L. S. PFOUTS AND E. J. MILLER.

PASTEURIZING APPARATUS AND PROCESS.

APPLICATION FILED AUG. 20, 1917.

1,325,800.

Patented Dec. 23, 1919.

5 SHEETS—SHEET 1.

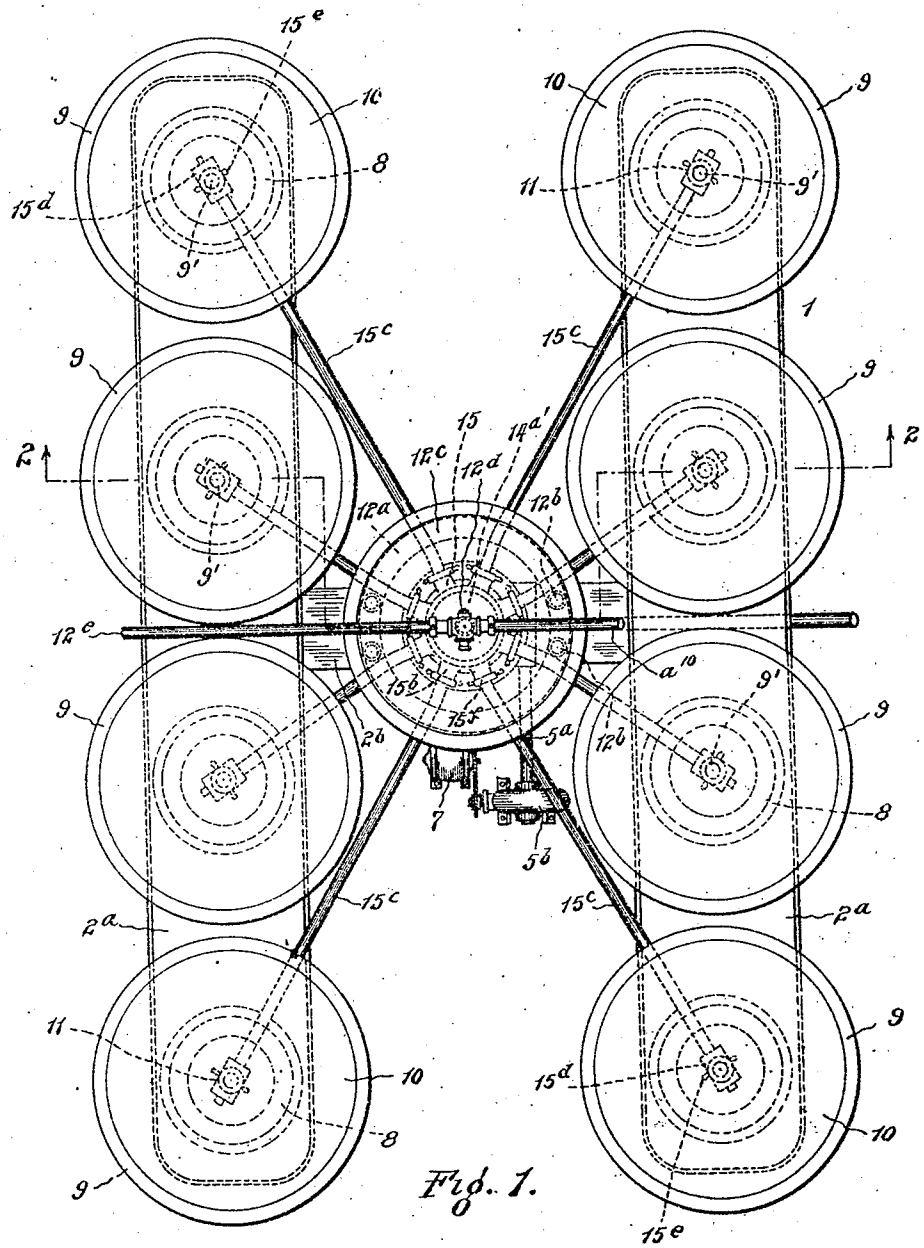


Fig. 1.

Inventors
Leroy S. Pfouts
Edward J. Miller
by Edward R. Alexander
their attorney

L. S. PFOUTS AND E. J. MILLER.

PASTEURIZING APPARATUS AND PROCESS.

APPLICATION FILED AUG. 20, 1917.

1,325,800.

