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(54) SOLAR PANEL

(71) We, FIAT SOCIETA PER AZIONI, an Italian Joint Stock Company, of Corso Marconi 10, Turin, Italy, do hereby declare

the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:–

The present invention relates to solar panels, in particular panels designed to absorb solar energy, whether in the form of luminous or infra-red radiation, in order to use it for the heating of water. Such solar heat collecting panels have application to the heating of water in, for example, one-family homes, condominiums, camps, hotels, sport installations and agricultural premises, where the use of the panel supplements traditional heating installations and hot water systems such as, for example, electrical water heaters and hot water storage tanks.

A fundamental problem of the prior art consists in realizing an economically convenient solar panel, which permits a completely passive working cycle, or which entails the minimum waste of "primary power" by providing for the recycling of water to be heated with a minimum of auxiliary components.

The state of the prior art for the manufacture of solar panels has disadvantages because the ratio of the panel weight to the quantity of stored heat is quite high compared with the panel of the present invention, given the same amount of kilocalories yielded to the circulating water.

Furthermore prior art panels, although allowing almost full exploitation of the incident luminous energy, are inferior as regards the thermal insulation.

It has been established that in order to improve the ratio of the weight to the quantity of heat captured and obtained, while decreasing the radiant energy dispersed to the outside of the panel, it is necessary first to pre-heat the water followed by a further heating of the pre-heated water. By keeping the water in a laminar flow regime an effect of thermal insulation is obtained, which also utilizes the optical qualities of the water to allow the realization of an efficient and economical panel transparent to visible radiation.

According to the present invention there is provided a solar panel for absorbing luminous and infra-red radiation for the heating of water, comprising a first plastics layer or wall, transparent to said radiation, superimposed upon a second plastics layer or wall, also transparent, and a third plastics layer or wall, underlying the second layer or wall, opaque to said infra-red and luminous radiation, an internal flow duct delimited between the first and second layers or walls for the flow of water to be pre-heated and a connection between said first and second layers or walls for introducing into said duct the said flow of water to be heated, and a further internal flow duct delimited between said first and third layers or walls for the flow of water to be heated under laminar flow conditions, and a further connection between said first and third layers or walls for the outflow of heated water.

The present invention will be further described, by way of example, with reference to the accompanying drawings, given by way of example, in which:

Figure 1 represents an outside view, partially cut-away in the lower left-hand corner, of a preferred embodiment of this invention, for the two-stage heating of water from an outside source;

Figure 2 is a cross-section taken on the line II-II of Figure 1; and

Figure 3 is a cross-section taken on the line III-III of Figure 1.

The solar panel illustrated in Figures 1, 2 and 3 comprises a transparent first layer or wall 1, for example of clear plastics sheet, a light-transmitting second plastics layer or wall 2 and an opaque third layer or wall 3 of black plastics forming the bottom surface of the solar panel.

An inlet connection 4 for admitting water is located in the right upper corner of the panel, as shown in Figure 1, and is inserted between the transparent first layer or wall 1 and said second layer or wall 2. An outlet

connection 5 for the outflow of water is located in the left upper corner of the panel, and is inserted between the first layer or wall 1 and the third layer or wall 3, the axis 5*a* of the flow duct 5*b* of the outlet connection 5 being coaxial with the axis 4*a* of the flow duct 4*b* of the inlet connection 4.

A flat tongue 6 formed by an integral appendix of the black plastics third layer or wall 3 extends along one longitudinal edge of the panel, adjacent the connections 4 and 5, and has a series of holes 3*a*, 3*b*, 3*c*, 3*d*, of a diameter suitable to provide for the fixing of the panel to the roof of a building or other support structure.

A series of welds, only partially indicated in Figures 1 and 2 for reasons of clarity by reference numerals 7, 7*a*, 7*b*, 8, 8*a*, serve to subdivide the three plastics layers into a number of intercommunicating ducts of which those indicated by reference numerals 9 and 10 are obtained by the welding together of the first and the second layers or walls 1 and 2 and those indicated by reference numerals 11 and 12 are obtained by the welding together of the first and the third layers or walls 1 and 3, the welds, being indicated by shaded areas in Figure 1.

In the installed position of the panel the ducts 9 and 11 are horizontal and the ducts 10 and 12 are vertical or inclined to the vertical.

