Nov. 26, 1935. N. C. SCHELLENGER 2,022,481

CIRCULATING AND MIXING SYSTEM

Filed Dec. 2, 1931

Fig. 1.

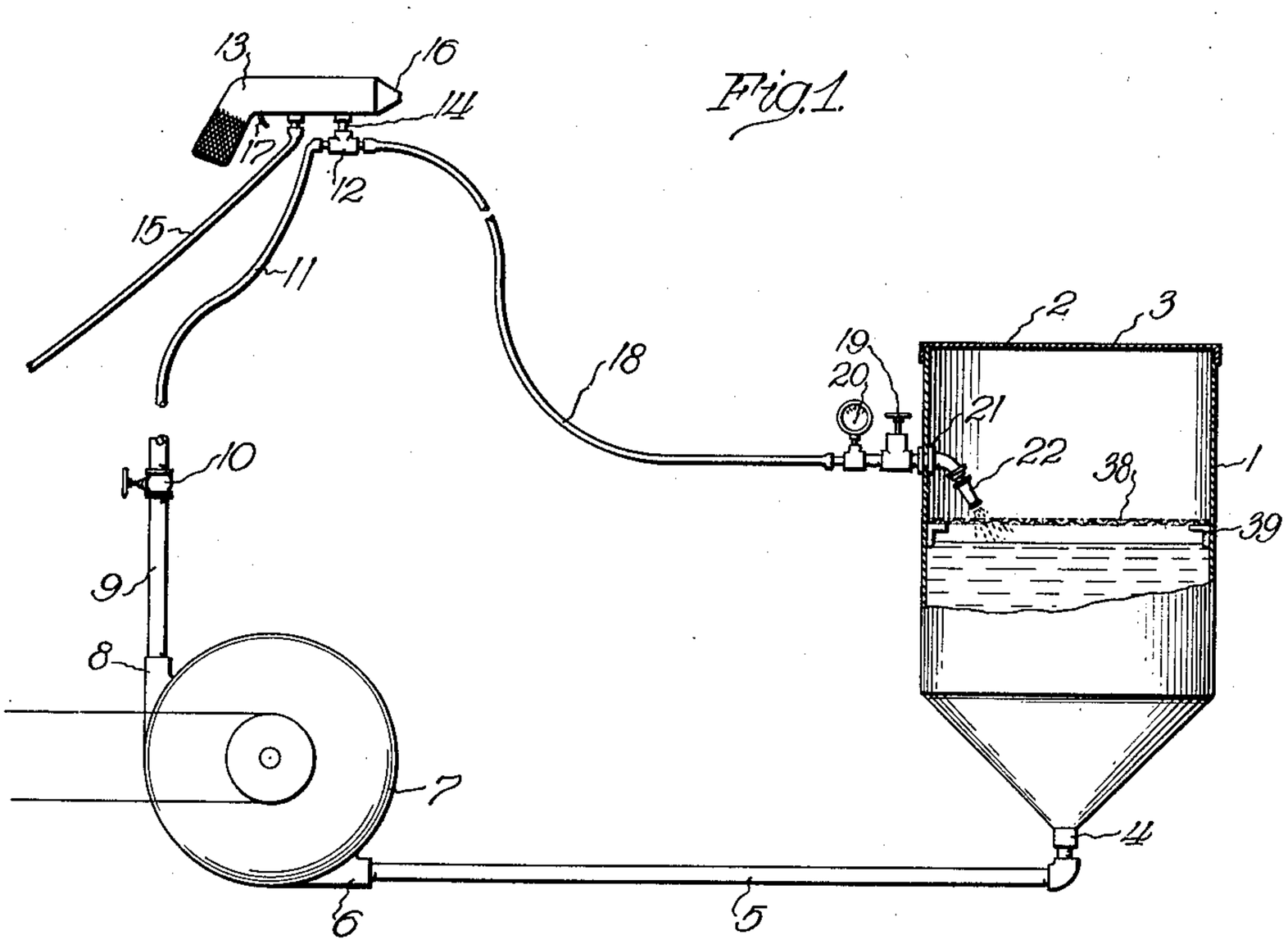
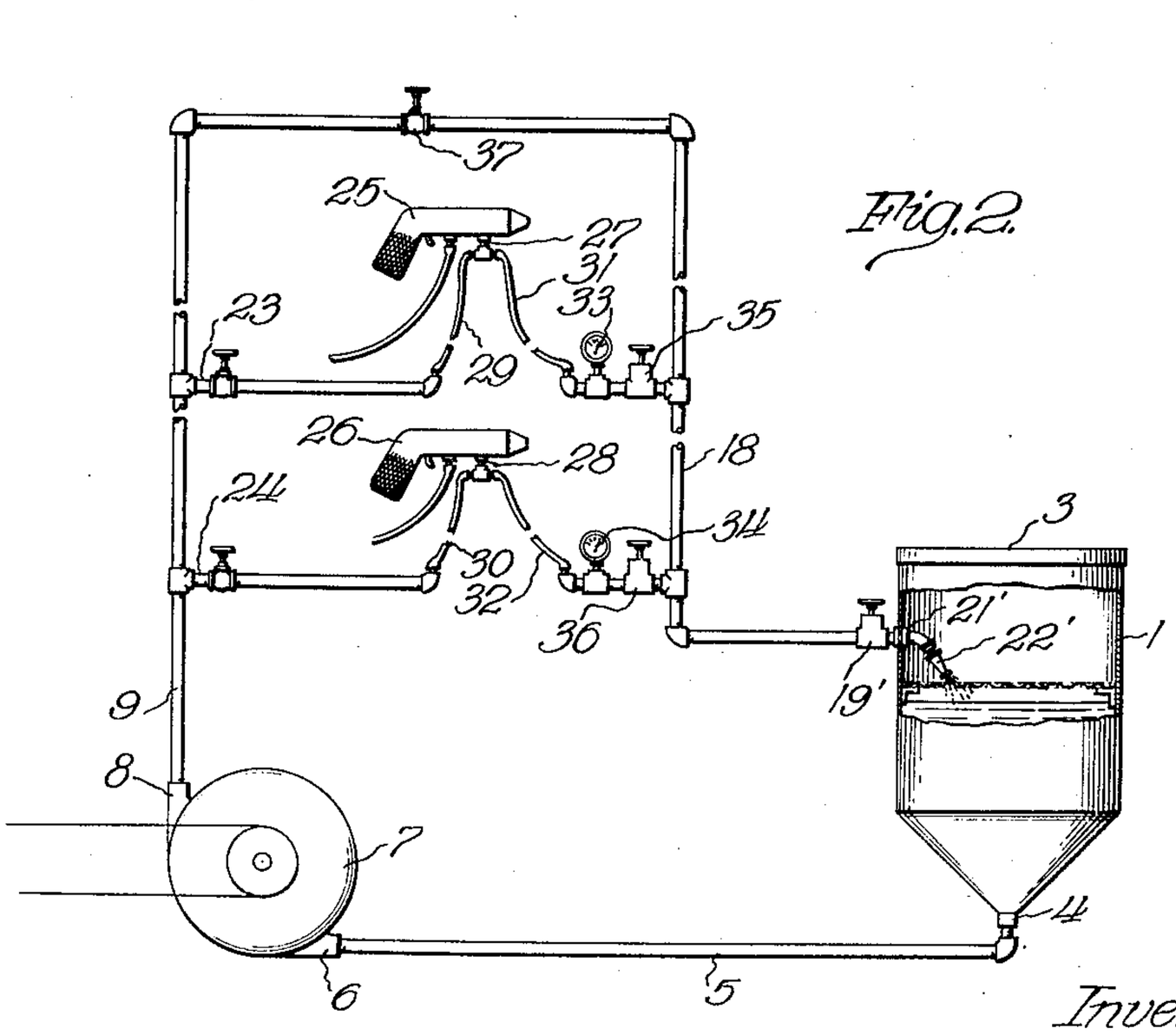


