APPARATUS HAVING CONNECTING MEANS BETWEEN CONTAINERS FOR PREPARING CONSUMER WATER

ABSTRACT: A unit for preparing consumer water, in which an inner longitudinal container arranged in radially spaced relationship within an outer longitudinal container has its end portions protruding from said outer longitudinal container while the coextensive portions of both containers define with each other an annular chamber communicating with fluid inlet and outlet means on the outside of said outer container. The protruding end portions of said inner container likewise being provided with fluid inlet and outlet means communicating with the interior of said inner container.
The present invention relates to an apparatus for preparing consumer water in which a substantially cylindrical and horizontal inner container filled with consumer water is surrounded by a substantially cylindrical outer container while the annular cylindrical intermediate space between the said two containers is passed through by heating water.

Apparatuses of the above-mentioned type operating in conformity with the storage principle are employed, for instance, in connection with boilers for accumulating heating installations the hot boiler water of which is also employed for heating the consumer water. The customary known apparatuses for preparing consumer water and pertaining to the above-mentioned type are so designed that their inner container has a volume designed in conformity with the total quantity of consumer water to be heated. Consequently, such apparatuses are to be produced in such a size that their storage content corresponds to the supply of heated-up consumer water desired by the consumer of the apparatus. Such apparatuses are therefore not particularly well suited for an economical mass production. When a high storage volume is desired, large outer dimensions and high weights of the apparatus are involved which make the transport and the installation of the apparatus in a building rather difficult. Furthermore, with a high storage volume it is difficult sufficiently fast to heat up the great volume of consumer water in the inner container so that an expensive canalization of the heating water and of the cold water to be introduced into the apparatus becomes necessary in order to accelerate the heat exchange between the heating water and the consumer water. This results in pressure losses in the heating water flow as well as in the consumer water flow, and these pressure losses become too high for the practice and therefore make necessary strong circulating pumps. In order to increase the heat exchange between the heating water and consumer water, and in order to be able to produce the inner container with a low wall thickness and thereby at permissible costs from stainless steel, the apparatus for preparing consumer water has according to another suggestion been so designed that the consumer water storage chamber is subdivided into a plurality of individual smaller inner containers which are arranged in an outer container enclosing the heating water chamber and common to the individual inner containers. Also this type of consumer water-producing apparatuses represents a closed and completely finished unit of a certain fixed storage volume which unit in view of high weights and large dimensions when a great storage volume is involved causes considerable difficulties when installing the apparatus in a building. Moreover, such an apparatus in order to be in conformity with the numerous consumer water volumes desired in practice has to be provided with a different number of inner containers and has to be equipped with a correspondingly large separate outer container which again is reflected in high manufacturing costs since a rational production in greater numbers cannot be effective.

It is, therefore, an object of the present invention to provide an apparatus of the above-mentioned type for producing consumer water, which will overcome the above-mentioned drawbacks.

It is another object of this invention to provide an apparatus for producing consumer water as set forth above which will be simple and inexpensive and will be suitable for mass fabrication.

It is still another object of this invention to produce an apparatus as set forth in the preceding paragraph which can be easily transported and which will meet all the requirements which may occur in practice.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 illustrates in side view and partly in section an apparatus according to the invention for preparing consumer water.

FIGS. 2, 3 and 4 illustrate different combinations of a plurality of one of the same apparatus according to FIG. 1.

FIG. 5 illustrates on a larger scale than FIGS. 1-4 a cross section taken along the line V-V of FIG. 1.

FIG. 6 illustrates on a larger scale than that of FIGS. 1-5 a cross section taken along the line VI-VI of FIG. 1.

The problem underlying the present invention has been solved according to the present invention by providing each end of an apparatus for preparing consumer water with radial consumer water connection which leads into the inner container, and with a radial hot water connection leading into the annular cylindrical space, said connections being located in a common plane passing through the longitudinal axis of the consumer water-preparing apparatus. The two connections at one end of the apparatus are arranged diametrically opposite those of the other end while the hot water connections are arranged on the mantle of the outer container, and the ends of the inner container protrude from the ends of the outer container while the consumer water connections are arranged on the mantle of the inner container.

