up to the clean part of the equalizer header 85. There is an intermediate suction from tanks 17, 18 and 19 by means of which comparatively dirty or discolored solvent may be drawn by means of the service pump 33, and discharged to the purifier 22. The particular tank, for instance 17, drawn from can then be refilled by shutting off the supply of solvent to the other tanks. This can be done by closing valves 90 and 91. This operation is usually performed at the end of the day's work. Frequent periodic withdrawal of dirty discolored solvent from the clarifying tanks 17, 18 and 19 enables the operator to keep his solvent in first-class condition. Such suction pipes so arranged are shown at 147, 148 and 149 in Figs. 3 and 4. However, as above explained, the clarifying tanks are intended to be completely filled and the clarified solvent flows through the risers 105, 106 and 107 to the operating overflow pipe 104 and thence into the overflow tank 20, and the clean circulating pump 31 pumps the clean solvent from the overflow tank to the supply pipe 137 connected to the washers.

As shown in Fig. 5, the suction pipe 150 extends from the overflow tank to the clean suction header 151. When the valve 152 is open and the pump 31 is operating, clean solvent will be drawn through the suction strainer 153 into the pipe 154 and then forced into the vertical pipe 155, as shown in Figs. 5, 6 and 7. The solvent then passes through the filters 156 and 157 in parallel. These filters may consist of screen baskets filled with waste. After flowing through the filters 156 and 157 the solvent passes through the pipe 158 to and through the supply pipe 137 which delivers the clarified solvent to the various washers in multiple or parallel.

The filters 156 and 157 have very little work to do in the dry cleaning system shown. They are included as a safe-guard to the solvent before it passes to the washers. The function of the filters 156 and 157 is to serve as a warning to the operator when attention to the clarifying tanks is necessary. For instance, the chemical charges in the clarifying tanks and the number of the clarifying tanks are usually so predetermined as to take care of one week's work done in the washers in the plant in which the dry cleaning system is installed. If the chemical charges in the clarifying tanks have been used for more than one week there is a possibility that such chemical charges may become exhausted in strength after a few more days use beyond the week and in such event the solvent passing through the clarifying tanks would not be properly cleansed and would run over into the overflow tank 20 in a more or less dirty or contaminated condition. When this solvent is then pumped by the clean circulating pump 31 to the filters 156 and 157, instead of being clean would carry some dirt with it. The filters would remove some of the dirt but not all of it and the solvent would appear at the washers slightly cloudy in appearance as observed by the sight-glasses at 159, 160 and 161 respectively below the control valves 38, 39 and 40. Pet cocks 162, 163 and 164 are also associated with the sight-glasses so that samples of the solvent may be obtained for testing purposes.

When the chemical charges in the clarifying tanks have been so reduced in strength as to prevent complete clarification of the dirty solvent, the dirt left in the solvent would be carried directly into the washers in the absence of the filters 156 and 157. However, with the clarifying tanks kept in proper condition no dirt reaches the filters 156 and 157.

While the operator is able to tell the condition of the solvent flowing into the washers by the sight-glasses 159, 160 and 161, he is also able to tell the condition of the solvent flowing out from the washers by the sight-glasses 47, 48 and 49, each of which may also be provided with a pet cock 165, 166 and 167. By closing the valves 41, 42 and 43 the operator may put into operation the by-passes in which the sight-glasses 47, 48 and 49 are located, these by-passes limiting the depth of the solvent in each washer. In other words, the operator may regulate the valves 38, 39 and 40 by opening them to just sufficient extent to cause a continuous flow through each washer of the solvent while its depth is maintained at the height of the sight-glasses 47, 48 and 49 of the depth regulating by-passes, while the valves 41, 42 and 43 are closed.

