July 12, 1938. H. G. MOJONNIER 2,123,340

LIQUID CONDITIONING SYSTEM

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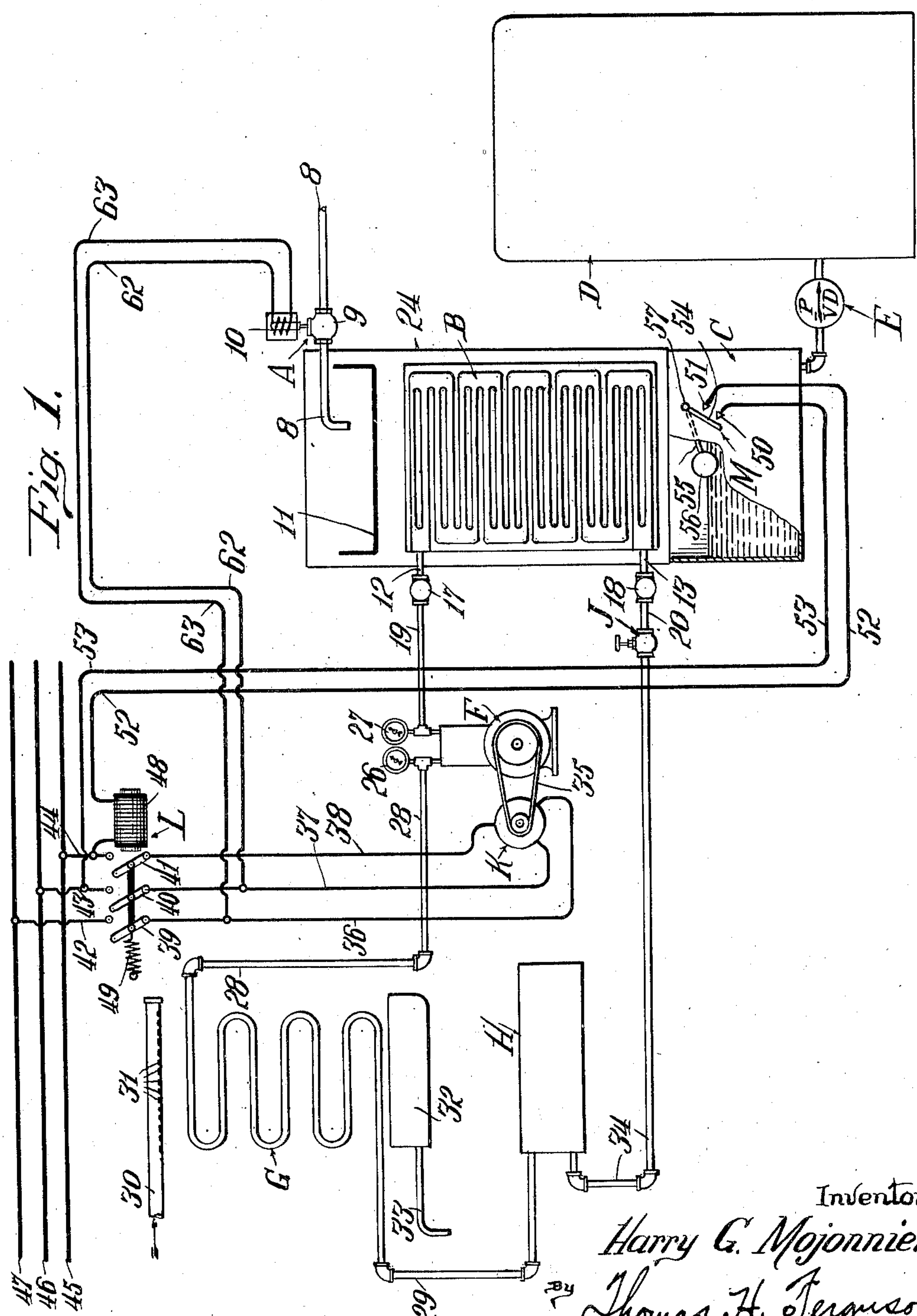

Inventor

Harry G. Mojonnier

By Thomas H. Ferguson

Attorney

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Fig. 2.

