

DEVICE FOR HEATING PROCESS WATER

1. Field of the Invention

The invention relates to an apparatus for heating service water with a solar collector, comprising a service water tank with a partly cylindrical jacket as an absorber and an enclosure which covers the service water tank and forms a translucent cylindrical jacket, the axis of which extends parallel to the axis of the jacket of the service water tank.

2. Description of the Prior Art

If service water is to be heated with the help of solar power, solar collectors are usually used which comprise a trough-like frame with a base plate acting as an absorber, on which parallel tubular flow channels are provided for water as a heat carrier for example. The trough with the absorber plate and the flow channels which are connected to a distribution and a collecting line is provided with a translucent cover, so that especially the thermal radiation is absorbed by the absorber plate and the flow channels arranged thereon, and the absorbed heat is transferred to the heat carrier, with the help of which a service water storage tank is charged via a heat exchanger. The disadvantageous aspect in such solar collectors is that a respective orientation is required with respect to solar radiation and that a hot water storage tank is required for heating the service water, which hot water storage tank is connected via a heat exchanger to the solar collector.

In order to avoid these disadvantages it has already been proposed (DE 20 2006 015 934 U1) to utilize the jacket of a cylindrical service water tank as an absorber and to provide the service water tank for this purpose with an enclosure, the translucent jacket of which forms a semi-cylinder with an axis parallel to the axis of the tank. The cylindrical shape of the service water tank leads to a substantial independence of the apparatus from the angle of incidence of the sunlight in co-operation with the enclosure forming a jacket in form of a semi-cylinder if the axis of the tank or the enclosure is aligned approximately in a north-south direction, so that a substantially radial incidence of light into the enclosure is ensured. As a result of the temperature-dependent density of the service water, the heated service water will accumulate in the upper region of the horizontally disposed service water tank and can be withdrawn via an upper hot water pipe by simultaneously supplying cold water in the base region. In order to reduce the thermal losses, the jacket of the enclosure is covered on the inside with a translucent knitted fabric in order to reduce the emission of heat to the outside in the case of low outside temperatures. Moreover, efforts are made to better utilize the light entering the enclosure by a light-reflecting bottom part. However, despite these measures efficiency remains limited.

SUMMARY OF THE INVENTION

The invention is therefore based on the object of improving the efficiency in solar collectors in which the jacket of the service water tank is used as an absorber.

On the basis of an apparatus for heating service water of the kind mentioned above, the invention achieves this object in such a way that the service water tank is connected in a thermally conductive manner with an absorber plate forming the bottom part of the enclosure and that the absorber plate and the jacket of the service water tank are covered with a wide-meshed, thermally insulating fabric.

The provision of an additional absorber plate which forms the bottom part of the enclosure and which is connected with the service water tank in a thermally conductive manner provides a better utilization of the thermal radiation entering the enclosure because the absorber plate heated by this thermal radiation will pass on the absorbed heat to the service water tank. Covering this absorber plate and the jacket of the service water tank with a wide-meshed, thermally insulating fabric prevents direct contact of air flows formed as a result of convection within the enclosure with the absorber plate and the service water tank, leading to a higher temperature of the absorber plate and a lower cooling of the service water tank and therefore to improved heating conditions for the service water. The wide meshes of the fabric ensure direct passage of thermal radiation to the absorber plate and to the service water tank through the fabric, wherein especially favorable heating conditions are obtained when the fabric is permissible to thermal radiation itself, as is the case in a glass-fiber fabric.

In order to ensure an advantageous heat transmission between the absorber plate and the service water tank, the absorber plate can accommodate the service water tank in a cylindrical bulged portion which sits close to the tank jacket, so that an enlarged heat transfer surface area is obtained. For fastening the service water tank, it can be welded onto or soldered together with the absorber plate.