Fig. 2.



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CIRCULATING AND MIXING SYSTEM

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3 Claims. (Cl. 137—78)

This invention provides a circulating and mixing system, and more particularly a circulating and mixing system adapted for use with spray gun equipment, or similar equipment adapted to apply fluid coatings in the form of spray.

The present invention, in its preferred embodiment, is directed to a circulating and mixing system for use with spray gun painting equipment and provides for uniform mixing of the paint components, and the supplying of this uniform mixture at a preselected constant pressure to the spray gun. I employ the term "paint" herein as covering liquids used for coating, coloring or shading for any desired purpose.

It is essential in equipment of this type that a uniform mixture of the fluid be supplied at constant pressure at the point of application.

In a system of this character, for use with the more or less volatile and explosive liquids used for spray painting purposes, the elimination of explosion and fire hazards must be considered. In connection with this feature, the extreme volatility of the paint vehicles and the pyroxylin bases used in some types of lacquer spraying equipment, necessitates eliminating the loss of these paint vehicles by evaporation. The difficulty of excluding foreign matter from the circulating and mixing system requires consideration. In order to apply a smooth and even coating of the paint, lacquer or enamel, it is necessary that the paint or spray fluid be uniformly mixed, and that no dust or dirt be permitted to become entrained in this solution, since any foreign matter in the spraying solution will interfere with the smoothness of the coating applied to the object being painted. Thus, after considering these factors, it is apparent that the circulating and mixing system provided for this type of equipment should preferably be of a construction that I term a closed type of system, wherein the spray solution is circulated and recirculated and kept at uniform pressure, without the inclusion of any air or other foreign substances. Further, it is desirable that the entire circulating system be separated from any part of the equipment that might cause ignition, either through undue heating, or the production of sparks generated by friction, or static electricity.

In a closed type type of liquid supply system, such as heretofore known, the problem of an economic method of cleaning the system after use becomes important, since such a system must be thoroughly cleaned each time it is used, in order to prevent the formation of dry dust particles or residue within the interior of the system or within the gun itself. This residue is explosive, and must be removed after the gun has been used, in order to eliminate the possibility of explosions or flash fires.

The system of my invention is adapted to maintain a uniform mixture throughout the entire circulating system, and also provides for the maintenance of a uniform but adjustable pressure at the point of application. The system of the present invention is capable of economical and inexpensive production.

The present invention preferably is adapted for use with either a single spray gun or with a plurality of spray guns, the pressure at each of the individual spray guns being controlled individually.

One of the most important features of the present invention resides in the provision of a circulating and mixing system which is entirely closed, and in which the explosion and fire hazards, occasioned by the use of inflammable and volatile liquids such as the thinners used in lacquer and enamel spray painting processes, have been substantially eliminated. In connection with this feature, the provision of such a closed type of system eliminates the loss of these volatile paint vehicles by evaporation, and also excludes the admixture of any foreign matter to the solution in the system.

The present invention also provides for the constant, but controlled, agitation of the spraying liquid, which will secure uniform mixing of the paint components and will prevent the heavier components of the liquid from settling out. This agitation may be such as to give a turbulent rotary motion to the spraying liquid, or may be directed to give a more or less splashing effect within the agitating tank.

The provision of suitable pressure regulating means is contemplated by the present invention for the purposes of controlling the pressure within the circulating system, and also for controlling the pressure at each of the individual spray guns when the system is used with a plurality of spraying equipments.

Another feature of the present invention is the provision of a simple and economical method of cleaning the entire system after use, which comprises merely removing any of the spraying liquid that may be left in the agitating tank, partially filling the tank with the cleaning solution, and circulating this solution through the system in the same manner that the spraying liquid is circulated through the system.

Other novel features and advantages of the present invention will appear more fully from

the following detailed description which, taken in connection with the accompanying drawing, will disclose to those skilled in the art one particular manner in which my novel circulating and mixing system may be constructed and operated.

In the drawing:

Figure 1 is a diagrammatic view of the circulating and mixing system as applied to a single spray gun; and

Figure 2 is a diagrammatic view of the same system employing a plurality of spray guns.

Referring now in more detail to the drawing, the agitating tank containing the spraying liquid is indicated generally by the reference numeral 1. The size of the agitating tank 1 will, of course, depend upon the amount of spraying liquid that is to be used, the size of the spray gun, and the number of guns used in the system. The agitating tank is provided with a small vent 2 in the cover 3 thereof, this vent permitting relief of the pressure within the tank as the liquid is drawn therefrom.

The tank 1 is provided with an outlet 4 at the bottom thereof, and a suitable pipe 5, or similar conductor, is threaded therein and leads to the inlet 6 of a rotary pump 7. This pump, which is shown only diagrammatically, may be of the rotating vane type and is actuated by any suitable power means, such as a small electric motor. It should be understood, however, that if an electric motor is used, it should be of the fully enclosed type, and should have no open commutator or brushes.

Leading from the outlet 8 of the rotary pump 7 is a conductor 9 having the control 10 disposed therein for controlling the pressure from the high pressure side of the pump. This valve is particularly useful when the frictional resistance of the pipe line is high and back pressure becomes a material item.

From the high pressure side of the pump 7, through the conductor pipe 9 and valve 10, the spray liquid from the tank 1 is forced through a suitable hose or flexible conduit 11 to a T member 12 which is connected to the spray gun 13, by means of the inlet 14, this inlet being relatively short so that there will be no detrimental separation of the paint components in this section when the gun is not in use.