Patented Dec. 23, 1919

5 SHEETS—SHEET 2.

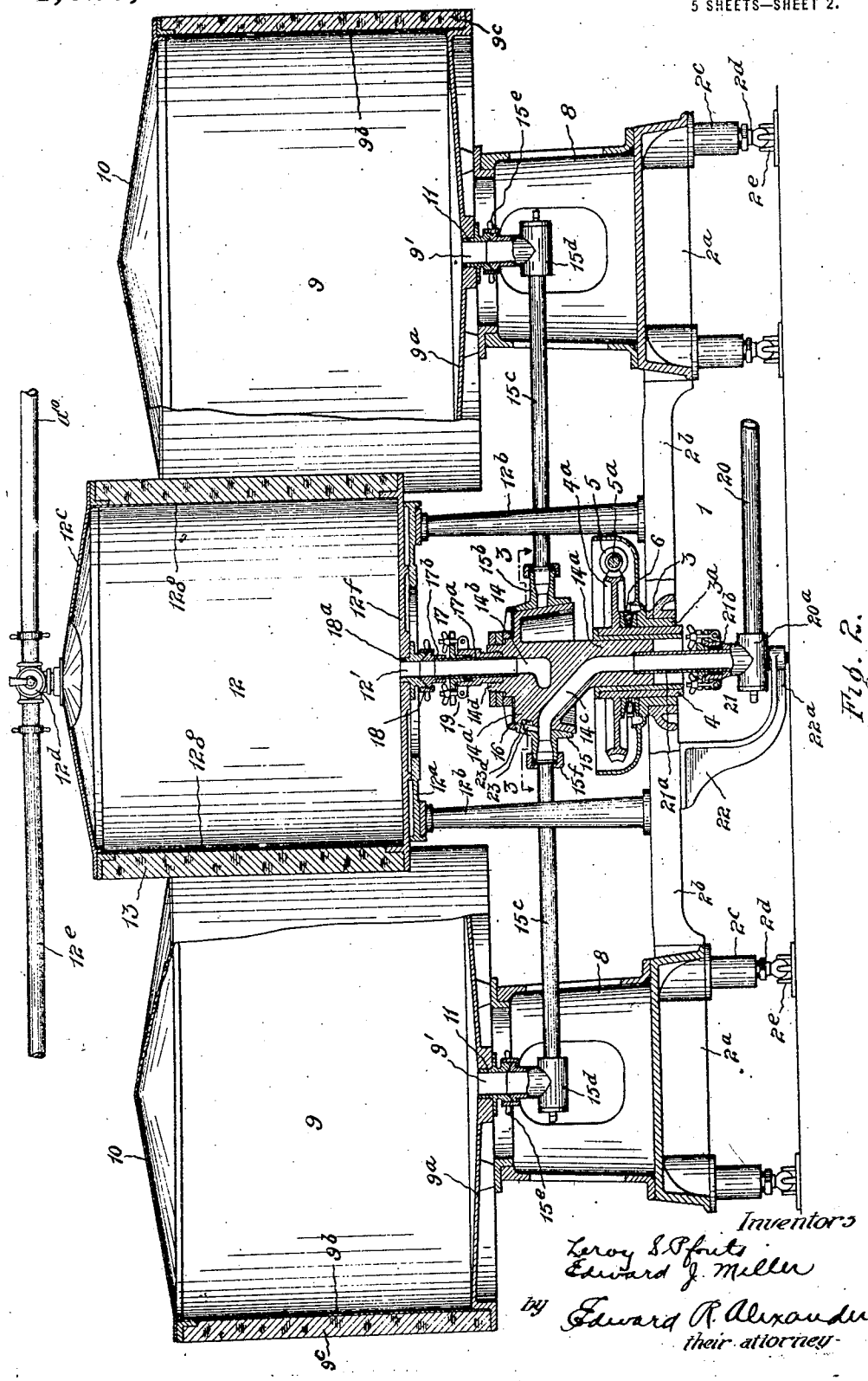


Fig. 2.

Inventors
Leroy S. Pfouts
Edward J. Miller
by Edward R. Alexander
their attorney

L. S. PFOUTS AND E. J. MILLER.

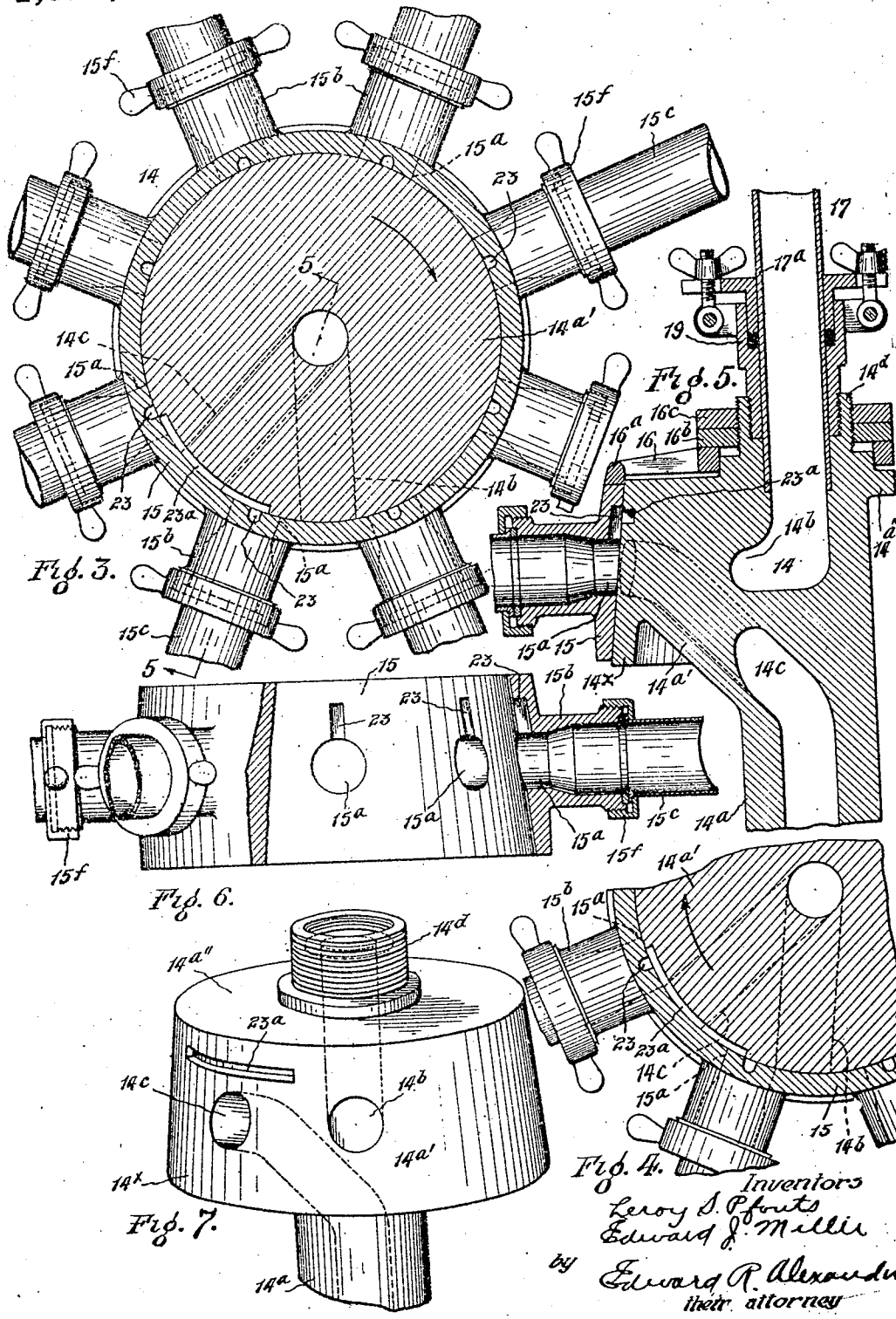
PASTEURIZING APPARATUS AND PROCESS.

APPLICATION FILED AUG. 20, 1917.

1,325,800.

Patented Dec. 23, 1919.

5 SHEETS—SHEET 3.



Inventors
Leroy S. Pfouts
Edward J. Miller
by Edward R. Alexander
their attorney

L. S. PFOUTS AND E. J. MILLER.

PASTEURIZING APPARATUS AND PROCESS.

APPLICATION FILED AUG. 20, 1917.

1,325,800.

Patented Dec. 23, 1919.

