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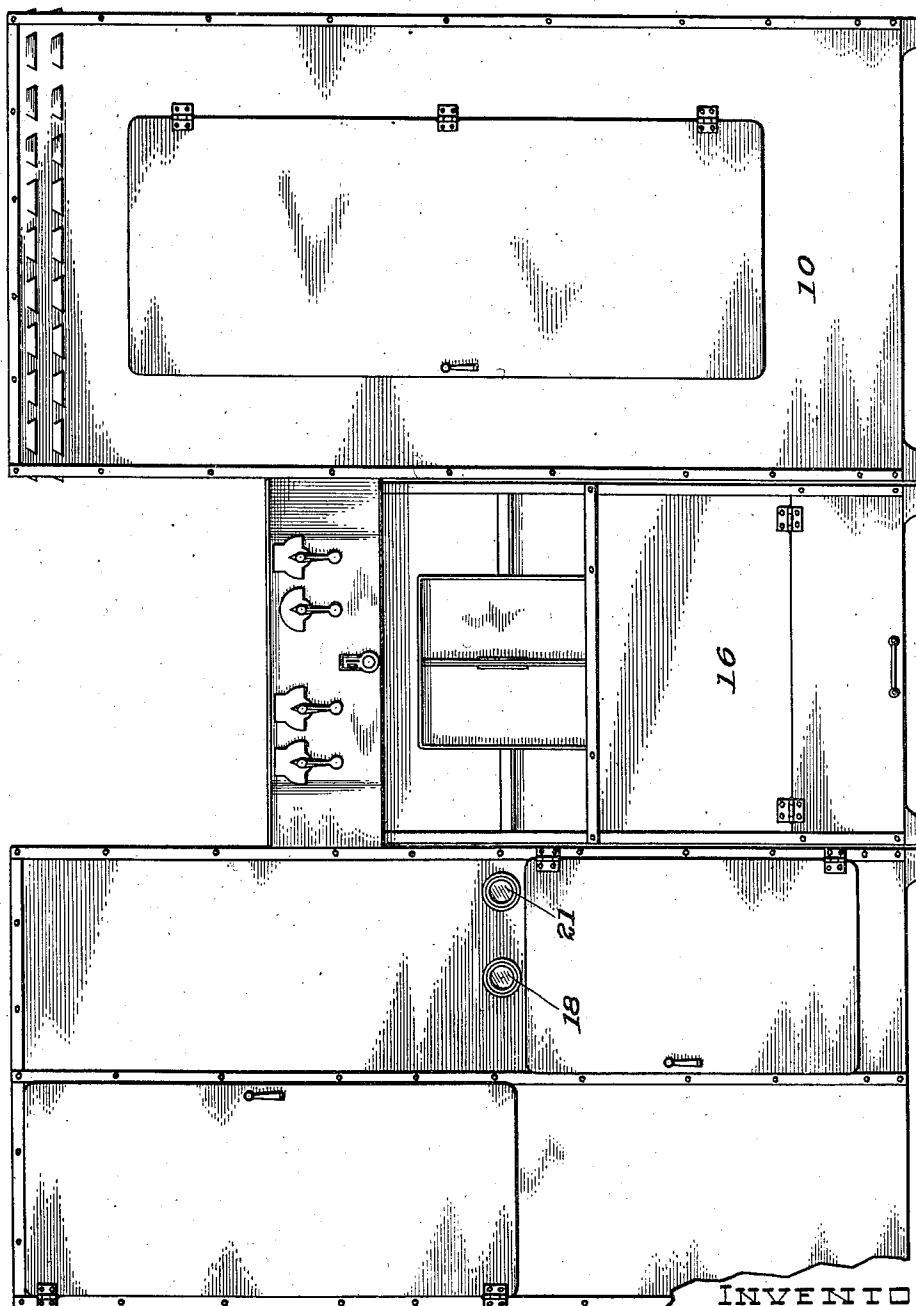
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1,917,096