This construction is especially useful for service water tanks with a circular-cylindrical jacket. The invention is not limited to such circular-cylindrical service water tanks. Especially simple constructional conditions are obtained when the service water tank is composed of a jacket approximately forming a semi-cylinder and a cylindrical wall connected to the inside of said jacket, the axis of which extends perpendicularly to the jacket axis. Since as a result of this measure the service water tank can be produced from two sheet metal cuttings which are each cylindrically bent and then welded together with each other, comparatively simple production conditions can be maintained. The semi-

cylindrical jacket of the service water tank which closes off the cylindrical wall of the service water tank to the outside forms protruding edge sections at least in the connection area of the cylindrical wall, which edge sections represent an additional absorber surface area which has an advantageous effect on the heat transmission, since the semi-cylindrical jacket of the service water tank can be arranged approximately co-axially with the jacket of the enclosure which also forms a semi-cylinder, so that the thermal radiation is aligned substantially radially with respect to the jacket of enclosure and the jacket of the service water tank, which therefore occurs substantially independent of any change in the position of the sun during the day.

Advantageous connections of the service water tank to the absorber plate are obtained with a jacket of the service water tank in form of a semi-cylinder when the jacket of the service water tank is arranged integrally with the absorber plate.

BRIEF DESCRIPTION OF THE DRAWING

The subject matter of the invention is shown in the drawing by way of example, wherein:

Fig. 1 shows a schematic cross-sectional view of an apparatus in accordance with the invention for heating service water;

Fig. 2 shows this apparatus in a longitudinal sectional view along the line II-II of Fig. 1;

Fig. 3 shows an illustration corresponding to Fig. 1 of an embodiment of an apparatus in accordance with the invention for heating service water, and

Fig. 4 shows the apparatus according to Fig. 3 in a sectional view along the line IV-IV of Fig. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In accordance with the embodiment according to Figs. 1 and 2, the apparatus for heating service water comprises a solar collector with an enclosure 1 which is composed of two semi-circular face walls 2 and a jacket 3 which is made of a translucent material and arched according to a half a circular cylinder. The bottom part of this enclosure 1 is formed by a thermally conductive absorber plate 4, which is preferably made of a metallic material such as copper or aluminum, and is provided with a thermal insulation 5 on the side facing away from the jacket 3. In the region of the cylinder axis of the enclosure 1, the absorber plate 4 forms a cylindrical bulging portion 6 which accommodates a horizontally disposed, cylindrical tank 7, the axis of which extends parallel to the axis of the enclosure 1. The arrangement is made in such a way that the jacket 8 of the service water tank 7 rests in a planar manner on the cylindrical bulging portion 6 of the absorber plate 4, which thereby ensures advantageous heat transmission from the absorber plate 4 to the tank jacket 8.

The service water tank 7 is connected at the bottom with a cold water pipe 9 and at the top with a hot water pipe 10, so that water accumulating in the upper region of the service water tank 7 can be discharged via the hot water line 10 under simultaneous supply of cold water into the bottom region of the service water tank 7, which as a result of the illustrated arrangement forms a service water tank within the enclosure 1 with a conventional temperature stratification of the service water. In the event that several apparatuses of this kind are switched in series, the individual service water tanks 7 are provided with cold water pipes 9 and hot water pipes 10 on the mutually opposite face sides, as is shown in Fig. 2. This connection in series allows temperature compensation over the individual service water tanks 7, which is important especially when erecting the individual apparatuses at different height levels. When the apparatuses are used individually, the pipes 9 and 10 are sealed or omitted on one side.