5 SHEETS—SHEET 4.

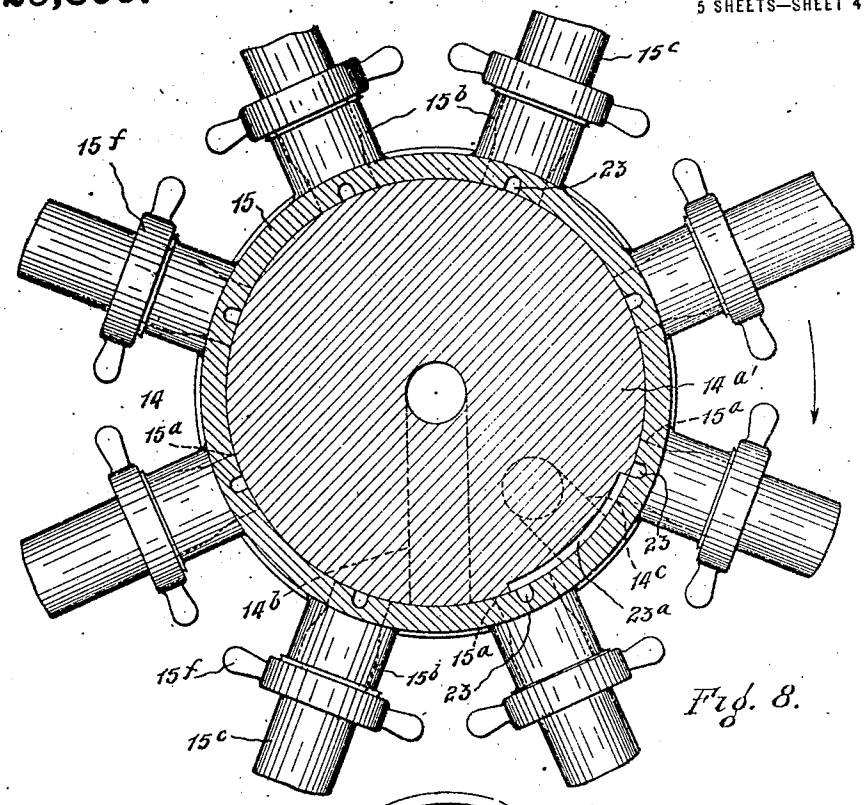


Fig. 8.

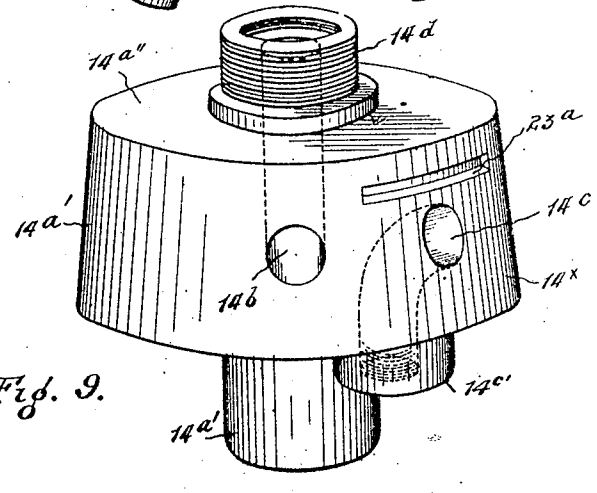


Fig. 9.

Inventors
Leroy S. Pfouts
Edward J. Miller
by Edward R. Alexander
their attorney

L. S. PFOUTS AND E. J. MILLER.

PASTEURIZING APPARATUS AND PROCESS.

APPLICATION FILED AUG. 20, 1917.

1,325,800. Patented Dec. 23, 1919.

5 SHEETS—SHEET 5.

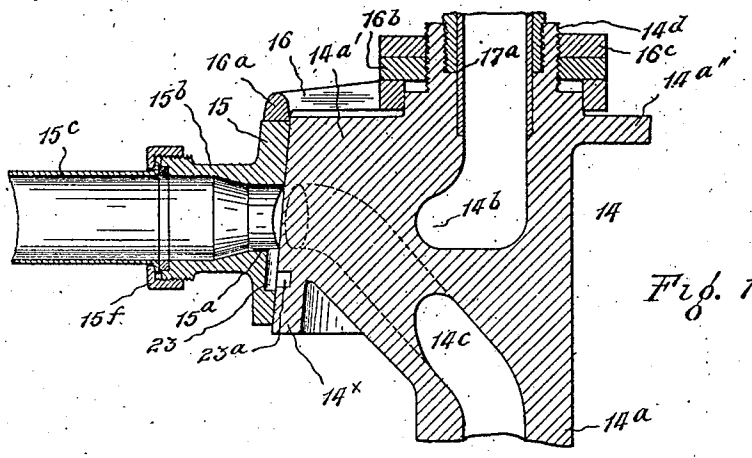


Fig. 10.

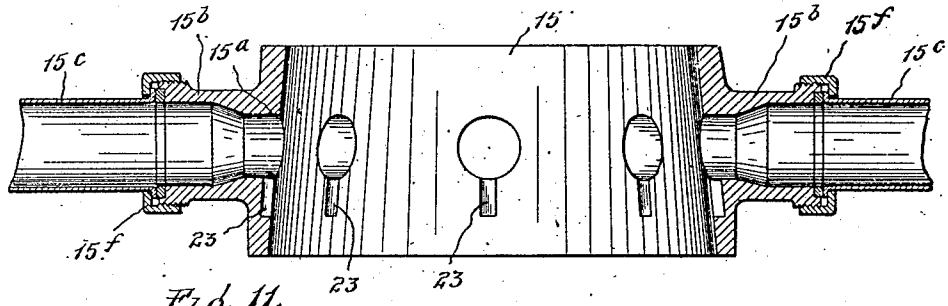


Fig. 11.

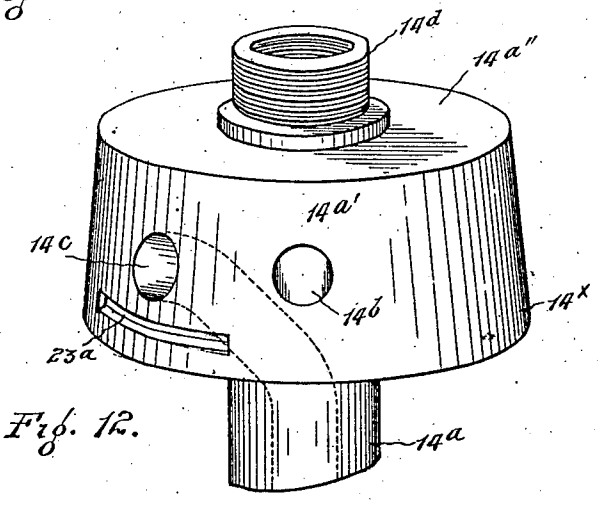


Fig. 12.

Inventors
Leroy S. Pfouts.
Edward J. Miller
by Edward R Alexander
their attorney

UNITED STATES PATENT OFFICE.