Referring now to the drawings in detail, the apparatus for preparing consumer water as illustrated in FIG. 1 comprises a substantially cylindrical and horizontal inner container 2 which is filled with consumer water, and a substantially cylindrical outer container 3 surrounding the inner container in spaced relationship thereto. The space 4 between the two containers is passed through by heating water. Both ends of the apparatus 1 is provided with a consumer water connection 5 each leading into the inner container 2, and with a hot water connection 7 and 8 leading into the annular cylindrical space 4. All four connections are arranged radially on the circumference of the apparatus and are located in a common plane passing through the longitudinal axis of the apparatus for producing consumer water. The connections 6 and 8 at one end of the apparatus are located diametrically opposite to the connections 5 and 7 at the other end of the apparatus. The connections 7 and 8 are connected to the cylindrical mantle of the outer container 3. The ends of the inner container 2 protrude from the ends of the outer container 3, and the connections 5 and 6 for the consumer water are without passing through the outer container 3 connected directly to that mantle portion of the inner container 2 which protrudes from the outer container 3 and thus can be welded to the outer container 3 from the outside. The inner container 2 has one end thereof provided with a cleaning opening 9 which is sealingly closed by a cover C. That portion of the mantle of the inner container 2 which is covered up by the mantle of the outer container 3 is, for purposes of stiffening, corrugated with a corrugated wall, and the outer container mantle has its ends, i.e. its inwardly folded marginal areas welded to the noncorrugated ends of the inner container mantle. In this way the corrugated portion of the inner container mantle is prevented from expanding in the longitudinal direction. The inner container 2 which is reinforced by the corrugated design has a narrower wall thickness and consists of stainless steel. The outer container 3 has a customary smooth mantle which may consist of ordinary steel sheet metal. The inner container 2 may be designed with smooth storage volume so that the consumer water-preparing device will have a small diameter and short length and a low weight.

FIG. 2 illustrates the assembly of completely identical apparatuses according to FIG. 1 to form a vertical system composed, for instance of three consumer water-preparing units.

The intermediate consumer water-preparing apparatus has been turned about its longitudinal axis by 180° so that its connections fit together with those of the lower and upper apparatus 1. The individual consumer water-preparing units are in this way in the hot water flow as well as in the consumer waterflow in series arrangement. The cleaning openings 9 of all units are located on the same side of the completed consumer water-preparing system. FIG. 3 illustrates the assembly of a plurality of identical apparatuses of FIG. 1 to form a horizontal system. The pertaining connections of the apparatuses 1 are interconnected by headers 10 of which there
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are provided a total of four whereby the individual consumer water-producing elements are in parallel arrangement as far as the hot water side and the consumer water discharge temperature.

FIG. 4 illustrates the assembly of consumer water-producing devices of FIG. 1 to a block-like system of units which are arranged one above the other in vertical direction and one adjacent to the other in horizontal direction. The units 1 of each vertical stack are arranged in series with regard to each other, whereas the vertical stacks at the lowermost and uppermost connection are arranged in parallel by headers 10. As will be seen from FIG. 4, it is also possible, for instance, to interconnect only two vertical stacks by the header 10 while the third vertical stack may be provided for a separate consumer water circuit so that with such a consumer water-producing system, it is possible to provide two different pressure zones or two different temperature zones.

Instead of the flange connections 11 shown in FIG. 4 of each two superimposed units 1, it is, of course, also possible to employ a welded connection.