The action of the whole system thus far described is to discharge the dirty solvent from the washers into the sump traps 57, 58 and 59 which will catch any buttons, coins, and other larger particles of foreign material that are carried out of the washers. These sump traps retrieve the buttons, coins, etc., and prevent them and foreign material from entering the underground tanks and therefore also prevent them from reaching any of the pumps. The dirty solvent is drawn from the dump tank and passed into the clarifying tanks and then the clarified solvent is passed into the overflow tank which acts as a storage tank of the clarified solvent in readiness for use in the washers. If the clean circulating pump is not delivering solvent to the washers but is nevertheless continuing to operate, there would be a tendency for the overflow or storage tank to fill up with no place for the excess solvent to go. When this condition occurs, the solvent will back up the overflow pipe 104 and up the vents 98', 99' and 100'. This raises the head of the dirty solvent in the standpipe 92 until it reaches the level of the dirty solvent by-pass 138, through which it can by gravity pass back to the dump tank 16. Thus the two pumps 29 and 31, being respectively the dirty circulating pump and the clean circulating pump, may be operated continuously and indefinitely without causing any trouble and without requiring the attention of any skilled labor, and yet when the operator is ready for solvent in any of the washers all he has to do is to open the supply valve above the same to effect the filling of the washer with clean solvent, and as above explained, the operator may by means of the discharge valves regulate the flow of the dirty solvent from the washers to the drain pipe and thence into the dump tank. It will thus be seen that the operation of the system is entirely automatic in its clarification of the used solvent and the re-supply of this same solvent to the washers in a continuous circulating system.

In Fig. 6, is shown the new and purified tank 21 for containing new and purified solvent in which there is no color. In operation of the washing processes, the dirty solvent running from

the washers contains three principal impurities. They are dirt, grease, and color. The clarifying tanks with the chemical solutions therein remove the dirt and grease, but they do not remove the color or colloidal particles remaining in suspension in the clarified solvent. In the system shown in the drawings, the operator has under his control for use in the washers two kinds of clean solvent, one from the overflow tank 20 which might have more or less color or colloidal particles in suspension and the other from the new or purified tank which will have no color or colloidal particles in suspension and will be free from odor.

In order to remove color from the solvent, a solvent purifier tank 22 is provided, as shown in Fig. 7. This tank has a cone-shaped bottom into which is placed a solution of industrial alkali and water, the industrial alkali consisting approximately of 97% sodium hydroxide and 3% sodium carbonate. Also, in the bottom of the solvent purifier tank is placed a mixture of finely divided de-colorizing carbon, preferably Darco, and a solvent. Darco is a trade name for finely divided carbon obtained from lignite treated with steam and marketed by the Darco Sales Corporation, 45 East 47th Street, New York city, New York. Other saponifying alkalies may be used in the clarifying tanks, and other saponifying alkalies and other decolorizing agents may be used in the purifier; but for effectiveness, I prefer to use those mentioned.

For a three-hundred gallon solvent purifier tank the proportions would be thirty pounds of industrial alkali mixed with fifteen gallons of water and poured into the purifier tank 22 through the filling funnel 168 after opening the valve 169. This is followed by pouring in about five gallons of dirty solvent. Then a charge of twenty pounds of Darco mixed with ten gallons of dirty solvent is poured into the funnel 168. When dirty solvent is pumped into the purifier tank 22 it passes through the alkaline solution and the Darco and is thoroughly mixed with both. After the purifier tank is filled to capacity with dirty solvent, air is pumped into the tank for a period of five minutes in order to thoroughly agitate the contents. It is then allowed to rest quietly for about one and one-half hours during which the following action has taken place. Any soap or grease in the solvent has been acted upon by the industrial alkali so as to form a heavy sludge. This heavy sludge in settling has carried down with it the particles of dirt and Darco. The Darco in its turn has collected to itself the vary small particles of color in colloidal suspension in the solvent and so small that they cannot be filtered out. Thus when the settling period is over the grease, soap, dirt and Darco are in the cone-shaped bottom 170 of the purifier tank while above this layer of dirty sludge is the purified solvent. This solvent is water white or colorless and transparent and entirely free from odor or rancidity. The purified solvent is directed into the new and purified tank 21.

The mixture of water, alkali and finely divided carbon obtained from lignite, when mixed with solvent containing color, odor and very minute particles of foreign material in suspension reacts thus; the alkali saponifies the grease content of the solvent and the carbon removes all color and minute particles in colloidal suspension and the combination of these actions with water forces rapid precipitation, the water and other precipitates sinking to the bottom and the soft white solvent rising to the top for discharge into the new and purified storage tank 21.