METHOD AND APPARATUS FOR CLEANING

Filed Oct. 24, 1932

5 Sheets-Sheet 1



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5 Sheets-Sheet 2

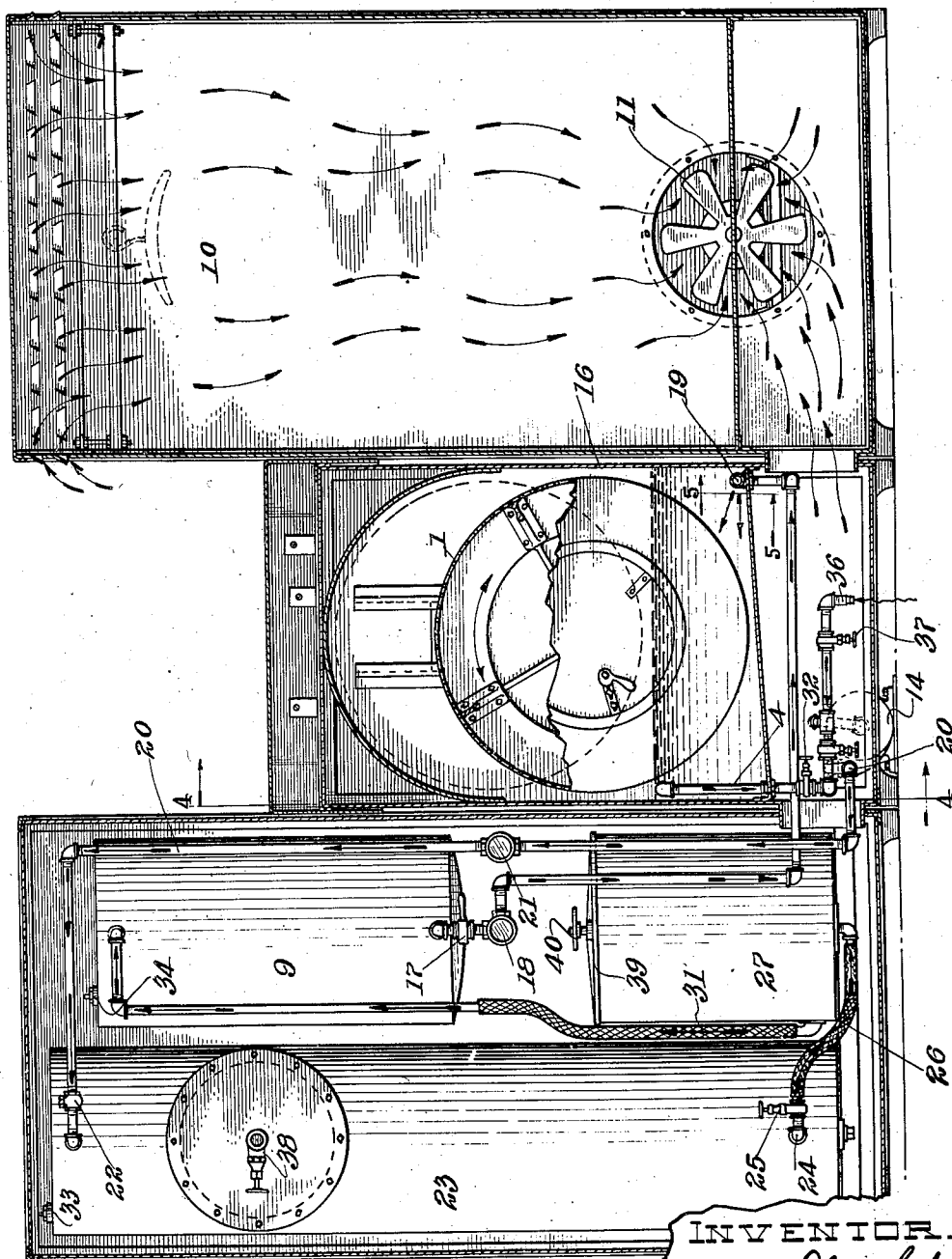


FIG. 2.