Since the apparatus is advantageously erected in such a way that the axis of the enclosure 1 or the service water tank 7 extends approximately in the north-

south direction, a substantially radial incidence of light is obtained during daily solar radiation, so that advantageous conditions concerning thermal radiation are provided, which applies not only to the absorber plate 4 but also to the service water tank 7. In order to improve these heating conditions, the absorber plate 4 and the jacket 8 of service water tank 7 are covered with a wide-meshed, thermally insulating fabric 11, as is indicated with the dot-dash line in Fig. 1. The meshes of this fabric 11 prevent an air flow directly along the service water tank 7 and the absorber plate 4 as a result of air cushions caught within the meshes of the fabric. This means that the air flows caused by convection within the enclosure 1 will not have a disadvantageous effect on the heat transmission in the region of the absorber plate 4 or the service water tank 7. The coarse meshes of the fabric 11 facilitate the passage of thermal radiation through the fabric 11, with advantageous constructional conditions being obtained especially in the case of glass-fiber fabrics because in this case the fabric 11 is permeable itself for the thermal radiation. Efficiency can additionally be improved by applying such a wide-meshed, thermally insulating fabric 11.

The relevant difference between the embodiments according to Figs. 1 and 2 on the one hand and Figs. 3 and 4 on the other hand consists of the construction of the surface water tank 7. Whereas the jacket 8 of the service water tank 7 according to Figs. 1 and 2 forms an enclosed circular cylinder, the jacket 8 of the service water tank 7 according to Figs. 3 and 4 is arranged in form of a semi-cylinder which extends substantially coaxially to the jacket 3 of the enclosure 1. This semi-cylindrical jacket 8 of the service water tank 7 outwardly seals a wall 12 which is open towards said jacket 8, with the arrangement being made in such a way that the semi-cylindrical jacket 8 of the service water tank 7 protrudes on both sides in the axial direction beyond the cylindrical wall 12, as is shown in Fig. 4. The axis of the cylindrical wall 12 extends perpendicularly to the axis of the semi-cylinder of the jacket 8.

As a result of this arrangement, the light radiation which enters substantially radially through the jacket 3 of the enclosure 1 also impinges substantially radially

on the jacket 8 of the service water tank 7, thereby providing advantageous heating conditions for the jacket 8 of the service water tank 7, which forms a comparatively large absorber surface. Since the absorber plate 4 according to Fig. 3 is integrally arranged with the jacket 8 of the service water tank 7, an advantageous heat transfer from the absorber plate 4 to the jacket 8 of the service water tank 7 is ensured. The absorber plate 4 and the jacket 8 of the service water tank 7 are covered with a wide-meshed, thermally insulating fabric 11, preferably a glass-fiber fabric, as in the embodiment according to Figs. 1 and 2, in order to prevent as far as possible any thermal losses by heat dissipation to the intermediate space between the service water tank 7 and the enclosure 1.

C L A I M S:

1. An apparatus for heating service water with a solar collector, comprising a service water tank (7) with a cylindrical jacket (8) as an absorber and an enclosure (1) which covers the service water tank (7) and forms a translucent, partly cylindrical jacket (3), the axis of which extends parallel to the axis of the jacket (8) of the service water tank (7), characterized in that the service water tank (7) is directly connected in a thermally conductive manner with an absorber plate (4) forming a bottom part of the enclosure (1), and that the absorber plate (4) and the jacket (8) of the service water tank (7) are in contact with and covered by a wide-meshed thermally insulating fabric (11) to ensure direct passage of thermal radiation to the absorber plate and to the service water tank, via the meshes, and to prevent an air flow directly along the service water tank (7) and the absorber plate (4).
2. An apparatus according to claim 1, characterized in that the fabric (11) consists of a glass-fiber fabric.
3. An apparatus according to claim 1 or 2, characterized in that the absorber plate (4) accommodates the service water tank (7) in a cylindrical bulging portion (6) sitting close to the tank jacket (8).
4. An apparatus according to claim 1 or 2, characterized in that the service water tank (6) is composed of a jacket (8) which approximately forms a semicylinder and a cylindrical wall (12) which is connected to the inside of the jacket (8) and whose axis extends perpendicularly to the jacket axis.
5. An apparatus according to claim 4, characterized in that the jacket (8) of the service water tank (7) is integrally arranged with the absorber plate (4).