It will be noted that each of the underground tanks 16, 17, 18, 19, 20 and 21 has a low suction pipe, the lower end of which extends down into the extremity of the cone. In Fig. 2, such low extension pipe is designated 171 and is connected to the pipe 172 which extends horizontally, as shown in Figs. 2, 3, 4, 5 and 6 to the low suction header 173 in Fig. 6. In Fig. 3, the low suction pipe 174 extends from the extreme bottom of the tank up to the horizontal pipe 175 and thence horizontally, as shown in Figs. 2, 3, 4, 5 and 6, to the vertical pipe 176 leading to the low suction header 173 shown in Fig. 6. In Fig. 4, a low suction pipe 177 extends from the extreme bottom of the tank 18 up to the horizontal pipe 178 and the latter extends horizontally, as shown in Figs. 4, 5 and 6, to the vertical pipe 179 which is connected to the low suction header 173. In Fig. 4, the low suction pipe 180 extends from the extreme bottom of the tank 19 up to the horizontal pipe 181 and the latter extends horizontally, as shown in Figs. 4, 5 and 6, to the vertical pipe 182 which is connected to the low suction header 173. In Fig. 5, the low suction pipe 183 extends from the extreme bottom of the tank 20 up to the horizontal pipe 184 and the latter extends horizontally, as shown in Figs. 5 and 6, to the vertical pipe 185 which is connected to the low suction header 173. The wheel-operated valves 186, 187, 188 and 189 control the flow from the pipes 176, 179, 182 and 172, respectively, to the low suction header 173. Connected to the low suction header is a suction strainer 190 having a cup screen therein and extending from the bottom of this suction strainer 190 is a pipe 191 connected to the service pump 33, as shown in Figs. 6 and 7. To the discharge pipe of the service pump 33 is connected a vertical pipe 192 having a valve 193 therein and below the latter is a can discharge spigot 194. By opening the valve 189 the low suction header will be connected to the pipe 172 which leads to the pipe 171 at the bottom of the dump tank 16. By opening the valve 186 the low suction header 173 will be connected to the bottom of the clarifying tank No. 1. By opening the valve 187 the low suction header will be connected to the bottom of the clarifying tank No. 2. By opening the valve 188 the low suction header 173 will be connected to the bottom of the clarifying tank No. 3. By opening the valve 195 the low suction header 173 will be connected to the bottom of the overflow tank 20. By opening the valve 196 the low suction header 173 will be connected through the pipes 197 and 198 to the bottom of the new and purified tank 21. The low suction header 173 is therefore connected to the bottoms of the tanks 16, 17, 18, 19, 20 and 21 in multiple so that by operating the valves mentioned the accumulated sediment or sludge at the bottom of any tank, together with accumulated water at the bottom of any tank, may be removed individually. This permits the operator to close all of the valves at the low suction header, except the one through which the sludge is to be withdrawn, and by keeping the valve 193 closed the operation of the pump 33 will cause the sludge to be discharged through the spigot 194 to a receiving can. So long as the sludge is of a watery nature it may be discarded, together with the solid or dirt impurities, but when the sludge begins to contain solvent the can discharge spigot 194 should be closed and the

valve 193 opened so as to direct the sludge containing solvent up through the vertical pipe 192 and down through the descending pipe 199, there being a check-valve 200 opening only toward the left which will automatically close and prevent the sludge from being pumped into the top of the purifier tank 22. The pipe 199 extends to an opening in the extreme bottom of the cone bottom 170 for discharge of the sludge into the chemical mixture at the bottom of the purifier tank 22. At such time the valve 201 is closed and this valve is opened only when the sludge at the bottom of the purifier tank is to be withdrawn at the discharge outlet 202.

A draw-off may also be provided at the upper portion of the cone bottom 170 as indicated at 247. This draw-off may consist of a manually operated valve for controlling a spigot so that when desired the depth of the chemical mixture in the cone bottom may be reduced and its upper surface lowered below the valve 217, thus assuring purified solvent passing into the pipe 218 when the valve 217 is opened.

Connected to the top of the solvent purifier tank is an air vent pipe 203 which opens to the atmosphere under the air vent protector 204. The solvent purifier tank 22 may also be provided with a sight-gauge 205 by means of which the depth of the liquid in the tank 22 may be observed and also the condition of the liquid in the upper portion of the tank.