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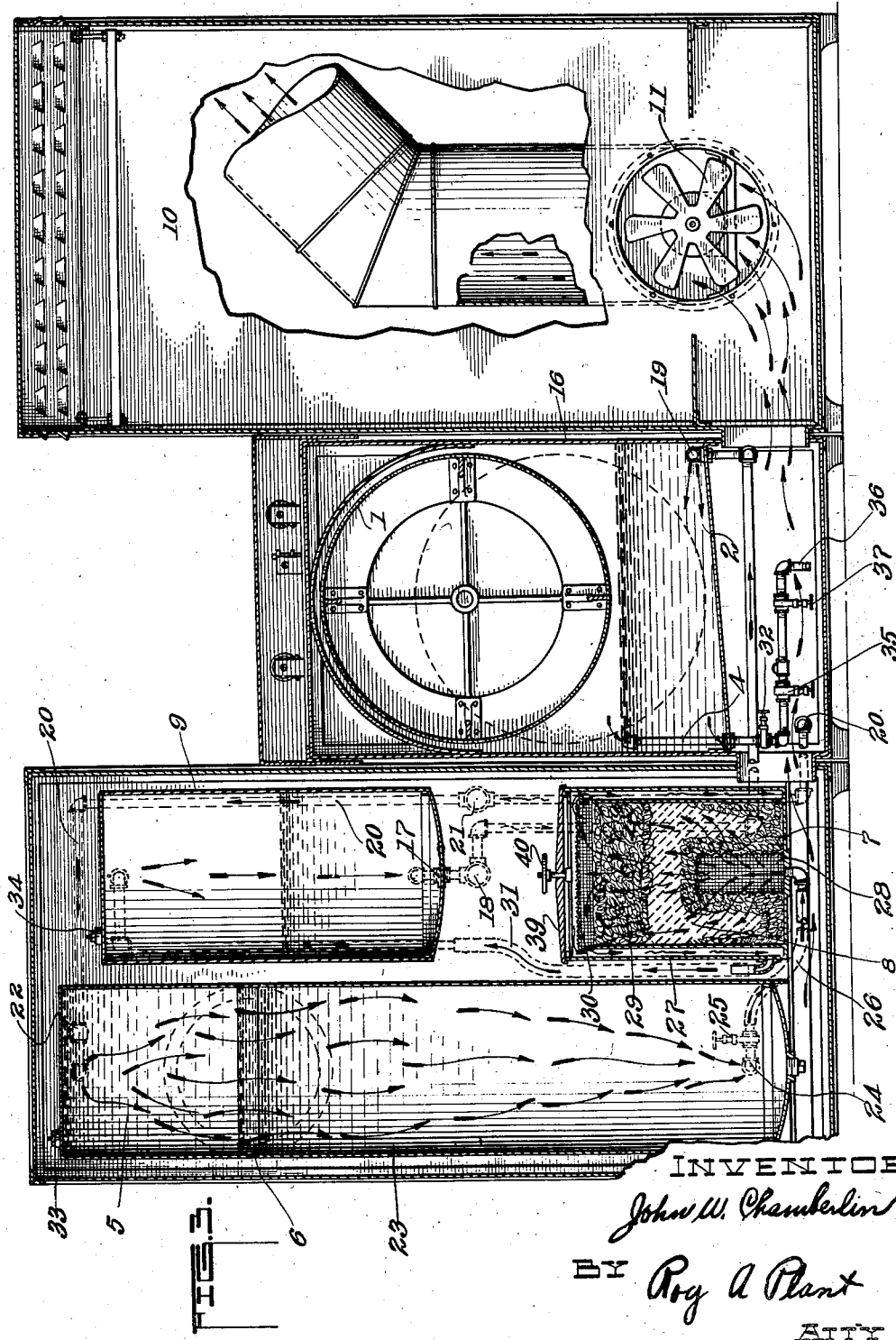
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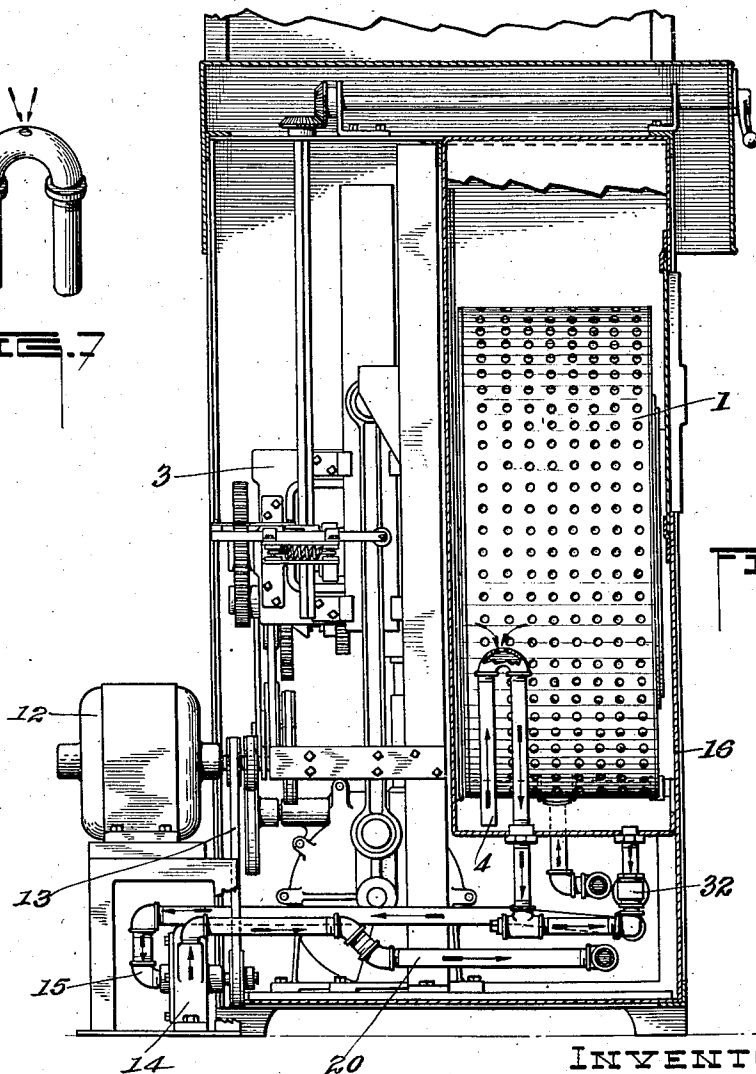
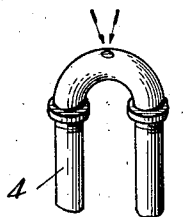
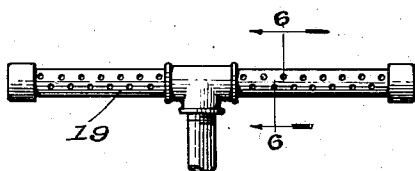
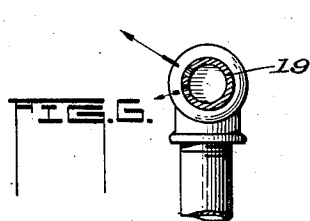
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METHOD AND APPARATUS FOR CLEANING