LEROY S. PFOUTS AND EDWARD J. MILLER, OF CANTON, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO THE MILLER PASTEURIZING MACHINE COMPANY, OF CANTON, OHIO, A CORPORATION OF OHIO.

PASTEURIZING APPARATUS AND PROCESS.

1,325,800. Specification of Letters Patent. Patented Dec. 23, 1919.

Application filed August 20, 1917. Serial No. 187,234.

To all whom it may concern:

Be it known that we, LEROY S. PFOUTS and EDWARD J. MILLER, citizens of the United States, residing at Canton, county of Stark, and State of Ohio, have invented new and useful Improvements in Pasteurizing Apparatus and Processes, of which the following is a specification.

This invention relates to pasteurizing apparatus and method or process, more particularly to apparatus for, and method or process of, treating liquid, such as milk.

Our invention is particularly applicable to apparatus of the character shown in U. S. Letters Patent granted to Leroy S. Pfouts, Nos. 1,076,604, 1,185,531 and 1,185,532. The apparatus embodying our invention is applicable for use in connection with liquid treating apparatus of the type shown in Patent No. 1,183,764, but it will be understood, however, that it may be used in connection with any preferred form of liquid treating apparatus.

One object of the invention is to insure the uniform treatment of all portions of the liquid as it passes through the apparatus.

Another object of the invention is to produce apparatus adapted to be used in pasteurizing and comprising in combination a series of liquid holders, a valve mechanism operating to successively fill such holders, to empty the holders and to transfer a portion of the liquid of one holder for the emptying thereof to another holder; and also a process or method of pasteurizing procedure consisting in filling and emptying liquid holders in a series progressively, and transferring a portion of the liquid in a filled holder to an empty holder, and more specifically in making such transfer prior to the filling of the latter holder.

Another object of the invention is to provide, in apparatus of this character, a by-pass or liquid connection, whereby a portion or portions of the liquid delivered by the valve to each holder may be conducted to another holder.

Another object of the invention is to provide, in apparatus of this character, a valve mechanism, the valve element of which is formed with a by-pass to conduct liquid from one conduit or liquid connection to another conduit or liquid connection.

Another object of the invention is to provide means for conducting any liquid remaining in each of the liquid connections for the holders to another liquid connection, whereby it will be conveyed to a holder and treated.

These and other objects of the invention will be apparent to those skilled in the art to which our invention relates.

For the purpose of illustration we have, in the accompanying drawings, shown and herein described one form of apparatus embodying our invention.

Figure 1 is a top plan view of a pasteurizing apparatus embodying our invention.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Fig. 3 is a section on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary section on the line 3—3 of Fig. 2 showing the valve element in another position.

Fig. 5 is a fragmentary vertical section on the line 5—5 of Fig. 3.

Fig. 6 is a view of the valve seat element, partly in section and partly in elevation.

Fig. 7 is a perspective view of the valve element.

Fig. 8 is a sectional view similar to Fig. 3 but showing a modified form of the invention in which the valve seat element rotates relative to the valve element.

Fig. 9 is a perspective view of the valve element for use in the form of the invention shown in Fig. 8.

Figs. 10, 11 and 12 are fragmentary views illustrating another modification of the invention.

In the drawings, 1 indicates as an entirety a support for the apparatus. The support 1 preferably comprises a pair of spaced base members 2^a, which are preferably arranged parallel to each other, and a connector 2^b, connected at its opposite ends, in any desired manner, to the base members 2^a. 2^c indicates a plurality of legs for each base member 2^a. The legs may be of any desired length to support the base members at any desired height above the floor. At its lower end each leg may be provided with an adjustable foot 2^d, whereby the adjacent base member can be raised and lowered, according to the unevenness or inclination of the floor to support it horizontally and in a plane coincident with that in which

the other base member is supported. Each foot 2^d preferably consists of a ball member fitted into a socket 2^e, which rests on the floor.

3 indicates an opening formed in and intermediate the opposite ends of the connector 2^b. The opening 3 is provided with a bearing 3^a. The bearing 3^a is preferably provided at its upper end with a flange which engages the top surface of the connector 2^b and supports the bearing in the opening 3. 4 indicates a shaft rotatably mounted in the bearing 3. The shaft 4 is preferably of tubular form to receive the shank 14^a of a valve element $14^{a'}$, which will be later described. At its upper end the tubular shaft 4 is provided with a worm gear 4^a which is driven by a worm 5 connected to a shaft 5^a. The worm gear 4^a and tubular shaft 4 are preferably formed integrally. Interposed between the under surface of the worm gear 4^a and the flange of the bearing 3^a is an anti-friction bearing 6, preferably of the tapered roller bearing type. The shaft 5^a is supported in suitable bearings and carries at its outer end a suitable drive device 5^b, such as a worm gear, meshing with a worm, driven by a motor 7, whereby the shaft may be driven at any desired speed. The worm gear 4^a and worm 4 serves as a suitable reduction gearing for the sleeve shaft 4.

8 indicates a plurality of pedestals or standards, preferably of uniform height, mounted on each of the base members 2^a. The pedestals 8 are preferably equally spaced from each other, as shown in Fig. 1. Each pedestal is made hollow and of skeleton form to economize metal and reduce the weight of the apparatus to a minimum.

9 indicates as an entirety a series of liquid holders each of which is supported on a pedestal 8. Each vessel 9 may be of cylindrical shape and formed with bottom and side walls 9^a, 9^b, respectively, the latter being preferably surrounded by a suitable heat insulating jacket 9^c. 9′ indicates an opening formed in the bottom of each holder 9 to permit liquid to flow into and out of the holder. 10 indicates a cover for each holder 9. Each cover 10 may be fitted to or detachably connected to the adjacent holder 9 in any desired manner. 11 indicates a pipe section suitably fitted in the opening 9′ for each holder 9 and depending downwardly therefrom. The purpose of these pipe sections will be later described.

12 indicates a receiving chamber preferably arranged between the rows of holders 9. The chamber 12 may be supported upon a supplemental base member 12^a which in turn is preferably supported by a plurality of standards 12^b mounted on the connector 2^b. The receiving chamber 12 is preferably supported by the supplemental base member 12^a in a plane above the plane of the holders 9 in order to insure the flow of the liquid from the receiving chamber 12 to each of the holders 9 by gravity in the manner hereinafter described. 12^c indicates a cover fitted in any well known manner to the chamber 12. It is formed with an opening through which extends the discharge end of a liquid supply pipe a^{10}. This pipe conducts the liquid in a substantially continuous and uniform manner from the heater (not shown) to the chamber 12. 12^d indicates a three-way valve interposed in the pipe a^{10}. The purpose of the valve 12^d is to cut off the flow of the liquid entirely, or to direct it downwardly into the chamber 12 or into a pipe 12^e, which preferably leads to a cooler (not shown) or some other point of discharge. When the pipe a^{10} is connected through the valve 12^d with the pipe 12^e, the liquid is cut off from the chamber 12. The receiving chamber 12 preferably comprises a bottom wall 12^f having a liquid discharge opening 12′ and an annular side wall 12^g, and the latter may be surrounded by a suitable heat insulating jacket 13.