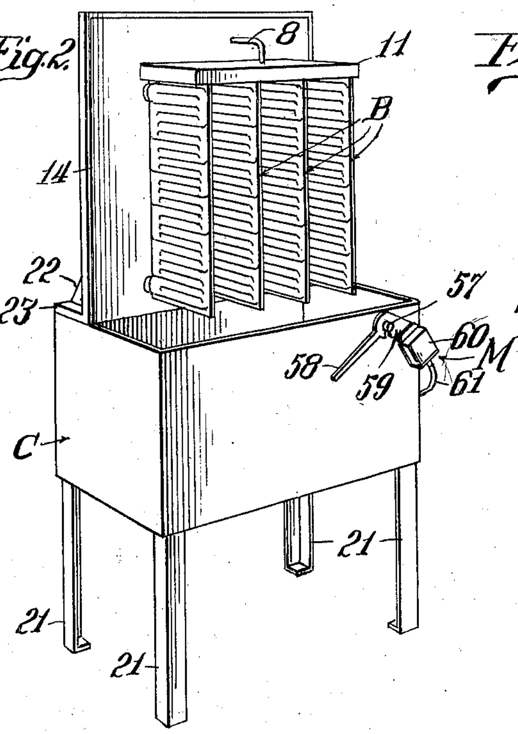


Fig. 3.

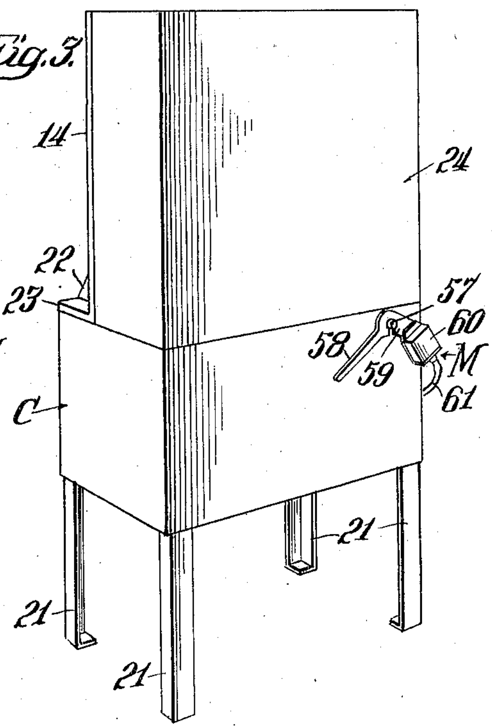
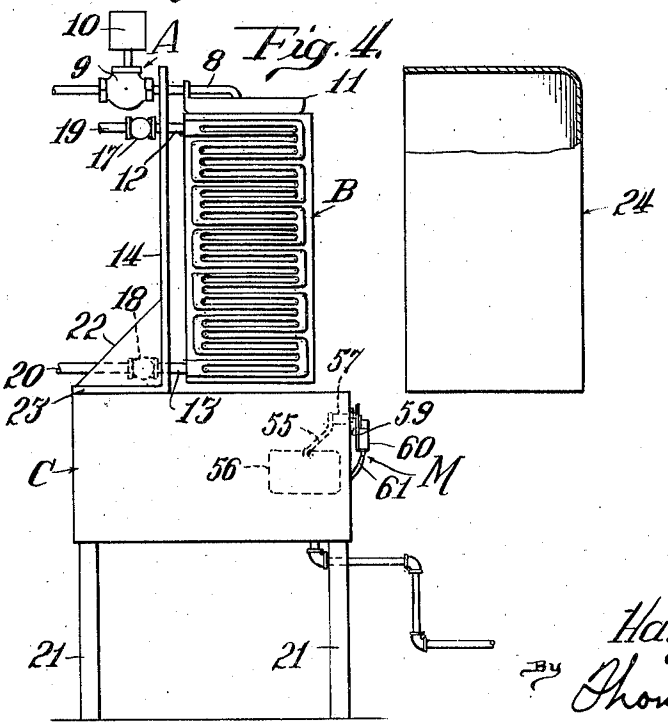


Fig. 4.