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5 Sheets-Sheet 4



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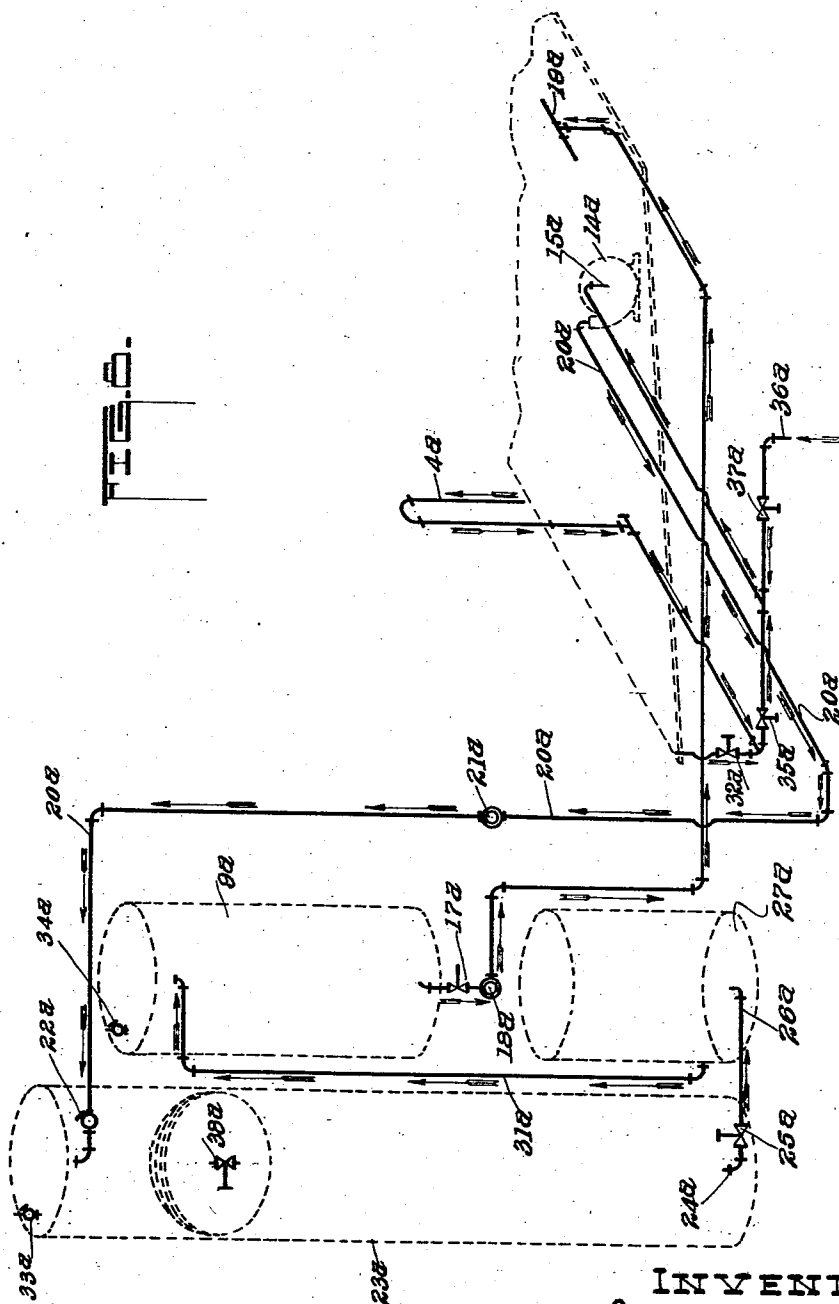
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5 Sheets-Sheet 5



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METHOD AND APPARATUS FOR CLEANING

Application filed October 24, 1932. Serial No. 639,291.

The present invention relates to a method and apparatus suitable for cleaning, degreasing or the like, of various materials which may be of animal, vegetable, or mineral origin. The system involved is commonly referred to in the sense of dry cleaning. While the present application deals generally with such systems, it is directed in its specific phases at the fluid circulating system and particularly at the treatment or purification of soiled cleaning fluid coming from the washing step.