14 indicates as an entirety a valve mechanism. It includes a valve or valve member $14^{a'}$ and a valve seat element or member 15, which coöperate to control the flow of the liquid to and from the holders or vessels 9. The valve member $14^{a'}$ preferably comprises a circular plate $14^{a''}$ provided with a depending rim or wall 14^x, which may be of conical shape. The stem or shank 14^a of the valve $14^{a'}$ is fixed in any well known manner to the shaft 4. At one side and between the plate $14^{a''}$ and rim 14^x the walls of the valve member $14^{a'}$ may be thickened and formed with two ducts 14^b, 14^c. The duct 14^b serves as a conduit for the liquid as it flows to the holders 9 to fill them, its inner end or port opening upwardly preferably centrally of the valve member $14^{a'}$ and its opposite or outer end or port leading through the rim 14^x. The duct 14^c conducts the liquid through the valve member when a holder 9 is emptying, its receiving end or port leading through the rim 14^x, and preferably adjacent to the port of the duct 14^b. The duct 14^c preferably leads inwardly and then downwardly axially through the stem 14^a of the valve member $14^{a'}$, as shown in Fig. 2. The valve seat member 15 preferably comprises a ring member formed with a series of openings or ports 15^a, (preferably uniformly spaced therearound and corresponding in number to the number of holders or vessels 9) with which the ports of the ducts 14^b, 14^c, in the member $14^{a'}$ successively register as said valve member rotates. The inner wall of the ring member 15 is shaped to snugly fit the outer conical wall 14^x of the valve member $14^{a'}$ to pre-

vent leakage of the liquid. 16 indicates a spider or equivalent device mounted upon the valve member $14^{a'}$ and having an annular bearing member 16^{a} arranged to engage the upper end wall of the ring member 15. 16^{b} indicates a nut engaging screw threads provided on the tubular extension 14^{d} of the valve element $14^{a'}$. The nut 16^{b} bears against the spider 16, when turned down upon the screw threads of the extension 14^{d}, and operates through the spider 16 to force the conical walls of the valve member $14^{a'}$ and valve seat member 15 into snug engagement and thus maintain a substantially liquid tight engagement between these elements. 16^{c} indicates a lock nut for locking the nut 16^{b} in position against the spider 16.

15^{b} indicates a series of pipe sections, preferably formed integral with the ring member 15 and extending radially therefrom, there being a pipe section 15^{b} for each opening 15^{a}. 15^{c} indicates a pipe leading from the outer end of each pipe section 15^{b} to the adjacent holder or vessel 9. As shown in the drawings, the outer end of each pipe 15^{c} leads to and is connected with the pipe section 11 of the adjacent holder 9, preferably by a T-member 15^{d} and a coupling 15^{e}. The opposite or inner end of the pipe section 15^{c} may be connected to the outer end of the adjacent pipe section 15^{b} by a coupling 15^{f}. The pipes 15^{c} and their unions with the vessels 9 and pipe sections 15^{b} serve as liquid tight connections between the valve seat element 15 and the vessels 9.

17 indicates as an entirety connections for conducting the liquid from the receiver 12 to the inlet port of the inlet duct 14^{b}. Since, in the preferred form of construction, above described, the valve member $14^{a'}$ rotates relative to the valve seat member 15 and the receiving chamber is stationarily mounted upon the support 1, the connections 17 between the valve member $14^{a'}$ and receiver 12 are of the swivel type. Of these connections, 17^{a} indicates a pipe section extending into the upper end of the tubular extension 14^{d} and arranged to conduct liquid to the inlet port of the inlet duct 14^{b}. The upper end of the conduit 17^{a} is provided with a collar 17^{b}, which forms one element of a coupling 18 to connect, in a liquid tight manner, the conduit 17^{a} to a duct 18^{a} extending through the opening 12′ in the receiver bottom 12′. 19 indicates a gland or packing for the liquid connections 17 to prevent leakage.

20 indicates a pipe or conduit for conducting the liquid from the valve mechanism 14, after discharge thereby from the holders 9, to the cooler (not shown) or other point of discharge. 21 indicates suitable liquid connections between the discharge port of the outlet duct 14^{c} and the pipe 20, these connections being of a character to permit rotation of the valve member $14^{a'}$. Of these liquid connections, 21^{a} indicates a pipe section connected to the valve shank 14^{a} and extending into the discharge port of the outlet duct 14^{c}. The lower end of the pipe section 21^{a} rotatably fits into an opening formed in a coupling 20^{a} carried by the pipe 20. 21^{b} indicates a gland or packing for the pipe section 21^{a} to prevent leakage of the liquid. 22 indicates a bracket preferably depending from the connector 2^{b} and provided with an arm 22^{a} on which the pipe 20, or coupling 20^{a} therefor, rests.

In operation, the valve member $14^{a'}$ rotates at any desired speed to cause registry of the ports of the ducts 14^{b}, 14^{c}, successively with the openings 15^{a}. During the time that the port of the duct 14^{b} is in registry with the valve opening 15^{a} for a holder or vessel 9, as the valve member $14^{a'}$ rotates, liquid will flow from the chamber 12 through the duct 14^{b} to the holder 9 to fill the same, the speed of the valve member $14^{a'}$ and the size of the openings 14^{b}, 15^{a}, being proportioned so that during the registry thereof sufficient liquid will flow through the valve elements to substantially fill the holder or vessel.

The liquid is held in the holder 9 during the rotary movement of the valve member $14^{a'}$ until the receiving port of the discharge duct 14^{c} registers with the opening 15^{a}, whereupon the liquid will flow by gravity from the holder through the valve opening 15^{a} and duct 14^{c} to the discharge pipe or conduit 20. As the ducts 14^{b}, 14^{c}, and the valve ports thereof are of substantially the same size, and the valve member $14^{a'}$ rotates uniformly, it will be understood that substantially the same quantity of liquid may flow out of each holder as flowed into it in the same time interval. As the holders 9 are arranged around the valve seat member 15 and each is connected to the adjacent port 15^{a}, provision is made for filling and emptying the holders progressively.