Still referring to Figures 1, 2, 3, the operation of the illustrated panel according to this invention will now be described. During the water pre-heating phase water flows, through the inlet connection 4, under slight pressure and with laminar flow into the horizontal duct 9 formed, as previously stated, by the joining of the first and second layers or walls 1 and 2. From the duct 9, which acts as a manifold, the water passes, still with laminar flow, along the vertical ducts 10, absorbing part of the solar energy and recovering heat absorbed by the underlying layer 2, the water being pre-heated in the process.

The flow of pre-heated water collects in the duct 11 formed, as previously stated, by the joining together of the first and the third layers or walls 1 and 3. In this way only the pre-heated water circulates in the duct 11 formed between the first and third layers 1 and 3, in which the water comes into direct contact with the black surface of said third layer or wall 3. A suitable corrugation of the surface of the layer or wall 3, favouring multiple reflections, improves the co-efficient of absorption of the layer or wall 3. The mass of pre-heated water flowing over the surface of the third layer or wall 3 absorbs almost all the remaining solar energy collected by the panel. The heated water flows through the vertical duct 12 and the outlet connection 5 to a utilization or storage device (not shown).

In the arrangement of Figures 1 to 3 the total quantity of wasted heat is much lower than that of the prior art for the reasons previously explained because part of the collected solar energy is retained by the panel and subsequently given up to the pre-heated mass of water by the third layer or wall 3, the jump in temperature between the pre-heated water and the ambient temperature being less than that between the final water temperature and the ambient temperature.

Naturally while keeping to the principle of this invention and to the embodiments described, it is possible to vary details of construction widely relative to what has been described and illustrated without departing from the scope of the appended claims.

WHAT WE CLAIM IS:–

1. A solar panel for absorbing luminous and infra-red radiation for the heating of water, comprising a first plastics layer or wall, transparent to said radiation, superimposed upon a second plastics layer or wall, also transparent, and a third plastics layer or wall, underlying the second layer or wall, opaque to said infra-red and luminous radiation, an internal flow duct delimited between the first and second layers or walls for the flow of water to be pre-heated, and a connection between said first and second layers or walls for introducing into said duct the said flow of water to be heated, and a further internal flow duct delimited between said first and third layers or walls for the flow of water to be heated under laminar flow conditions, and a further connection between said first and third layers or walls for the outflow of heated water.

2. A solar panel for absorbing luminous and infra-red radiation according to Claim 1, wherein said third plastics layer or wall has a corrugated surface profile to accentuate the absorption of infra-red radiation on the mass of water in order to promote multiple reflections.

3. A solar panel for absorbing luminous and infra-red radiation according to Claim 1 or 2, wherein the panel is flexible so as to be adaptable to any supporting structure.

4. A solar panel for absorbing luminous and infra-red radiation substantially as herein described with reference to and as shown in the accompanying drawings.

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1585787 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale

FIG. 3

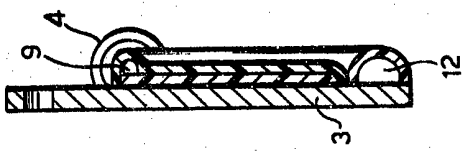

FIG. 1

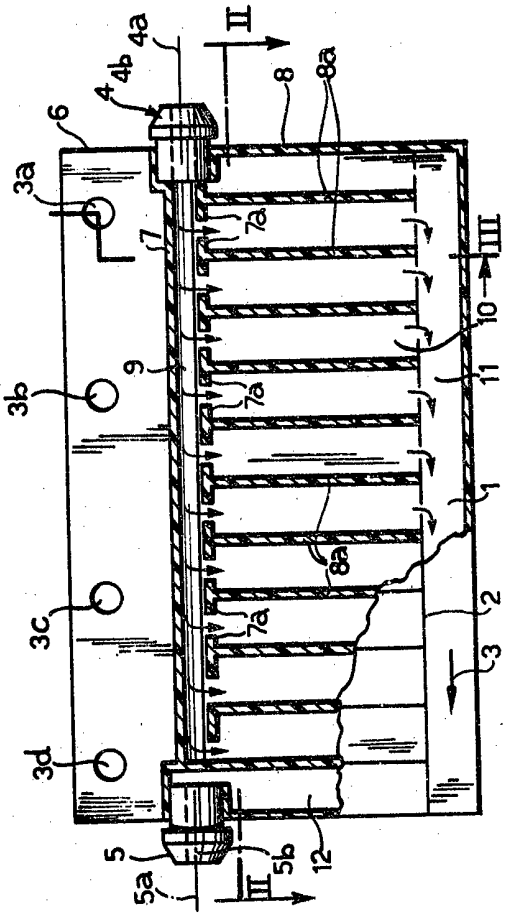

FIG. 2