The common practice now in use for dry cleaning clothing or the like is to use a naphtha, gasoline, or benzine solution to which has been added a dry cleaning soap soluble therein. The clothing is placed in the washing machine in contact with this solution and the machine is then started and the washing continued for fifteen or twenty minutes, following which the clothing is removed and transferred to a separate washing machine where it is washed in clear gasoline or benzine. After the bulk of the soap has been washed out of the clothing by means of the clear solvent, the clothing is transferred to a centrifugal extractor where from 80% to 90% of the cleaning fluid is thrown off. The clothing is next placed in a conventional deodorizer where the remaining cleaning fluid evaporates and is withdrawn from the clothing. This system involves two handlings of the clothing while wet with cleaning fluid, and one handling when the bulk of the cleaning fluid has been removed and the clothing is on the way to the deodorizer. This system as well as all other systems now in commercial use for doing a good grade of cleaning involves the use of equipment that occupies a large floor space, is relatively dangerous, particularly when inflammable cleaning fluids are used, and has innumerable valves and connections to operate, and moreover requires at the very least semi-skilled labor to do the work. Many attempts have been made to produce systems that have a lower initial cost and are simpler to operate. Nevertheless, so far as I am aware, these efforts have in general met with failure or else have resulted in a marked

decrease in efficiency of operation. A number of attempts have been made to use carbon tetrachloride as a cleaning fluid due to its non-inflammability. However, numerous difficulties have beset this procedure and one of the most serious of these difficulties has been due to the inherent tendency of carbon tetrachloride to hydrolize in the presence of water and/or moisture to form free acid which attacks and deteriorates the articles being cleaned and moreover corrodes metal buttons, buckles, hooks and eyes, etc., as well as the commercial metals that are commonly used in dry cleaning apparatus. These difficulties, with which I am thoroughly familiar from long contact with the problem, clearly showed me that in spite of the extensive efforts that had been made in the past to devise simpler systems that could be used economically without sacrificing cleaning efficiency, such efforts, generally speaking, had not attained the desired end. With this in mind, I have carried out an extensive series of tests and experiments which have now resulted in my discovery of a system which is very simple to operate, occupies a very small floor space, does not require skilled or semi-skilled operators, eliminates fire hazard, and does a high class dry cleaning job economically, rapidly, and efficiently.

Accordingly among the objects of the present invention is the provision of a new method and combination of apparatus suitable for the economic and efficient dry cleaning of articles such as clothing. Another object is to provide an apparatus which is simple, easily operated, and does not occupy an excessive amount of floor space. Another object is to provide a system for continuously purifying, reclaiming, and decolorizing the cleaning fluid. Another object is to provide a continuous flow system wherein dirt and soil removed from the articles being cleaned are continuously removed from the cleaning fluid and the so-purified fluid returned to the washing machine. Another object is to provide a system wherein a non-inflammable cleaning fluid can be used without the drawbacks which have been heretofore encountered by the art. Further ob-

jects and advantages will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the steps and means hereinafter fully described and particularly pointed out in the claims, the annexed drawings and the following description setting forth in detail certain means and modes of carrying out the invention, such disclosed means and modes illustrating, however, but several of the various ways in which the principle of the invention may be used.

In said annexed drawings:—

Fig. 1 is a front elevational view showing my cleaning machine construction as the same appears when the several units are assembled in straight alignment with relation to each other. It will be understood that upon certain occasions conditions may arise relative to floor space where the various units entering into the general assembly of the cleaning machine may be such as to limit the floor space to such a degree that straight line assembly would be impossible. Where such conditions are encountered, the various units may be positioned at right angles to each other.

Fig. 2 is a sectional elevational view as the same would appear with the front of the various cabinets removed, the position of the cleaning member with respect to the liquid within the tub while operating to cleanse fabrics being shown in full lines and the raised or drying position of the cleaning member being shown in dotted lines, with certain parts of the cleaning member broken away to show the impellers located therein. The various liquid conduits and their connections with the several receptacles located within the cabinets are shown in full lines, the direction of flow through the conduits being indicated by the arrows appearing thereon. The position of the exhaust fan with relation to the floor and connecting ducts between the cabinets is shown in full lines, the division of the suction set up by the fan being regulated by the floor of the cabinet, the direction of air currents being indicated by the arrows appearing in connection therewith.

Fig. 3 is a sectional elevational view similar to that shown in Fig. 2, the various receptacles being shown in section, with the connecting liquid conduits shown in dotted lines and the direction of flow of the liquid within the receptacles indicated by the arrows. The cleaning member is shown herein in the raised position which it assumes at the time the drying operation is being performed upon the fabrics, the lowered or cleaning position being indicated by dotted lines.

The position of the exhaust fan with respect to the exhaust pipe is shown in full

lines, certain portions being broken away in order to show the exhaust pipe and the direction of air currents, which are indicated by the arrows.

Fig. 4 is an enlarged sectional elevation of the cleaning unit, as the same would appear if taken on line 4—4 of Fig. 2, and particularly showing the liquid circulating pump and conduits connected therewith, the direction of flow of the liquid within the conduits being indicated by the arrows shown thereon.

Fig. 5 is an enlarged fragmentary elevational view, showing the liquid distributor head which is located within the tub (shown in Figs. 2, 3 and 4, and taken on line 5—5 looking in the direction of the arrows in Fig. 2).