It should be understood that the water and sludge should be withdrawn from the extreme cone bottoms of the dump tank 16, the overflow tank 20 and new and purified tank 21 once a day since these tanks do not contain any chemical mixtures in their cone bottoms. The chemical mixtures in the cone bottoms of the clarifying tanks 17, 18 and 19 should not be disturbed until necessary. After a week's run of the dry cleaning system in a plant the used chemical mixtures at the bottoms of the clarifying tanks may be removed. When the sludge and water are to be removed from the bottoms of the tanks 16, 20 and 21 the valves 189, 195 and 196 are opened and the remaining valves near the low suction header 173 are kept closed. Then while the valve 193 in Fig. 7 is kept closed and the service pump 33 operated, the sludge and water from the bottoms of the dump tank, overflow tank and new and purified tank may be removed at the spigot 194 and as soon as the solvent begins to appear the spigot 194 is closed and the valve 193 opened so as to direct the mixture containing the solvent into the bottom of the solvent purifier tank 22. When the sludge and water at the bottoms of the clarifying tanks are to be removed, the valves 186, 187 and 188 may be opened and the remaining valves near the low suction header 173 closed and the sludge and water removed at the spigot 194 until solvent appears, when the mixture may be directed into the bottom of the purifier tank. The flow of the liquid in the pipe 191 may be observed in the sight-glass 207. When the appearance of the flow is such that it indicates that substantially all of the chemical solution has been withdrawn from the bottoms of the clarifying tanks, the valves are closed and the operation of the service pump 33 will be stopped by the shifting of the belt at the pulleys 34.

There is also connected to the top of the purifier an overflow pipe 225 which discharges into emergency pipe 240. This emergency pipe connects also to an overflow pipe leading from the tops of the filter sections 156, 157; to the drain 243 leading from the bottom of the filter receptacle; and to the connection from the emergency valve 239. This emergency pipe 240 then connects with main return line 72 which is equipped with a check-valve 248 to prevent backflow from the horizontal pipe 72 to the vertical pipe 240.

In Fig. 5, I have shown a process tank 208 provided with a cover 209. Into this tank may be introduced the chemical mixtures used in the dry cleaning system shown. When the chemical mixtures at the bottoms of the clarifying tanks are to be replenished the desired quantity of mixture of Huron alkali and water, as above explained, is placed in the process tank for flow by gravity into one of the clarifying tanks. By referring to Figs. 5 and 6 it will be seen that when the valves 210' and 211' are closed and the valve 212' opened, the chemical mixture in the tank 208 may flow by gravity into the pipe 213 and through the valve 212' into the pipe 95 and thence into the cone bottom 101 of the clarifying tank 17. The proper amount will be received by the clarifying tank as predetermined by the quantity placed in the process tank 208. In the same manner the required quantity of chemical mixture may be placed in the bottom 102 of the clarifying tank 18. The control will be effected by closing the valves 211' and 212' and opening the valve 210'. The third clarifying tank may be supplied with chemical mixture by closing the valves 210' and 212' and opening the valve 211' and allowing the desired quantity to flow from the process tank 208 by gravity to the clarifying tank 19.

It will also be noted that the process tank is connected by the pipes 213 and 214 to the low suction header 173. A mixture of industrial alkali and water in the required proportions may be placed in the process tank 208 and pumped into the purifier tank by means of the service pump 33 while the valve 215 is open and while the valve 193 is also open. Then a mixture of Darco and solvent in the required proportions is placed in the process tank 208 and pumped into the purifier tank by the pump 33. At such times the valves 210', 211' and 212' are closed.

After the mixture of industrial alkali and water, and the mixture of Darco and solvent have been pumped from the process tank 208 into the purifier tank 22, the valve 215 is closed and the valve 216 opened to the atmosphere so that continued operation of the service pump 33 will withdraw air from the atmosphere through the valve 216 into the low suction header 173 and thence into the bottom of the purifier tank so as to thoroughly agitate the mixture of industrial alkali, water and Darco with the solvent which has been introduced into the purifier tank from any of the other tanks 16 to 21, inclusive. The action of the industrial alkali is to remove all remaining traces of grease and dirt which remain in the solvent, and the action of the Darco or finely divided carbon is to remove the amber color and the very minute particles of foreign material which are in suspension in the solvent in a colloidal state or otherwise.

It should be understood that after any solvent or solvent mixed with impurities from the cone bottoms of the ground tanks is directed into the solvent purifier, the chemical mixture in the cone bottom 170 may be thoroughly mixed therewith by air agitation obtained by opening the air valve 216 in the low suction header 173 and operating the service pump 33 while the valve 193 is opened

and the valves associated with the low suction header 173 other than the one designated 216, are closed.