The spray gun 13 is of the general type disclosed in the De Vilbiss Patent No. 1,045,266 of November 26, 1912, and has the customary compressed air inlet 15 leading thereto, and is provided with the spray nozzle 16 for applying a spray of the painting solution to the article being coated. A trigger member 17 is provided for controlling the valve which permits the compressed air to force the spraying liquid out through the nozzle 16.

Continuing from the T member 12, the spraying liquid is conducted through the flexible hose or tubing 18 to a pressure regulator valve 19, preferably of the spring loaded type, which has a positive shut-off, and which is positioned adjacent the tank 1. This conductor or tubing 18 is, in effect, a continuation of the high pressure conduits 9 and 11, and affords a continuous flow of liquid past the inlet 14. This particular construction is of value in that regardless of whether inlet 14 to the gun 13 is opened or not, the liquid passing through the tubing 11 will be at substantially constant pressure and in motion at all times, so that no trouble will be encountered with the heavier components of the liquid settling out.

A suitable pressure gauge, indicated at 20, may be provided for the purpose of indicating the pressure existing in the tubing leading from the high pressure side of the pump 7. From the pressure gauge, the spraying liquid is led back through the pressure regulating valve 19 into the agitating tank 1 by means of a gas-tight connection 21 which terminates in a nozzle member 22 within the tank. This nozzle is capable of adjustment and may be directed so as to give a turbulent rotary motion to the liquid or to give a splashing effect upon the surface of the liquid, depending upon which motion will result in the most effective mixing condition for the type of paint used.

In the preferred form of my invention, a screen or filter 38 is suitably secured, as by means of brackets 39, in the tank 1 below the agitating nozzle 22, so that any solid or semi-solid paint constituents, or any foreign material, that may be present in the spraying liquid, will be filtered out. The screen is preferably secured in the tank in such a manner that it may be readily removed and cleaned.

It will be apparent, after considering this diagrammatic representation of my normal circulating and mixing system, that the liquid within the agitating tank 1 is at all times in constant motion and is at all times being agitated so as to maintain a uniform mixture of the paint components. The circulating system is continuous, and regardless of whether the gun is being used or is idle, the liquid is at all times circulating through the system and is under a constant pressure, as determined by the pressure regulator 19, or by the pressure regulator 19 and the pressure regulator 10.

In cases where a relatively light spray liquid is being used, and the lengths of tubing 11 and 18 are not of very considerable extent, it is possible to control the pressure of the entire circulating system by means of the valve 19 only, but in cases where the spray liquid is relatively heavy, or where the spray gun is being used at a point remote from the system, it is preferable to provide also the valve 10 for controlling this pressure.

Referring to Figure 2, which discloses a modification of my circulating and mixing system and provides for the use of a plurality of guns connected to a single circulating system, the tank 1 corresponds to the tank 1 shown in Figure 1. It has the cover 3 and the outlet 4 leading to the pipe line 5. This line 5 is connected to the inlet 6 of the rotary pump 7 and the spraying liquid within the tank 1 is supplied to the pump under atmospheric pressure or less.

From the pump 7 the spraying liquid is led out through the outlet 8 into the high-pressure pipe line 9. At suitable intervals along this pipe line, branch lines 23 and 24 are connected into the main high-pressure line 9. As many branch lines as desired, determined by the size of the circulating system, may be taken off of this high-pressure line and lead through suitable piping and flexible tubing to spray guns 25 and 26. As many spray guns as desired may be used, depending upon the work to be done and the capacity of the system. These guns are similar to the spray gun 13 of Figure 1, and are provided with the usual nozzles and trigger members.

A suitable compressed air inlet leads into each of the guns 25 and 26, and may be supplied from a single source of compressed air. Leading to the inlets 27 and 28 of the spray guns 25 and 26,

respectively, are the tubings 29 and 30 which conduct the spraying liquid from the branch lines 23 and 24 to the spray guns. Suitable outlets 31 and 32 lead away from the guns and out into the return line of the circulating system.

Pressure gauges 33 and 34 are placed in the return line before the valves 35 and 36 and these valves are connected to the main return line 18 of the system. The return line 18' leads to a suitable pressure control valve 19' disposed adjacent the mixing tank 1, and leads through the gas-tight connection 21' to the nozzle 22'. This is all the same as disclosed in the detailed description of Figure 1.