Fig. 6 is an enlarged sectional view of the liquid distributor head, showing the angularity of outlet openings, taken on the line 6—6 of Fig. 5.

Fig. 7 is a detailed perspective view showing the siphon outlet conduit within the tub and the air opening which automatically controls the level of the liquid contained within the tub.

Fig. 8 is a scenographic view, showing diagrammatically the general arrangement and connections of conduits with respect to the several units, the direction of flow of liquid within said conduits being indicated by the arrows appearing thereon.

In the operation of my present improved system, the clothing or articles to be dry cleaned are placed in the washing machine while the drum 1 is in its upper position as shown by solid lines in Fig. 3. The drum is then brought into contact with the cleaning fluid 2, in the washing machine either by raising the cleaning fluid into contact with the drum or by lowering the drum into the cleaning fluid. For most purposes, I prefer to do the latter. The drum 1 with its charge of soiled clothing or like articles is accordingly lowered by a suitable mechanism 3 (Fig. 4) into contact with the cleaning fluid in the washing machine as it shown by heavy lines in Fig. 2. The washer mechanism is then started to rotate the drum in a back and forth direction as shown by double arrow on Fig. 2, thus forcing the cleaning fluid back and forth through the clothing. The cleaning fluid containing the soil and dirt removed from the clothing is continuously withdrawn from the washing machine through a vented level maintaining draw off pipe 4 and passed through a body of sweetener and dehydrator 5, thence through a body of soap 6 that is substantially insoluble in the cleaning fluid. The cleaning fluid is then passed through a filter mass 7 for removing lint, suspended dirt, and moisture, and thence through a bed of decolorizing and clarifying material 8 to a storage receptacle 9 from whence the

cleaning fluid is continuously returned to the washing machine in cyclic manner. After the clothing or like articles have been washed for a sufficient period of time to remove the dirt and soil therefrom, the washing machine drum is removed from the cleaning fluid in the washing machine either by dropping the bottom of the washing machine containing the cleaning fluid or preferably by elevating the washing machine drum to the position shown by solid lines in Fig. 3, the oscillation of the drum having been stopped before the drum has reached its uppermost position, the drum is then ready to be rotated to centrifugally dry the clothing or like articles contained therein. This is done by revolving the drum slowly at first until such articles have distributed themselves in fairly uniform manner over the inner peripheral surface of the drum. At this time the drum is speeded up to extracting speed and allowed to run for a period of time normally ranging from five to fifteen minutes depending upon the kind and amount of goods in the drum as well as the speed of rotation thereof. The drum is then stopped and the substantially dry clothing removed therefrom and hung in the deodorizing cabinet 10 which is ventilated by means of a fan 11, as is shown in Figs. 2 and 3. The specific construction and operation of my improved washing and drying machine is set forth in my co-pending application filed October 24, 1932, Ser. No. 639,290.

The operation of my improved cleaning and purifying system for the dry cleaning fluid used therein is as follows:—Motor 12 (Fig. 4) is started and by means of a suitable driving connection 13 operates pump 14, the inlet 15 of which is connected to vented overflow pipe 4 in the washing machine 16. Valve 17 (Fig. 2) at the outlet from storage tank 9 is opened sufficiently to permit the desired flow through the system. Valve 17 is the only valve to adjust in operating my improved system as contrasted with the multitude of valves used in all other systems. With valve 17 opened, purified cleaning fluid flows through sight glass 18 as shown by the arrows to a perforated outlet pipe 19 in the lower portion of washing machine 16. The vented overflow and level maintaining pipe 4 in the washing machine 16 which is connected to pump 14 withdraws cleaning fluid from the washer 16 in proportion to the amount that is fed thereto through spreader pipe 19. The cleaning fluid withdrawn from the washing machine passes through pump 14 and is discharged therefrom into passageway 20 in which is mounted a sight glass 21 and a check valve 22. The flow of dry cleaning fluid through passageway 20 empties into the top of receptacle 23 where it is brought immediately into contact with a body of sweetening and