Upon discontinuing the air agitation in the purifier tank and allowing the contents thereof to settle the solvent above the cone bottom will be completely and thoroughly purified and free from the usual amber color, so as to be water white, transparent and colorless and so as also to be free from water and all other impurities. By opening the valve 217 at the purifier tank the transparent colorless and purified solvent may be directed into the pipe 218 while the condition of the flowing solvent may be observed in the sight-glass 219. From the pipe 218 the purified solvent may be directed into the pipe 220 by opening the valve 221. The pipe 220 directs the purified solvent into the new and purified tank 21 through the T-discharge 222 at approximately the upper portion of the cone bottom 223 of the tank 21, as shown in Fig. 6. The pipe 220 at the tank 21 may be provided with an air vent pipe 224 which, as shown in Figs. 6, 7 and 8, is connected to the clean air vent header 128 and then to the atmosphere through the pipe 129.

The purified solvent may also be directed from the solvent purifier tank 22 into the pipe 72 by opening the valve 226, the pipe 72, as shown in Figs. 2, 3, 4, 5, 6 and 7, leading directly into the dump tank for discharge into the upper portion of the cone bottom thereof through the T-discharge 75.

By providing the two valves 221 and 226 respectively in the pipes 220 and 72 the purified solvent may first be directed from the tank 22 into the dump tank 16 by opening the valve 226 and keeping the valve 221 closed. This will give the operator an opportunity to observe the condition of the solvent in the tank through the sight-glass 219. If the sight-glass shows that the solvent is free from color and impurities, that is, colorless and transparent, the valve 226 is closed and the valve 221 may be opened so as to direct the purified solvent into the new and purified tank 21. It will also be evident that if the operator observes in the sight-glass that by opening the valve 221 and keeping the valve 226 closed no solvent flows from the purifier tank 22 when the valve 217 is opened, the new and purified tank 21 is completely filled. If it is desired to nevertheless draw off purified solvent so as to introduce more liquid into the purifier tank 22, the valve 217 may be opened and so also the valve 226 while the valve 221 is closed and thus direct the liquid in the purifier tank 22 into the dump tank 16 by means of the pipe 72.

The clean circulating pump 31 may withdraw purified solvent from the tank 21 through the pipe 228 when the valve 229 at the header 151 is opened. By opening the valve 152 at the header 151 clarified solvent may be withdrawn from the overflow tank 20. It will thus be seen that by opening either one of the valves 152 and 229, clean solvent may be pumped into the pipe 155 to the filters 156 and 157 for use in the main supply pipe 137 which extends to the various washers. The filters 156 and 157 may be placed at a high elevation to obtain sufficient head for flow of the supply to the washers. When the most delicate garments and particularly when white garments are to be washed, the valve 152 may be closed and the valve 229 opened so as to pump only the colorless and purified solvent from the new and purified tank 21.

Connected to the top of the new and purified tank 21 is an air vent pipe 230, as shown in Fig. 6. This pipe 230, as shown in Figs. 6, 7 and 8, is connected to the air vent header 128 and thence to the atmosphere through the pipe 129. The air vent pipe 230 is similar in its function and location to the air vent pipes 77, 123, 124 and 125 connected respectively to the tops of the tanks 16, 71, 18 and 19. There is also an air vent pipe 231 connected to the top of the overflow tank 20, as shown in Fig. 5, and as shown in Fig. 8, this air vent pipe 231 is connected to the air vent header 128.

In Fig. 2, is shown an air vent pipe 232 connected to the top of the main drain pipe 72 and, as shown in Fig. 8, this air vent pipe 232 is connected to the air vent header 78.

As shown in Fig. 5, there is an air vent pipe 233 connected to the clean summit by-pass 133 or to the top of the pipe 136. This air vent pipe 233, as shown in Fig. 8, is connected to the air vent header 128.

It should also be noted that the clarified solvent may be withdrawn at any time from any individual clarifier tank and directed into the purifier tank. As shown in Fig. 3, the pipe 147 extends down to a position just above the cone bottom but at a sufficient elevation to withdraw solvent above the dirty strata on top of the chemical mixture. By opening the valve 234 in the low suction header 173, as shown in Fig. 6, and operating the service pump 33 while the valve 193 is open clarified solvent may be withdrawn from the clarifying tank 17 through the pipe 147, as shown in Figs. 2, 3, 4, 5 and 6, into the low suction header 173 and then through the pipes 191, 192 and 199 into the solvent purifier tank 22.

In the same manner clarified solvent may be withdrawn from the clarifying tank 18 through the pipe 148 when the valve 235 at the low suction header 173 is opened.

Clarified solvent may be withdrawn from the clarifying tank 19 through the pipe 149, as shown in Figs. 4, 5 and 6, when the valve 236 is opened.