Inventor
Harry G. Mojonnier
By Thomas H. Ferguson
Attorney

Patented July 12, 1938 2,123,340

UNITED STATES PATENT OFFICE

2,123,340

LIQUID CONDITIONING SYSTEM

Harry G. Mojonnier, Oak Park, Ill., assignor to Mojonnier Bros. Co., a corporation of Illinois

Application August 30, 1937, Serial No. 161,533

4 Claims. (Cl. 257—2)

The present invention relates to liquid conditioning systems generally, and more particularly to systems of this kind wherein a liquid from a given source of supply is conditioned and then held in its conditioned state as a supply to be intermittently drawn upon for subsequent use.

As illustrative, it is the practice in the carbonating beverage industry to use water at a more or less definitely low temperature as a supply for the carbonator, the latter operating more or less regularly and intermittently to withdraw the cool water from the supply, drawing off the water, say for three minutes, and then being inactive, say for six minutes, and then withdrawing again for three minutes, and so on. In such systems it has been common practice heretofore to cool the water by means of a mechanical refrigerating system and to do so by sending the water through the cooler of such a system over and over again, thus "recirculating" it, as the practice is sometimes called.

The principal object of the present invention is to produce a system of the kind indicated in which the water, or other liquid, will pass only once through or over the cooling elements of the refrigerating system without recirculating the same, and yet will meet all requirements of apparatus with which it is subsequently to be used, whether carbonating apparatus or otherwise. There are many advantages in such a system over recirculating systems of equal capacity. These advantages include low initial cost of equipment and installation, low cost of maintenance, more economical operation, and greater efficiency.

Other objects of the invention are to provide simple apparatus which may be readily installed, easily cleaned and repaired, and which at the same time will be sanitary and pleasing in appearance.

The invention has been developed for use in the carbonated beverage industry and so will be described in that connection, although, as will appear more fully hereinafter, the same may be used in other relations and in some instances for heating instead of cooling.

The various features and advantages of the invention will be best understood upon reference to the showing detailed description taken in connection with the accompanying drawings and the scope of the invention will be particularly pointed out in the appended claims.

In said drawings, Fig. 1 is a diagram of a system constructed and arranged in accordance with the present invention and intended for furnishing a water supply for a carbonator. Fig. 2 is a perspective view of the cooling element of the system shown with the heat exchanger elements exposed to view. Fig. 3 is a similar view showing the heat exchanger elements inclosed, a suitable cover cooperating with other parts to provide the enclosure. And Fig. 4 is a side elevation of the heat exchanger, with the cover displaced to the right. Throughout these views like characters refer to like parts.

In brief, the system herein disclosed includes electromagnetically operated water supply mechanism A for furnishing water to the heat exchanger elements B which are intended to cool the water received and deliver it in cooled condition to a receiver C located below the cooling elements and serving to hold a considerable supply of the conditioned water ready for the use of a carbonator D which is supplied with water from the receiver C through the agency of an intermittently operated pump E.