dehydrating agent 5 (Fig. 3) which is of a lower specific gravity than the cleaning fluid itself. The preferred cleaning fluid is a mixture of carbon tetrachloride and propylene chloride, with or without ethylene chloride. Carbon tetrachloride alone, a mixture of carbon tetrachloride and ethylene chloride, tetrachlorethylene, perchlorethylene, trichlorethylene, or the like, may be used in equivalent manner. The preferred material to use, however, is one that is non-inflammable. A number of these non-inflammable, high specific gravity dry cleaning fluids are on the market, and can be used satisfactorily in my present improved system. The sweetening or dehydrating agent 5 used in the upper portion of receptacle 23, is an alkali and preferably an aqueous alkali. The alkali, when in suitable form for use, has a specific gravity that is substantially less than that of the dry cleaning fluid. Among the materials that can be satisfactorily used in an aqueous solution for the purpose at hand are the following, soda ash, caustic soda, caustic potash, or mixtures of these, as well as commercial preparations known under the names of "Wyandotte solvent clarifier", and "Huron alkali". Directly below the body of sweetener and/or dehydrator 5, I use a somewhat shallower layer or body of a soap that is insoluble or substantially insoluble in aqueous alkaline solutions as well as in the dry cleaning fluid. This soap layer must have a specific gravity that is between that of the sweetener and/or dehydrator, and the dry cleaning fluid. This will make it stay in a position between these two fluids as is shown in Fig. 3. As suitable soaps usable for this purpose, the potassium and/or sodium salts of oleic, palmitic, or stearic acids may be used. I find that a preferred way to establish this soap layer is to make a mixture, for instance, of from 80% to 60% of potassium oleate with from 20% to 40% of oleic acid. While the oleic acid is soluble in the dry cleaning fluid, this is not a serious drawback since in passing through the system it contacts with the sweetener and/or dehydrator 5 in the top of the receptacle 23 where it is converted into a suitable soap, for instance, if the sweetener consists of soda ash or caustic soda, then sodium oleate is formed which joins the potassium oleate present in the soap bed 6. This soap bed in a sense acts as a filter in that it collects dirt, lint, etc., out of the cleaning fluid passing through the system. As an aid to the clarifying and decolorizing of the dry cleaning fluid, finely divided activated carbon can be added to the soap bed, and when this is done, I find that it is of a distinct advantage particularly when exceptionally dirty articles are being cleaned. The dry cleaning fluid entering into the top of receptacle 23 is sweetened and/or dehy-

drated in the aqueous chemical body 5 in the top thereof. The dry cleaning fluid then passes downwardly through the soap bed where a further purification of same takes place. Directly below the soap bed, I prefer to have a relatively extended body of dry cleaning fluid to permit stratification to take place so that the dry cleaning fluid removed from the bottom thereof will be substantially free from entrained soap or the like. At a point near the bottom of receptacle 23, I provide an outlet 24 controlled by valve 25 through which the so-preliminarily cleaned dry cleaning fluid is passed by means of connection 26 to the bottom of receptacle 27 where it passes upward through a screen 28 into a body of waste 7 or the like which acts to absorb moisture and to filter out the bulk of lint and suspended dirt that has succeeded in passing through the soap bed 6. Directly above the cotton waste 7 is placed a bed of one or more of the materials charcoal, activated carbon, bone black, activated alumina, fuller's earth, or like clarifying and decolorizing agent 8. I have found that in some instances a solid sweetening agent such as one or more of the materials limestone, lime, magnesium oxide, calcined dolomite, caustic soda, caustic potash, soda ash, potassium carbonate, or the like can be used to advantage either above, below, or admixed with the decolorizing material. Over the bed of clarifying and decolorizing material, (and solid sweetening material if used), I prefer to place a second bed of cotton waste or the like 29 which acts to absorb moisture and to filter out fine suspended particles of solid matter. The dry cleaning fluid then passes through screen 30 to passageway 31 through which it is delivered to the top of storage tank 9 in purified condition ready for returning to washer 16 by way of valve 17, sight glass 18, and distributor pipe 19.

When it is desired to drain all of the dry cleaning fluid from washer 16, and deliver it to storage tank 9, valve 17 on the bottom of storage tank 9 is closed and valve 32 communicating with the bottom of the washer as shown in Fig. 4, is opened. The operation of pump 14 will then remove the dry cleaning fluid from washer 16 and pass it through the cleaning steps hereinbefore described and deliver it into storage tank 9 which is of a size so as to have a sufficient capacity to hold all of the fluid removed from the washer. At the top of receptacles 23 and 9, I prefer to place breather valves 33 and 34 respectively. These valves are preferably of a type which will permit the tanks to breathe but which will close tightly as soon as liquid attempts to pass therethrough. A float, for instance, can be used in connection with these breather valves to close off the breather opening when the liquid level raises to the overflow point.

In case it is desired to empty the washing machine into an external receiver, it is only necessary to open valves 32 and 37, and transfer the cleaning liquid to said external receiver through connection 36.

Sufficient makeup dry cleaning fluid can be added to the system, particularly to compensate for that lost by evaporation or carried away by the clothing removed from the washer, by pouring such additional cleaning fluid into the washer itself or if desired valves 17 and 35 may be closed and a hose or the like connected to inlet 36, and valve 37 opened. The free end of the hose connected to 36 is then placed in a drum or other supply of dry cleaning fluid and sufficient pumped therefrom to meet the requirements of the system.