Advantageously, the downwardly directed connections 5 and 7 respectively form the inlet for the consumer water and the inlet for the heating water, and similarly, the upwardly directed connections 6 and 8 respectively form the discharge for the consumer water and the discharge for the heating water. As will be seen from FIG. 5, the connection 5 for the consumer water through which the latter passes into the inner container 2, is provided with an inlet nozzle 12, the outlet opening of which is located closely to the mantle of the inner container and is directed in the circumferential direction of the inner container mantle. As a result thereof, the incoming consumer water is directed in the circumferential direction of the inner container and when consumer water is withdrawn, the entire water content of the inner container 2 is subjected to rotation so that the consumer water will not pass along a straight line through the inner container 2, i.e. in its longitudinal direction, but will flow from the connection 5 to the connection 6 along a helical path and will circulate along the inner container mantle. In this way the heat transfer from heating water to the consumer water will be considerably increased. As will be seen from FIG. 6, an inlet baffle plate 13 is arranged in the annular cylindrical space 4 in front of the mouth of the hot water connection 7, through which the hot water flows into the space 4. The said inlet baffle plate deviates or guides the flow velocity of the consumer water in the circumferential direction of said space 4 so that the total water content of the space or chamber 4 is subjected to rotation which further contributes to an increase in the heat transfer from the heating water to the consumer water. Preferably, the inlet baffle plate 13 is so arranged that it guides the incoming hot water in opposite circumferential direction to the flow of the consumer water guided through the inlet nozzle 5. The installation of the inlet baffle plate 13 is not necessary when the annular cylindrical space or chamber 4 has a narrow cross section whereby the heating water will anyhow obtain a sufficiently high flow velocity. On the other hand, it is advisable always to install an inlet nozzle 12 because the inner container 2 will as a rule have a relatively wide cross section and correspondingly, the flow velocity of the consumer water in the longitudinal direction of the inner container will be slow. For this reason, as will be evident from FIG. 5, the inlet nozzle 5 is designed as a separate tubular part which is later insertable into that consumer water connection 5 or 6 which serves as consumer water inlet and said nozzle 12 may be held in this connection, for instance, by welding.

In certain instances of employment as, for instance, in connection with industrial water consumption, the requirement that the consumer water-preparing system has a large stored consumer water supply for intermittent withdrawal of consumer water is less important but a high continuous output is the decisive factor. Also, this requirement can be met by the apparatus according to the invention when employing the above-described extremely simple arrangement in series. While a single-consumer water-preparing unit according to the invention will be able with customary heating water lead-temperature (Vorlauftemperature) and consumer water discharge temperature to transfer a certain quantity of heat from the heating water to the consumer water, the arrangement in series with further elements as described above will bring about a considerable increase in the individual output of all units arranged in series. Thus, it has been ascertained that three units arranged in series will have an output which practically equals four units arranged in parallel which means that in view of the arrangement in series one unit can be saved.

As will be seen from the above, the present invention results in numerous advantages which may be summarized as follows:

1. The invention embraces the following advantages. The inner container connections form a single element for the preparation of consumer water, and this element is fully workable by itself while permitting in the manner of a building block the building up of different systems by interconnecting identical elements in superimposed arrangement or adjacent to each other or both while arranging the water-conducting parts in series or in parallel. In this way, by using the same units, it is possible to build up systems in conformity with the respective requirements of the practice with regard to storage volume, pressure zones, and temperature levels of the consumer water. The unit for preparing consumer water can in conformity with the present invention be produced in a single-standard size and is therefore subject to economical mass production. Each unit can be produced with small walls and small outer dimensions so that relatively thin wall thicknesses can be employed and the weight of each unit can be kept very low. Furthermore, the transport and installation of these units and their assembly to larger systems is extremely simple. When stacking two units to be installed expediently so that for purposes of preventing air enclosures in the water chambers the connections are directed perpendicularly upwardly or downwardly, it is merely necessary to turn one of the two units about its longitudinal axis by 180° so that these connections of the two units which are to be interconnected will be located opposite to each other and can be welded together or flanged together, while the units are arranged in series.