To cool the elements B, any suitable compression refrigerating system may be employed. That shown is similar to one illustrated on page 3 of "Miscellaneous Publication No. 138, United States Department of Agriculture, Washington, D. C., March 1932." The illustrated refrigerating system includes, besides the elements B, a compressor F which takes ammonia gas or like temperature controlling medium from the upper passages of the cooling elements B and advances it in a compressed condition to the coils of a condenser G wherein it is condensed and passed in liquid form to a receiver H from which it flows as a liquid through an expansion valve J to the lower coils of the cooler element B. As the liquid expands in its passage upward through the cooler elements B, it withdraws heat from the water which is flowing from the supply mechanism A to the receiver C. So long as the compressor F is in operation the refrigerating medium travels repeatedly over the circuit just traced and thus heat is continuously abstracted during such operation from the water flowing over the elements B. An electric motor K drives the compressor F. An electromagnetically operated switch L controls the motor K and also the electromagnetically operated valve of the water supply mechanism A. A little further examination will show that the switch L is under the control of a float-controlled electric switch M located in the receiver C. Whenever the level of the liquid in the receiver drops low enough, the switch M will close its circuit and actuate the switch L to start the motor K. At the same time the supply means A will operate to start a flow of water over the cooling elements B. This action will continue until the level of the liquid in the receiver C rises sufficiently to cause switch M to open its circuit. Upon a subsequent sufficient lowering of the level of the liquid in the container C, the operation just outlined will be repeated. Thus, both the refrigerating system and the water supply are under the control of the valve M.

The water supply mechanism A includes a supply pipe 8 which leads from a suitable source of water such as that furnished by a city main. In the pipe 8 is a valve 9 which is normally closed but may be opened through the action of a solenoid 10 associated with the valve stem. Such electromagnetically operated valves are well known and the diagrammatic illustration of the same should suffice for the present disclosure. At the delivery end the pipe 8 preferably turns down into the distributor 11 of the associated cooler. The circuit by which the valve 9 is operated will be pointed out later when considering the other electrical connections.

The heat exchange elements B are of well known construction, being individually made up of pressed sheets of metal which are welded together to provide interior passages for the heat exchange medium and smooth outer surfaces for contacting with the liquid which passes over them. For a fuller disclosure of heat exchange elements of the kind described, reference may be had to United States Patent No. 2,040,947, dated May 19, 1936.

The elements B are, in the present instance, held in vertical position by the pipes 12 and 13 which connect with the upper and lower, outlet and inlet, openings of the elements. As shown more particularly in Fig. 2, these pipes pass through openings in a vertical wall 14 which forms part of the frame structure of the heat exchanger of the system. Obviously, since there are several elements B, four being shown, the pipes 12, 13 preferably connect with manifolds or headers 17, 18 located in the rear of the upright panel or wall 14. Of these manifolds, the outlet manifold 17 is connected to pipe 19 and the inlet manifold 18 to pipe 20.

Obviously, the elements B might be mounted differently but for the present purposes the rigid mountings are quite satisfactory. These elements are quite limited in size and are therefore preferably spaced apart sufficiently to permit an attendant to reach between them and thoroughly scrub or otherwise clean them.

The receiver C is positioned directly beneath the elements B and is in the form of an oblong box provided with legs 21 which rest upon the floor and elevate the entire structure. The upright back 14 rests upon the ends of the receiver C and is supported in its upright position by one or more brackets 22 which may be formed integral with the part 14 or separate therefrom as desired. Preferably the container C has an open top except that the portion behind the back 14 is preferably closed by a cover 23.

The back 14 provides a bearing for the edges of a box-like cover 24 which is adapted to rest upon the upper edges of the container walls and to bear against the back. When the cover is in place, it entirely incloses the elements of the heat exchanger as will be apparent from a comparison of Figs. 2 and 3, the cover 24 being shown in place in the latter figure.

The carbonator D may be any one of several carbonators now in the market. As the same in itself is old, and forms no part of the present invention, except as it may do so in association, it is merely diagrammatically illustrated in Fig. 1.

The pump E which supplies the carbonator D with conditioned water from the receiver C is indicated as one of variable delivery. This merely means that it will be operated to supply the cooled water to the carbonator at intervals, as previously pointed out. As before stated, it is common for carbonators to have their pumps operate continuously for three minutes and then remain quiescent for six minutes and then again operate three minutes, and so on, except, of course, that such intermittent regularity may be interfered with when it is necessary to stop the carbonator because of a broken bottle or otherwise as may occur in practice. In such instances, however, the stop is not long enough to interfere with the efficient operation of the invention.