It is thus apparent that each of the guns is bridged across the pipes 9 and 18 and the valves in the branch lines 23 and 24 and the valves 35 and 36 placed in these secondary circulating systems regulate the pressure at each of the individual guns. By properly adjusting the valves it is possible to maintain the same pressure at each gun, and by properly adjusting the valve 19' this pressure may be varied through a very wide range.

As noted in connection with Figure 1, if the spraying liquid is relatively heavy, or if the length of piping is of considerable extent, a second regulating valve 37 may be provided for the purpose of cooperating with the valve 19' to control the pressure in the circulating system.

It is apparent that the effectiveness of this circulating system is dependent to a considerable extent upon the size of the rotary pump 7, and also upon the speed at which the pump operates. This speed, of course, may be varied widely, depending upon the spraying liquid being used. The pump must have a sufficient capacity to maintain the required pressure, regardless of whether paints having relatively light or heavy pigments are used. In one of the systems actually in use, it has been found that the spraying liquid contained in the tank 1, from one to two gallons, is entirely circulated through the system every ten seconds. It is seen, therefore, that a very effective mixing of the paint components is provided, and that the constant circulation of the liquid through the system under constant pressure, provides a very effective method of supplying a uniform mixture of the liquid to the spray guns.

In order to clean the circulating system, all that is necessary is to drain off the spraying liquid remaining in the system after the gun has been used, and then partially fill the agitating tank with the cleaning fluid. The tank is then closed, and the system is set in operation. The cleaning fluid is circulated through all of the passages at a very high rate of speed so that quite an effective cleaning is accomplished in a very short time. Inasmuch as the cleaning fluid used in practically all cases is extremely inflammable, it is important that the explosion and fire hazards be practically eliminated.

As will be apparent from a survey of this system, it is seen that the entire system is closed to any outside ignition sources, and that the quantity of air that may remain in the circulating system can be reduced to as small an amount as desired, by controlling the level of liquid in the agitating tank 1. Also, because of the closed type of circulating system, it is possible to exclude practically all foreign matter from the spraying liquid, and thus to preserve the uniform mixture of the paint components in such a manner as to provide a spray which will be very smooth and will effect a uniform coating over the object being sprayed.

The only limitation imposed with respect to the number of guns desired is the capacity of the pump 7 and the size of the agitating tank 1. However, this is a matter of design only, and I contemplate the provision of a suitable pump and tank that will provide sufficient capacity for any desired number of guns.

It is thus apparent that I have provided a mixing and circulating system which is comparatively inexpensive to construct, and which may be used with one or a plurality of spray guns. The system is capable of providing a uniform mixture throughout the entire circulating portion thereof, and also maintains a uniform adjustable pressure at the point of application. In addition to these features, the entire system is closed, and thus eliminates the possibility of explosion and fire hazard, or the loss of volatile paint vehicles by evaporation, as well as excluding the admixture of any foreign matter to the solution.

It is to be understood that I do not intend to be limited to the exact system shown and described in connection with the particular embodiment disclosed in the drawing, but only insofar as defined by the scope and spirit of the appended claims.

I claim:

1. In a liquid circulating and mixing system, a liquid reservoir, a closed circulatory system having an inlet and a discharge passage connected to the reservoir, means for circulating liquid through said system under pressure, a plurality of parallel connections between the inlet and discharge ends of the system, discharge means connected to said parallel connections, means for independently regulating the pressure in each of said parallel connections, and means located in the circulatory system beyond the points of connection of the final parallel connections for controlling the flow through the system.

2. In a liquid circulating and mixing system, a liquid reservoir, a closed circulatory system comprising common inlet and discharge passages and a plurality of parallel connections between the inlet and discharge passages, discharge means connected to certain of the parallel passages, means for passing a fluid from the reservoir under pressure to the system, means in the common discharge passage for controlling pressure in the system, and means in the parallel connections for controlling the pressure in each connection, one of said connections having no discharge means connected thereto and serving as a by-pass between the inlet and discharge passages.

3. In a liquid circulating and mixing system, a liquid reservoir, a closed circulatory system having an inlet and a discharge passage connected to the reservoir, means for circulating liquid through said system under pressure, a plurality of parallel connections between the inlet and discharge ends of the system, discharge means connected to said parallel connections, means for independently regulating the pressure in each of said parallel connections, and discharge means on the discharge end of the system so located in the reservoir as to cause agitation of the liquid in the reservoir by the return flow to the reservoir.

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