When the chemical charge in the solvent purifier tank 22 becomes exhausted or nearly so and before a new charge is introduced, the water and sludge at the cone bottom 170 of the tank 22 is withdrawn through the outlet 202 by opening the valve 201.

In the event of fire the fusible link 237 will be melted, thus releasing the weight 238 and operating the emergency valve 239 to open the same and permit the contents of the purifier tank above the valve 239 to be discharged into the emergency pipe 240 which is connected to the main drain pipe 72 for directing the solvent into the underground dump tank 16. It should be understood that the valve 239 is normally closed. The valve 239 is at such an elevation near the cone 170 of the tank 22 that when this valve is opened in the event of fire all of the contents of the tank 22, except the sludge and water, at the extreme bottom will be removed to the dump tank underground. That is to say, when the emergency valve 239 is opened by fire melting the fusible link 237 and the weight 238 dropping, communication will be established through the emergency pipe 240 to the pipe 72 from the side of the cone bottom 170 at such elevation above the extreme bottom that the sludge and water will be left in the tank 22.

The operation of the solvent purifying apparatus should be performed at frequent intervals, for instance, the bottoms of overflow tank 20 and new

and purified tank 21 should be pumped into it every morning. The intermediate suctions 147, 148 and 149 of the clarifying tanks 17, 18 and 19 should be used each day at the end of the work, although it is not necessary to pump all of these tanks every day; they can be alternated. Its operation is therefore under full control of the operator, and he can exercise his own judgment as to the necessity of frequent operation. He can observe the sight gauge 205 to determine the depth of the liquid in the tank 22, and if the tank becomes too full, he can open the valves 217 and 226 to let the excess go back into the dump tank. If he should forget to observe the sight-glass, and the purifier becomes full, the overflow 225 then comes into play, and the excess flows through emergency pipe 240 into main return 72, and thence to dump tank 16. If after stopping the pump 33 the valve 193 should remain open while the pipes 192 and 199 are filled with liquid any tendency toward siphoning action back on the pump 33 would be counteracted by the flow of air from the pipe 203 toward the left through the check-valve 200, thereby restoring the level of the liquid in the column 199 to that of the liquid in the tank 22. The check-valve 200 closes when the air or liquid pressure is toward the right from the pipe 192. Filters 156 and 157 may be drained by opening the valves 241 and 242 so that the liquid may flow out of the filters down the pipe 243 into the pipe 240, and 72 which is the common drain pipe leading back to the dump tank 16. For instance, when the waste is to be removed from the filters 156 and 157 the solvent may first be squeezed out of such waste and whatever dirt goes with the solvent may pass down the pipe 243 into the dump tank 16, thereby saving the solvent without sending it to any of the washers prior to being clarified and purified.

The arrows on the various views of the drawings indicate the directions of flow during the various operations above described. Fig. 1 is a diagrammatic illustration showing the pipes by means of single lines on which the arrow heads indicate the direction of flow of the fluid in the operation of the dry cleaning system.

One of the important features of my improved dry cleaning system is that it enables a plurality of washers to be initially used in the system and additional washers to be added as the dry cleaning business increases and this may be done without altering the system. The washers are connected in parallel between the supply line 137 and the common drain line 72, as diagrammatically illustrated in Fig. 1, and it would be a simple matter to connect one or more additional washers in parallel to those shown and between the supply line 137 and the common drain line 72, each additional washer, as well as those shown in Fig. 1, being independently and separately operable.

When a washer is added to the dry cleaning system another clarifying tank may also be readily installed because of the manner in which the dirty distributing header 85 and the low suction header 173 are arranged. An additional clarifying tank can readily be connected to the equalizer header 85 by means of a riser corresponding to that designated 107 in Fig. 4, and a vent pipe corresponding to 100'. Vent pipes corresponding to those designated 122 and 125 may be connected to the headers 78 and 128, as shown in Fig. 8. A pipe corresponding to that designated 97 may be connected to the header 85. This is because the header 85 permits additional pipes to be added in parallel, as shown in Fig. 9.

The only additional pipes to be used are those corresponding to 149 and 181 of Fig. 4. These pipes, as shown in Fig. 6, are connected to the low suction header 173 in parallel. Therefore two additional pipes for the clarifying tank No. 4 may be connected in multiple to the low suction header 173. An additional pipe may be connected to the pipe 213 in the same manner that the pipe 97' is connected therewith, and an additional valve corresponding to the valve 211' may be added.