The receiving port of the outlet duct 14^{c} of the valve mechanism 14 may be arranged at any predetermined point angularly of the axis of the valve member $14^{a'}$ relative to the discharge port of the inlet duct 14^{b}, so that the distance of travel of the valve member $14^{a'}$ from the position for filling to the position for emptying may be of proper length in order that the period for holding the liquid may be fixed according to any particular circumstances or conditions. From the construction and operation above described, it will be seen that the holders will be automatically filled and emptied at predetermined points, and that the liquid in each holder will be held therein for a predetermined period, the extent of which depends upon the length and time of travel of the valve member from the place of filling

to the place of discharge. It will be obvious that the speed of the valve member can be changed in various ways to increase or decrease the period between the filling and emptying of the holders.

In the form of construction above described the liquid connection 15^c between the valve mechanism 14 and each holder 9 is arranged below the latter so as to lead into the bottom of the holder to fill and empty it therethrough without causing froth, foam or undue agitation. When so constructed, a portion of the liquid delivered by the valve mechanism 14 through each opening 15^a, remains in the liquid connection 15^c until the outlet duct registers with the adjacent opening 15^a to discharge it; as a result of this, the temperature of the liquid remaining in the liquid connection 15^c may become reduced as compared with the temperature of that portion of the liquid which flows into the adjacent holder. In carrying out our invention we provide means for conducting or transferring the liquid remaining in each liquid connection 15^c to another liquid connection 15^c in advance of the filling of the holder 9 connected with the latter liquid connection, so that such portion of the liquid so conducted or transferred thereto will be forced into the adjacent holder by the liquid delivered to such liquid connection by the inlet duct 14^b when the latter registers therewith. The liquid conducting means are controlled by the movable element of the valve mechanism 14, that is, the valve member $14^{a'}$ in the construction above described, and by preference these means are arranged to operate prior to the emptying of each holder 9 and the filling of the adjacent holder. Of these means, 23 indicates a plurality of recesses, one for each opening 15^a, formed in the inner wall of the valve seat member 15. Each recess 23 preferably extends from the adjacent opening 15^a vertically and communicates at its inner end therewith. The longitudinal axis of each recess 23 is preferably arranged in the vertical plane cutting the axis of the adjacent opening 15^a. The recesses 23 may extend downwardly, as shown in Figs. 10 and 11, but we prefer to extend them upwardly as shown in Figs. 2, 3, 4, 5, 6 and 8, because in this latter form of construction all pockets in which liquid can accumulate are eliminated. 23^a indicates a conduit, preferably comprising an elongated horizontal slot formed in the rim 14^x of the valve member $14^{a'}$. The slot 23^a is arranged angularly of the axis of the valve member $14^{a'}$ relative to the outer ports of the outlet and inlet ducts 14^c, 14^b, so as to first establish connection with each recess 23 with the next rearward recess 23 and thereafter disconnect them prior to the registry of the outer port of the outlet dut 14^c with the opening 15^c adjacent, the first mentioned recess 23, and prior to the registry of the outer port of the inlet duct with the opening 15^c adjacent the other or said next rearward recess 23. For this purpose, the slot 23^a extends forward of the outer port for the outlet duct 14^c so as to come into registry or communication with the recess 23 for each connection 15^c to be emptied prior to registration of the outlet duct 14^c with the opening 15^a adjacent thereto; likewise, the slot 23^a extends rearward of the outlet duct 14^c so as to connect the said recess 23 with the next adjacent rearward recess 23 of the opening 15^a for the connection 15^c to be filled. The slot 23^a is of such length and the width of the recesses are so proportioned relative to the size of the openings 15^a and ducts 14^b, 14^c, that the slot 23^a will (1) not come into communication with recess 23 of that connection 15^c leading to the holder 9 which is next to be emptied of its contents until after the outlet duct moves out of registry with or past the opening 15^c leading to the holder which has emptied; and (2) become disconnected from the recess 23 of the liquid connection 15^c last emptied by the duct 14^c prior to the registration therewith of the inlet duct 14^b. The conduit 23^a is preferably of a length slightly greater than the distance between centers of two adjacent recesses 23 to prevent premature cutting off of the recess for the connection 15^c which is next to be filled by the inlet duct 14^b. The recesses 23 and the conduit 23^a are of ample size to permit all of the liquid which may fill any one of the connections 15^c at any time to flow therefrom to the next rearward connection 15^c during the time interval that any two openings are connected by the conducting means.

By the construction and arrangement above described, it will be seen that each pair of adjacent recesses 23 and the slot or conduit 23^a serve as a by-pass between adjacent liquid connections 15^c and that we are enabled to transfer or conduct the liquid from that liquid connection 15^c, connected to the holder 9 which is next to be emptied by the outlet duct 14^c, to the liquid connection 15^c for the holder 9 which is next to be filled and also to make such transfer after one holder has been emptied and prior to the refilling thereof by the inlet duct 14^b. Further, it will be seen that as a result of this operation, the liquid which filled each liquid connection 15^c is transferred to the connection 15^c for the holder which is next to be filled in advance of the filling thereof, so that the liquid delivered by the inlet duct 14^b to this latter connection will carry the liquid transferred by the by-pass thereto into the adjacent holder 9, where it is mixed with and reheated by the liquid therein. As the conduit 23^a is carried by or formed in the valve member $14^{a'}$, it will be also been

that the transfer of the liquid from one connection 15^c to the adjacent connection is effected progressively and controlled by the movement of one valve element relative to the other.

In the construction above described the valve member $14^{a'}$ rotates relative to the valve seat member 15. Where our invention is applied to a construction in which the valve seat member 15 moves relative to the valve member $14^{a'}$, like that shown in said Letters Patent 1,076,604, we prefer to rotate the seat member in a clockwise direction, as viewed in Fig. 8. When the valve seat member operates in this manner, we arrange the outer port of the outlet duct 14^c and conduit 23^a rearward of the outer port of the inlet duct 14^c, as shown in Figs. 8 and 9. In the form of construction illustrated in Figs. 8 and 9, we prefer to have the outlet duct 14^c lead downwardly and discharge at one side of the axis of the valve member $14^{a'}$, as shown at $14^{c'}$.

When the recesses 23 extend upwardly from the openings 15^a (see Fig. 6) the conduit is arranged above the outer port of the outlet duct, but when the recesses 23 extend downwardly, as shown in Figs. 10 and 11, the conduit 23 is arranged below this port as shown in Fig. 12, so as to complete the by-pass between the recesses.

While we have shown the conduit 23^a as formed in the circumferential wall of the rim 14^x, it might extend through the rim and have ports therein positioned to register with the recesses 23.