By making it possible to turn the units about their longitudinal axis it will be made possible that when the inner containers of the units have one end provided with a cleaning opening the cleaning openings of all units of the finished installed block-shaped system will be located on one and the same side. Units which are stacked adjacent to each other can be connected to each other by simple rectangular headers which extend transverse to the longitudinal direction of the units and are arranged in parallel. In view of the fact that the inner container is longer than the outer container and that the ends of the inner container protrude from beyond the ends of the outer container, the connections need not be passed through passages of the outer container which are costly to provide. Instead the connections can directly and easily from the outside be welded to the cylindrical mantle of the inner container whereby the production and as especially mass production of a device according to the invention will be greatly simplified and facilitated.

By providing that connection through which the consumer water flows into the inner container with an inlet nozzle the outlet opening of which is located adjacent the mantle of the inner container and which extends in the circumferential direction of said inner container, there is obtained the advantage that when withdrawing consumer water while the consumer water flows through the inner container in the longitudinal direction thereof, the total contents of the inner container is subject to rotation from one connection to the other connection. This considerably increases the heat transfer from the heat water to the consumer water. Furthermore, in the annular cylindrical chamber between the two containers ahead of the mouth of that heating water connection through which the heating water flows into said annular
chamber, there may be inserted the inlet baffle plate 13, above referred to, which directs the heating water in circumferential direction of the annular chamber preferably in a circumferential direction opposite to the flow of the consumer water as directed through the inlet nozzle. This brings about a further improvement in the heat transfer.

Finally, due to the fact that as mentioned above, the mantle of the outer container has its ends welded to the mantle of the inner container while the inner container mantle has an undulated contour on that portion which is covered by the outer mantle, the strength of the inner container mantle is increased to such an extent that the inner container can be made at favorable cost from corrosion-resistant steel while still being able to withstand pressure loads exerted by the heating water. The outer container which has its end welded to the inner container while its mantle may be an ordinary smooth cylinder, will in this instance act as tie rod for the corrugated portion of the inner container mantle and will prevent that portion from expanding in an accordionlike manner in view of the water pressure prevailing in the inner container.

It is, of course, to be understood that the present invention is, by no means, limited to the particular constructions shown in the drawings, but also comprises any modifications within the scope of the invention.

We claim:

1. An apparatus for preparing consumer water, which includes in combination: a longitudinally extending essentially cylindrical horizontal outer container having its end portions provided with radially extending first and second connecting means respectively located at diametrically opposite sides of said outer container for respectively admitting and discharging heating water, a longitudinally extending essentially cylindrical horizontal consumer-water-filled inner container located over its major length within said outer container and arranged in radially spaced relationship thereto so as to define therewith an annular chamber closed at its ends and filled with heating water in communication with both said first and second connecting means, the end portions of said inner container respectively each axially protruding horizontally from said outer container and being provided at each end with radially extending third and fourth connecting means respectively also located at diametrically opposite sides of said inner container for respectively admitting consumer water into and discharging the same from said inner container, the improvement therewith which comprises all four connecting means collectively at both ends of the apparatus for preparing consumer water lying in planar relationship coinciding with longitudinal axis of the apparatus, extending in the same radial direction in pairs and standing diametrically opposite each other at both ends of the apparatus for preparing consumer water, inlet nozzle means arranged in that one of said third and fourth connecting means which is intended as inlet for the consumer water, said inlet nozzle means having an outlet opening adjacent the outer mantle wall of said inner container means and being directed in the circumferential direction thereof, inlet-baffle plate means arranged in said annular chamber in front of where that one of said first and second connecting means which is intended as heating water inlet means introduces heating water into said annular chamber, said inlet-baffle plate means being so designed as to direct the heating water being introduced into said annular chamber in the circumferential direction of said annular chamber, said inlet-baffle plate means being so arranged as to direct the heating water being introduced into said annular chamber in a direction opposite to the direction of flow imparted upon the consumer water by said nozzle means.

2. An apparatus in combination according to claim 1 having further improvement in which the end portions of said outer container are welded to the respective adjacent outer wall portions of said inner container, that outer wall portion of said inner container which is located inside said outer container being corrugated.