After the system has been in operation for a period of time, normally several days, the soap bed 6 will gradually become thick and somewhat slow acting and will have to be at least partially replaced to maintain the efficiency of the cleaning system. To remove the soap solution valve 38 which is directly opposite the soap layer is opened and the soap is withdrawn (if desired, the sweetener and dehydrator body can be removed at the same time). A new soap bed can be then established (also dehydrator and sweetener) by connecting on to valve 38 with a suitable hose or funnel like connection arranged for receiving the filling material at a level above the top of receptacle 23. As soon as the filling is completed valve 38 can be closed and the excess material contained in the hose or funnel drained out. In some instances, it may be desirable to fill receptacle 23 with the requisite amount of soap and/or sweetener and dehydrator through the breather connection 33 or the like, and this can be readily accomplished by removing the breather connection and pouring in the requisite amount of material following which the breather connection can be replaced.

The filtering and clarifying agents contained in receptacle 27 may be removed and replaced with fresh material as desired by removing cover 39 which is held tightly in place by means of hand wheel 40 or other equivalent means.

Referring to Fig. 8 which is a scenographic view of the fluid circulatory system, the operation of my improved cleaning fluid reclaiming system is as follows:—Pump 14a is started up and valve 17a opened, vented pipe 4a then acts to maintain the level of the dry cleaning fluid in the washer at a constant height. The fluid flows through connection 4a, valve 35a and connecting pipes to pump 14a from whence the dry cleaning fluid is delivered by means of connection 20a, sight glass 21a, and check valve 22a, into the top of receptacle 23a where it is sweetened, dehydrated and treated with a soap solution. The

so-purified dry cleaning fluid passes out of receptacle 23a by means of connection 24a near the bottom thereof and thence by means of valve 25a and connection 26a to the bottom of receiver 27a where the fluid is further filtered and treated with a decolorizing agent following which it passes through conduit 31a into the top of storage tank 9a. From storage tank 9a, the clean fluid returns to the washing machine by means of valve 17a, sight glass 18a, and delivery pipe 19a, thus completing the circuit through the machine.

Other modes of applying the principle of my invention may be employed instead of those explained, change being made as regards the means and the steps herein disclosed, provided those stated by any of the following claims or their equivalent be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. A reclaiming mechanism adapted to reclaim a solvent of high specific gravity which has been contaminated by a washing of fabrics in a washing machine, which comprises a container having a contaminated solvent inlet at its top and a reclaimed solvent outlet at its bottom, said container having in its upper portion a volume of liquid alkaline material into which the used solvent is introduced through said inlet so as to pass therethrough in a downward direction for removing soluble greases from the solvent, a comparatively small volume of liquid viscous porous material beneath said liquid alkali for removing insoluble foreign matter from the solvent as it passes downwardly therethrough, and a considerable volume of solvent from which the above mentioned foreign matter has been removed in said container and extending from the bottom thereof to the liquid viscous porous material which it supports.

2. A reclaiming mechanism adapted to reclaim a substantially fireproof solvent of high specific gravity which has been contaminated by a washing of fabrics in a washing machine, which comprises a container having a contaminated solvent inlet at its top and a reclaimed solvent outlet at its bottom, said container having at its top a volume of liquid alkaline material of lighter specific gravity than the solvent and into which said solvent is introduced so as to pass downwardly therethrough for sweetening said solvent, a layer of liquid viscous porous material within

said container below said liquid alkaline material for removing insoluble foreign matter from the solvent as it passes downwardly therethrough, and a considerable volume of the reconditioned solvent in the lower portion of said container and extending from the bottom thereof to the layer of liquid viscous porous material, said liquid viscous porous material having a specific gravity greater than that of the liquid alkaline material and less than that of the fireproof solvent.

3. The process of reclaiming a substantially fireproof solvent having a relatively high specific gravity and which has become contaminated in the washing of fabrics in a washing machine, comprising, sweetening said solvent and removing greases therefrom by introducing the contaminated solvent from above into a volume of liquid alkaline material and allowing said solvent to pass downwardly therethrough, treating the partially reclaimed solvent to remove insoluble foreign matter therefrom by permitting said solvent to pass downwardly through a liquid viscous porous layer positioned beneath and supporting said alkaline material and having a specific gravity greater than said alkaline material and less than said solvent, and into a considerable volume of reclaimed solvent which supports said viscous porous layer.

4. A reclaiming mechanism adapted to reclaim a solvent of high specific gravity which has been contaminated by a washing of fabrics in a washing machine, which comprises a container having a contaminated solvent inlet at its top and a reclaimed solvent outlet at its bottom, said container having in its upper portion a volume of a liquid caustic soda solution into which the used solvent is introduced through said inlet so as to pass therethrough in a downward direction for removing soluble greases from the solvent, a comparatively small volume of viscous porous soap mixture of 60-80% potassium oleate and 20-40% of oleic acid beneath said caustic soda solution for removing insoluble foreign matter from the solvent as it passes downwardly therethrough, and a considerable volume of solvent from which the above mentioned foreign matter has been removed in said container and extending from the bottom thereof to the viscous porous soap mixture which it supports.

Signed this 19th day of September 1932.

JOHN W. CHAMBERLIN.