From the foregoing description it will be seen that all portions of the liquid are, under the control of the valve mechanism, delivered to and from the holders and treated in the desired manner and finally discharged for cooling or other purposes. By transferring the liquid which remains in each liquid connection to the next liquid connection where it flows into the adjacent holder, we are enabled to re-heat it to the desired temperature without affecting to any substantial extent the remaining portion of the liquid.

To those skilled in the art of making apparatus of the class described, many alterations in construction and widely differing embodiments and applications of our invention will suggest themselves, without departing from the spirit and scope thereof. Our disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

It will be noted that all walls of the conduit, pipe connections and receptacle in the apparatus, with which any liquid to be treated may come in contact, are readily accessible for the purpose of cleaning merely by disassembling adjacent parts or conduits. The importance of this in the sanitary handling of milk, for example, is well known.

What we claim is:

1. In apparatus of the character described, the combination of a valve mechanism comprising two members, one of which rotates relative to the other, one of said members being formed with two ducts each having an inlet and a discharge port and the other member being formed with a plurality of ports each arranged to register successively with the discharge port of one of said ducts in the first mentioned member and the inlet port of the other of said ducts in said member, a series of holders, a conduit leading from each of said ports in the last mentioned member to one of said holders to conduct liquid to and from the latter, and means for conducting liquid from each conduit to an adjacent conduit.

2. In apparatus of the character described, the combination of a plurality of liquid holders, a liquid conduit for each of said holders, a valve mechanism for controlling the flow of liquid to each of said conduits, means for conducting the liquid from each conduit to an adjacent conduit, and means for rotating one element of said valve mechanism.

3. In apparatus of the character described, the combination of a plurality of holders, a liquid conduit for each of said holders, a valve mechanism for controlling the flow of liquid, to each of said conduits, means for conducting the liquid from each conduit to an adjacent conduit, the said conducting means being controlled by the valve of said valve mechanism, and means for rotating one element of said valve mechanism.

4. In apparatus of the character described, the combination of a plurality of holders, a liquid conduit for each of said holders, a valve mechanism for controlling the flow of liquid to and from each of said conduits, and means for conducting the liquid in each conduit prior to the emptying of the adjacent holder connected thereto to the conduit for the holder to be filled.

5. In apparatus of the character described, the combination of a plurality of liquid holders, a liquid conduit for each of said holders, and a valve mechanism for controlling the flow of liquid to and from each of said conduits, said mechanism including means for conducting liquid from each conduit to an adjacent conduit.

6. In apparatus of the character described, the combination of a plurality of liquid holders, a liquid conduit for each of said holders, and a valve mechanism for controlling the flow of liquid to and from each of said conduits, said mechanism including means for successively conducting the liquid from each of the conduits to an adjacent conduit.

7. In apparatus of the character described, the combination of a plurality of liquid holders, a liquid conduit for each of said holders, the valve mechanism comprising two relatively movable elements, for controlling the flow of liquid to and from the conduits, means for conducting liquid from each of said conduits to an adjacent conduit, said means including a by-pass carried by the valve of said valve mechanism, and means for rotating one element of said valve mechanism.

8. In apparatus of the character described, the combination of a plurality of liquid holders, a liquid conduit for each of said holders, relatively movable valve elements for controlling the flow of liquid to and from said conduits, and means operating prior to the emptying of one holder and the filling of an empty holder for conducting the liquid in the conduit for the holder to be emptied to the conduit for the holder to be filled.

9. In apparatus of the character described, the combination of a plurality of liquid holders, a liquid conduit for each of said holders, relatively movable valve elements for controlling the flow of liquid to and from said conduits, and means operating prior to the emptying of one holder and the filling of an empty holder for conducting the liquid in the conduit for the holder to be emptied to the conduit for the holder to be filled, the said liquid conducting means being controlled by one of said valve elements.

10. In apparatus of the character described, the combination of a plurality of liquid holders, a conduit connected to each of said holders, relatively movable valve elements for controlling the flow of liquid to and from said conduits and arranged successively to fill and empty said holders, and a by-pass carried by one of said valve elements to permit the flow of the liquid in each conduit to one of the other conduits.

11. In apparatus of the character described, the combination of a plurality of liquid holders, a conduit connected to each of said holders, relatively movable valve elements for controlling the flow of liquid to and from said conduits and arranged successively to fill and empty said holders, and a by-pass carried by one of said valve elements and arranged to permit the flow of liquid from the conduit of each holder prior to the emptying thereof to the conduit of the holder to be filled prior to the filling thereof.

12. In apparatus of the character described, the combination of a plurality of liquid holders, a conduit connected to each of said holders, a valve seat element having ports each connected to one of said conduits, a valve element formed with an inlet duct and an outlet duct, the outer ports of which are arranged to register successively with the ports of said seat element to successively fill and empty the said liquid holders, said valve being formed with a by-pass for successively connecting each port of said seat element with another port thereof, means for rotating one of said valve elements.

13. In apparatus of the character described, the combination of a plurality of liquid holders, a conduit connected to each of said holders, a valve seat element having ports each connected to one of said conduits, a valve element formed with an inlet duct and an outlet duct, the outer ports of which are arranged to register successively with the ports of said seat element to successively fill and empty the said liquid holders, said valve being formed with a by-pass arranged to connect each conduit prior to the emptying of the holder connected thereto with the conduit of the holder to be filled prior to the filling thereof, and means for rotating one of said valve elements.

14. In apparatus of the character described, the combination of a plurality of liquid holders, a conduit connected to each of said holders, a valve seat element having ports each connected to one of said conduits, and a valve element formed with an inlet duct and an outlet duct, the outer ports of which are arranged to register successively with the ports of said seat element to successively fill and empty the said liquid holders, said valve element being formed with a by-pass successively connecting each port of the valve seat element with another port thereof, and said by-pass being arranged to connect said ports prior to the emptying and filling of the holders controlled by the ports to which the by-pass is connected.

15. In apparatus of the character described, the combination of a series of holders, a valve mechanism for successively filling and successively emptying said holders, and means for transferring or conducting a portion of the liquid in one holder to another holder.

16. In apparatus of the character described, the combination of a series of holders, a valve mechanism for successively filling and successively emptying said holders, and means for transferring or conducting a portion of the liquid in one holder to another holder after the latter holder has been emptied but prior to the refilling thereof.

17. In apparatus of the character described, the combination of a plurality of holders, relatively movable valve elements for controlling the flow of liquid to and from said holders, one of said valve elements being connected with the latter, and the other of said valve elements being formed with a by-pass arranged to successively register with the openings in the valve element

connected with said holders to permit a portion of the liquid in one thereof to flow to another of said holders, and means for rotating one of said valve elements.