It will thus be seen that on account of the parallel arrangement of the headers 85 and 173 and of the valves in connection with the pipes 213, extensions may readily be made for the purpose of adding one or more additional clarifying tanks in accordance with the number of additional washers.

When washers and clarifying tanks are added the same dump tank, the same overflow tank, the same new and purified tank and the same solvent purifier tank may be retained, and so also the other parts of the system arranged as shown in the drawings.

When washers and clarifying tanks are added the circulating pumps 29 and 31 may have substituted therefor pumps of a larger capacity, but their capacities would nevertheless be predetermined and limited in accordance with the requirements of the dry cleaning system, including the additions of washers and clarifying tanks, and after such pumps have been installed the operator cannot overtax the automatic circulating system. In other words, while the washing operation and the clarification of the solvent and the purification of the solvent are under the control of the operator, the operation is automatic in the continuous circulation of the solvent to and through the washers and back again to the washers.

Each of the tanks 16 to 22, inclusive, is entirely closed except for the pipe connections. The closed tops of the ground tanks 16 to 21, inclusive, forces overflow under certain conditions and co-operate with the automatic circulating connections. For instance, if the supply to the washers is cut off and solvent is forced through the summit by-pass 133 the overflow tank 20 may be filled beyond its capacity whereupon the excess solvent will flow along the dirty solvent by-pass 138 into the dump tank 16.

It should be particularly noted that the dirty vent header 78 has connections to the main drain line 72, the places where the dirty solvent is introduced into the dump tank and into the clarifying tanks, and to the dirty distributor header. The connection between the dirty vent header 78 and the dirty distributor header is by means of the pipe 141 which is connected to the top of the standpipe 92. The dirty summit by-pass 138 is therefore also connected to the dirty vent header. The dirty vent header is connected to the places where the dirty solvent flows and is separate and independent from the clean vent header 128. The clean vent header has connections to the clean solvent chambers of the clarifying tanks. The clean vent header 128 is also connected to the overflow tank and to the new and purified tank. The clean vent header is also connected to the clean distributor header by means of the pipes 98', 99' and 100', as shown more particularly in Figs. 8, 9 and 9a. The clean vent header is also connected to the clean

summit by-pass. It will thus be seen that the clean vent header is connected to the places in the system where clean solvent flows or is stored.

It should also be noted that the distributing header is in two sections separated by the solid connection 246 so that there will be no flow between the clean section and the dirty section. The standpipe 92 receives dirty solvent from the dirty circulating pump 29. When the clarifying tanks tend to become overfilled, the overflow will occur by means of the pipes 105, 106 and 107 which are connected through the sight-glasses 98, 99 and 100 to the clean section of the distributing header 85. The overflow will be taken by the pipe 104 to the overflow tank. It can readily be seen that the standpipe 92 being at a higher elevation than the distributing header will furnish sufficient head to effect the overflow from clarifying tanks to the overflow tank, thus permitting the dirty circulating pump 29 to operate continuously even when the clarifying tanks tend to become overfilled.

Under the extractor 56 is a check-valve 248 which allows free flow of solvent from the extractor to the drain pipe 72 but automatically prevents back flow of the solvent from the pipe 72 up into the extractor.

The extractor 56 is for the purpose of removing solvent from the garments only and is not for the purpose of removing impurities from the solvent by centrifugal action, as in my system of dry cleaning no centrifugal mechanism for removing impurities from the solvent is necessary or desirable. Furthermore, in the system of dry cleaning herein disclosed no still of any kind for reclaiming solvent is necessary, it being preferred to use the system disclosed since it is much more efficient than the wasteful method of distillation.

It should be understood that under certain circumstances certain fabrics may be cleaned in the washers without the use of any soap but by means of a continuous circulation of solvent through the washers while the garments are agitated by oscillation of the washers.

It should also be noted that the dirty distributing header 85 shown in Figs. 4 and 9 and diagrammatically in Fig. 1 is in reality an equalizer in that it is provided with controlling valves so as to equalize the flow of dirty or used solvent to the clarifying tanks Nos. 1, 2 and 3. By means of the pumps and controlling valves in the system connected and arranged as shown, the quantity of clean solvent is maintained at all times without any undue roiling or disturbance of the contents of the clarifying tanks. The used solvent is dumped from the washers into the dump tank, thus preventing roiling or disturbance of the solvent where it is being clarified. As above explained, the pump 29 is set for the capacity of gasoline required and is continuously operated and is so arranged that if the predetermined quantity per minute is not used, it flows back to the dump tank without roiling or disturbing the contents of the clarifying tanks.