The compressor F may be of any well known construction. It is preferably provided with a head pressure gage 26 and a back pressure gage 27. The latter is included in the piping 19 which runs from the header 17 of the heat exchange sections B, to the compressor head. The former is in direct connection with the pipe line 28 which runs from the compressor head to the upper coils of the condenser G.

The condenser G consists of a number of coils, as indicated, through which the ammonia or other heat exchange medium is forced by the compressor F. The medium, after being condensed, passes through pipe line 29 to the receiver H. The condenser G also includes a water inlet pipe 30 which is suitably pierced on its under side with a series of apertures 31 for the delivery of water to the exterior of the coils as is usual. The water passing from the coils of the condenser G passes into a trough 32 and through a suitable pipe outlet 33 to a waste water connection. Thus there is a constant flow of cooling water over the coils of the condenser and it performs its function of cooling the gas or other medium and liquefying it for collection in the receiver H.

The receiver H is of well known construction and may be provided with suitable gages if desired. The pipe line 29 enters the upper part of the receiver H and thus any gas which may be contained in the liquefied medium will collect in the upper part of the receiver whereas the liquid will lie in the lower portion. From this lower portion a pipe line 34 extends to the expansion valve J.

The expansion valve may be of any well known design. Such valves are in common use and that shown need not be further described. The expansion valve in turn is connected by the pipe 20 with the lower header 18, and thence to the lower passages of the heat exchange elements B.

Any suitable motor may be employed for driving the compressor F. In the present instance, a three-phase electric motor K is shown. Power is transmitted from the motor K to the compressor F through a power belt 35. The motor connections are made through three conductors 36, 37, 38 which lead from the motor to corresponding movable switch contacts 39, 40, 41. These contacts cooperate with fixed contacts and conductors 42, 43, 44, respectively, to complete the connection with the supply leads 45, 46, 47. The switch L normally has its contacts open. When current is passed through the winding 48 of the switch then the contacts are drawn into closed position. As soon as current is cut off, the contacts move to open position. A return spring 49 serves to bring about the opening throw of the switch. It will be observed that the winding 48 of the switch L is in series circuit with the fixed contacts 50 and 51 of the switch M. The conductors which establish this series arrangement are conductor 52 which connects with lead 44 and conductor 53 which connects with lead 43.

The switch M is of the float controlled type and is merely diagrammatically illustrated. Such illustration shows a bridging contact 54 which is fixed to the arm 55 which carries the float 56. These members, so united, are pivoted to the receiver casing at the point 57. With this construction it will be seen that as the float 56 drops down, due to the withdrawal of water from the receiver C, a point will ultimately be reached whereat the two fixed contacts 50, 51 will be bridged by the movable contact 54. When circuit is thus closed, the switch L is also closed as previously noted. In practice the switch M will ordinarily be a mercury type switch and the tilting of the same will cause the circuit to be made and broken. In Figs. 2 and 3 the pivot 57 upon which the float 56 oscillates in response to variations in liquid level, extends through the outer casing of the container C and there has attached to it a pointer 58 which lies about in the plane of the arm 55 and indicates the position of the float within the receiver. In the same views, the pointer 58 is shown with an extension 59 carrying a switch box 60 in which the mercury switch is located, the electric conductors leading to the switch being inclosed in a cable 61. The detailed construction of this mercury type switch need hardly be given in the present disclosure as such switches are well known in the prior art. However, if details of the switch illustrated are desired, reference may be had to the copending application of Albert B. Mojonnier, Serial No. 160,202, filed August 21, 1937, for improvements in float controlled electric switches.

Not only does the closing of switch L complete the starting circuit for the three-phase motor K, but the closing of said switch also completes a circuit for the winding 10 of the supply mechanism A. This is brought about through the agency of conductors 62 and 63 which on the one hand, are connected to the terminals of the winding 10, and, on the other hand, are connected to conductors 37 and 36, respectively. With this circuit arrangement, it follows that each time the switch M causes switch L to close, both compressor F and the supply mechanism A are operated. At once, then, a refrigerating action begins upon the newly admitted liquid emerging from the supply mechanism A.