18. In apparatus of the character described, the combination of a series of holders, relatively movable valve elements for controlling the flow of liquid to and from said holders successively, means for conducting or transferring a portion of the liquid in one holder to an adjacent holder after the latter has been emptied and before it is refilled, and means for rotating one of said valve elements.

19. In apparatus of the character described, the combination of a series of holders, a valve mechanism comprising a valve member formed with an inlet duct and an outlet duct and a valve seat member formed with a series of openings each of which is connected with one of said holders, means for rotating one of said valve members to cause registry of said ducts with said openings, whereby said valve mechanism controls the flow of liquid to and from said holders, and a by-pass for transferring a portion of the liquid in a filled holder to an empty holder.

20. In apparatus of the character described, the combination of a series of holders, a valve mechanism comprising a valve member formed with an inlet duct and an outlet duct and a valve seat member formed with a series of openings and recesses each communicating with one of said openings, each of said openings being connected with one of said holders, means for rotating one of said valve members to cause registry of said ducts with said openings, whereby said valve mechanism controls the flow of liquid to and from said holders, and a by-pass for connecting together adjacent recesses for transferring a portion of the liquid in a filled holder to an empty holder.

21. In apparatus of the character described, the combination of a series of holders, a valve mechanism comprising a valve member formed with an inlet duct and an outlet duct and a conduit, and a valve seat member formed with a series of openings with which the outer ports of said ducts register and a series of recesses each communicating with one of said openings, each said opening being connected with one of said holders, and said conduit being arranged to connect each recess with an adjacent recess to permit liquid to flow from a filled holder to an empty holder, and means for rotating one of said valve members, whereby said valve mechanism controls the flow of liquid to and from said holders.

22. In apparatus of the character described, the combination of a series of holders, a valve mechanism comprising a valve member formed with an inlet duct and an outlet duct and a conduit extending circumferentially of its outer wall, and a valve seat member formed with a series of openings with which the outer ports of said ducts register and a series of recesses each communicating with one of said openings, each said opening being connected with one of said holders, and said conduit being arranged to connect each recess with an adjacent recess to permit liquid to flow from a filled holder to an empty holder, and means for rotating one of said valve members, whereby said valve mechanism controls the flow of liquid to and from said holders.

23. In apparatus of the character described, the combination of a series of holders, a valve seat element having a series of openings each of which is connected with one of said holders, a valve element formed with an inlet duct and an outlet duct the outer ports of which register with the openings in said valve seat element to control the flow of liquid to and from said holders, a by-pass carried by said valve element and extending from a point in front of the outer port of the outlet duct to a point between such port and the outer port of the inlet duct to permit the flow of a portion of the liquid from one of said holders to another thereof, and means for rotating one of said elements.

24. In apparatus of the character described, the combination of a series of holders, a valve seat element having a series of openings each of which is connected with one of said holders, a valve element formed with an inlet duct and an outlet duct the outer ports of which register with the openings in said valve seat element to control the flow of liquid to and from said holders, a by-pass carried by said valve element and arranged to communicate with each opening prior to the registration of the outlet duct therewith and with the adjacent opening after the outlet duct has moved out of registry with the latter and before the inlet duct moves into registry with said opening, and means for rotating one of said elements.

25. In apparatus of the character described, the combination of a series of holders, a valve seat element having a series of openings each of which is connected with one of said holders, a valve element formed with an inlet duct and an outlet duct the outer ports of which register with the openings in said valve seat element to control the flow of liquid to and from said holders, recesses formed in the opposing walls of said elements and coöperating to transfer a portion of the liquid in each holder successively to an empty holder, and means for rotating one of said elements.

26. The herein described method of treating liquid which consists in successively filling a series of holders, then conducting

a portion of the liquid delivered to each holder to one of the remaining holders prior to the filling thereof, and finally successively emptying the holders of the remaining liquid therein.

27. The herein described method of treating liquid which consists in successively filling and emptying a series of holders, and transferring a portion of the liquid delivered to each holder prior to the emptying thereof to another holder.

28. The herein described method of treating liquid which consists in filling and emptying pairs of holders in a series of holders progressively, and transferring a portion of the liquid in the filled holder of the pair of holders to be filled and emptied to the empty holder of the pair intermediate the emptying or filling thereof.

29. The herein described process which consists in filling and emptying holders in a series of holders progressively, and transferring a portion of the liquid in a filled holder to an empty holder.

30. The herein described process which consists in filling and emptying holders in a series of holders progressively, and progressively transferring a portion of the liquid in the filled holders to the empty holders prior to the filling of the latter.

31. In a system for pasteurizing milk and other liquid, the combination of a plurality of holding receptacles, a combined filling and emptying duct for each receptacle communicating at one end with said receptacle at its lower end and having at its outer end a combined inlet and discharge port, liquid conducting means including an inlet duct having a discharge port arranged to register with said combined inlet and discharge port of said combined filling and emptying ducts, one after the other, whereby the liquid always flows in one direction only through said inlet duct and then into the lower end of each of said holding receptacles to fill it to the extent desired, and a discharge duct having an inlet port arranged to register with said combined inlet and discharge ports of said combined filling and emptying ducts, one after the other, a predetermined period after each said holding receptacle has been filled to the extent desired with liquid and through which discharge duct the liquid from each holding receptacle always flows in one direction, means for conducting away the liquid discharged from said discharge duct, means for effecting communication between said discharge port of said inlet duct and said inlet port of said discharge duct, respectively, and said combined ports of said combined inlet and emptying ducts, one after the other, and means for conducting the liquid in one of said combined inlet and emptying ducts to another of said ducts after the receptacle connected to the latter duct has been emptied and prior to the refilling thereof.

32. In apparatus of the character described, the combination of a series of holders, a filling and emptying duct leading from each of said holders, a member formed with an inlet duct and an outlet duct, the outer ports of which register successively with the filling and emptying ducts to control the flow of the liquid thereto and therefrom, means for rotating said member, and means for transferring the liquid in each filling and emptying duct to an adjacent filling and emptying duct after the holder connected thereto has been emptied and prior to the refilling thereof.

33. In apparatus of the character described, the combination of a series of liquid holders, and a valve mechanism operating successively to fill said holders, empty said holders and transfer a portion of the liquid in one holder before emptying thereof to another holder.

34. In apparatus of the character described, the combination of a series of liquid holders, and a valve mechanism operating successively to fill said holders, empty said holders and transfer a portion of the liquid in one holder before emptying thereof to another holder after it has been emptied but prior to the filling thereof.

In testimony whereof, we have hereunto subscribed our names.

LEROY S. PFOUTS.
EDWARD J. MILLER.