At intervals, such as once a month, or at the end of a week's work, the clarifying tanks should have the accumulated material in their lower portions immediately above their bottoms pumped out into the purifier tank, as above explained, and the solvent remaining in the clarifying tanks may then be heated and agitated with steam for about five minutes by attaching a steam-hose to the steam-hose connection shown at 206 in Fig. 6. With the valves 186, 187 and 188 closed and the valves 212, 210 and 211 open, the steam may be admitted to the extreme bottoms of the clarifying tanks through the pipes 174, 177 and 180. After the clarifier tanks have thus had their contents steamed and agitated the valves 212, 210 and 211 may be closed and the above-described operation performed for recharging the clarifier tanks with chemicals from the process tank.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended and I wish therefore not to be restricted to the precise construction herein disclosed.

Having thus fully disclosed an embodiment of my invention, what I desire to secure by Letters Patent of the United States is:

1. In solvent purifying apparatus for dry cleaning systems, the combination with a solvent purifier tank adapted to contain a mixture of industrial alkali, finely divided carbon and solvent, a suction header, a plurality of pipes connected thereto each having a controlling valve, a pump for withdrawing the material from said pipes and delivering it to said purifier tank, and an air valve on said suction header for opening of the latter to the atmosphere to introduce air into said purifier tank to agitate the mixture therein when said pump operates.

2. In a dry cleaning system, a main supply line for supplying cleaning fluid to a washer, a main drain line for draining used solvent from the washer, a dump tank connected to said drain line, a plurality of solvent clarifying tanks adapted to contain an alkaline solvent treating medium, a dirty solvent circulating pump connected to said dump tank for pumping solvent from said dump tank to said clarifying tanks, a dirty solvent distributing header connected between said clarifying tanks and said pump for individual and independent control of the pumping of used solvent thereto, a dirty solvent summit by-pass in communication with said clarifiers and said dump tank for by-passing solvent back to the dump tank, an overflow tank, an operating overflow between said clarifying tanks and said overflow tank, a clean fluid summit by-pass connected between said main supply line and said overflow tank for by-passing solvent from said main supply line to said overflow tank, and means whereby clarified fluid is caused to flow from said overflow tank to said main supply line.

3. In a dry cleaning system utilizing continuous circulation of the solvent, a main drain line for receiving used cleaning fluid from a washer, a dump tank for receiving used solvent from said drain line, a plurality of clarifying tanks, a dirty solvent circulating pump connected to said dump tank, a dirty solvent distributing header connected between said pump and said clarifying tanks, an overflow tank, a clean solvent distributing header overflow connections between said clarifying tanks and said clean solvent distributing header, connections between said clean solvent distributing header and said overflow tank for receiving the overflow from said overflow connections, a clean solvent circulating pump, a clean solvent suction header connected between said overflow tank and said clean solvent circulating pump, means for connecting the discharge of said clean solvent circulating pump to a washer, a clean solvent summit by-pass between said last means and said overflow tank, a dirty solvent summit by-pass between said dirty solvent

distributing header and said dump tank, a dirty solvent vent header connected to the dirty solvent distributing header, the dump tank, the main drain line, and the places of entrance of the used solvent into the clarifying tanks, and a clean solvent vent header with connections to the clean solvent distributing header, the clarifying tanks, the overflow tank and the clean solvent summit by-pass.

4. In a solvent purifying apparatus for dry cleaning systems, a solvent purifier tank adapted to contain a solvent cleanser and a solvent, a suction header, means for connecting the suction header to a dry cleaning system to withdraw solvent to be cleaned, a pipe connected to the header and leading into said purifier tank below the normal level of the solvent therein, means for applying suction to said header and to thereby cause solvent to flow through said pipe to the purifier tank and an air valve on the suction header in communication with the atmosphere whereby air may be sucked through said valve and introduced into said purifier tank to agitate the material therein.

5. In a dry cleaning system, a dump tank for receiving used solvent, clarifying apparatus, a conduit connected to conduct solvent from the dump tank to the clarifying apparatus, a solvent purifier tank, pump means connected between the purifier tank and the clarifier tank for conducting solvent to the purifier tank, an emergency drain pipe connected between the solvent purifier tank and said dump tank for draining the solvent from the purifier tank to the dump tank, a valve in said drain pipe normally preventing drainage of said purifier tank, and a check valve in said drain pipe for preventing back flow of fluid from said dump tank.

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