It will be noted that, as soon as switch L opens, and the compressor F stops operating, the supply mechanism A will also cut off the admission of water to the cooling elements B. However, there will still be some of the heat exchange medium within the elements B in condition to continue abstracting heat from the space around the elements within the cover 24. The continued withdrawal of heat units in this way will have an effect upon the previously conditioned water in the container C and help to keep it in its cool condition. In other words, there will be a sort of lag in the functioning of the cooling equipment which will be helpful in retaining the conditioned liquid in the condition to which it has been brought.

The cover 24 together with the back 14 and the boxlike receiver C form the inclosure wherein the refrigeration takes place. The maintaining of such space with fairly tight joints is quite important and for this reason the cover 24 is made to fit closely upon the top of the receiver C and against the upright back 14. It should be noted that the cover 24 is shown in its physical form in Figs. 2 and 3 but only diagrammatically in Fig. 1 by an enclosing line.

It will be apparent that in its details, the structure herein disclosed may be considerably changed without departing from the spirit and scope of the invention. It is therefore intended that such changes shall be covered by the terms of the appended claims.

I claim:

1. A liquid conditioning system comprising a heat exchange element arranged to bring a liquid to be treated and a liquid conditioning medium into heat exchange relation to each other, a liquid supply means for delivering the liquid to be treated to said element, a receiver for catching and holding said liquid after being treated by said element, the held liquid serving as a supply of conditioned liquid which may be drawn upon as needed, a medium supply means for delivering the heat exchange medium to said element, an electromagnetically operated device for controlling the operation of said liquid supply means, an electromagnetically operated device for controlling the operation of said medium supply means, electric circuits for said electromagnetically operated devices, and means responsive to variations in the level of the liquid in said receiver to vary said circuits to operate said electromagnetically operated devices to variously operate said liquid and medium supply means.

2. A liquid conditioning system comprising a heat exchange element arranged to bring a liquid to be treated and a liquid conditioning medium into heat exchange relation to each other, a liquid supply means for delivering the liquid to be treated to said element, a receiver for catching and holding said liquid after being treated by said element, the held liquid serving as a supply of conditioned liquid which may be drawn upon as needed, an electric motor, means responsive to the operation of said motor to deliver the heat exchange medium to said element, an electromagnetically operated device for controlling the operation of said liquid supply means, an electromagnetically operated switch, electric circuits for supplying current to said motor in response to operations of said switch, an electric switch operable in response to variations in the level of the liquid in said receiver, circuit connections for energizing said electromagnetically operated switch in response to the operations of said electric switch, and other circuit connections for operating said electromagnetically operated device in response to the operations of said electromagnetically operated switch.

3. A liquid conditioning system comprising a heat exchange element arranged to bring a liquid to be treated and a liquid conditioning medium into heat exchange relation to each other, a liquid supply means for delivering the liquid to be treated to said element, means for receiving and holding said liquid after being treated by said element, the liquid thus held serving as a supply of conditioned liquid which may be drawn upon as needed, a medium supply means for delivering the heat exchange medium to said element, a first electromagnetically operated device for controlling the operation of said liquid supply means, a second electromagnetically operated device for controlling the operation of said medium supply

means, electric circuits and connections operative to actuate said second device, and other electric circuits and connections for operating said first device in response to the operation of said second device.

4. A liquid conditioning system comprising a heat exchange element arranged to bring a liquid to be treated and a liquid conditioning medium into heat exchange relation to each other, a liquid supply means for delivering the liquid to be treated to said element, means for receiving and holding said liquid after being treated by said element, the liquid thus held serving as a supply of conditioned liquid which may be drawn upon as needed, an electric motor, means responsive to the operation of said motor to deliver the heat exchange medium to said element, an electromagnetically operated device for controlling said liquid supply means, means for supplying current to said motor, and circuit connections operative in response to the actuation of said current supplying means to operatively energize said electromagnetically operated device.

HARRY G. MOJONNIER.