Dec. 29, 1936. H. M. CARRUTHERS 2,065,653

SOLAR WATER HEATER

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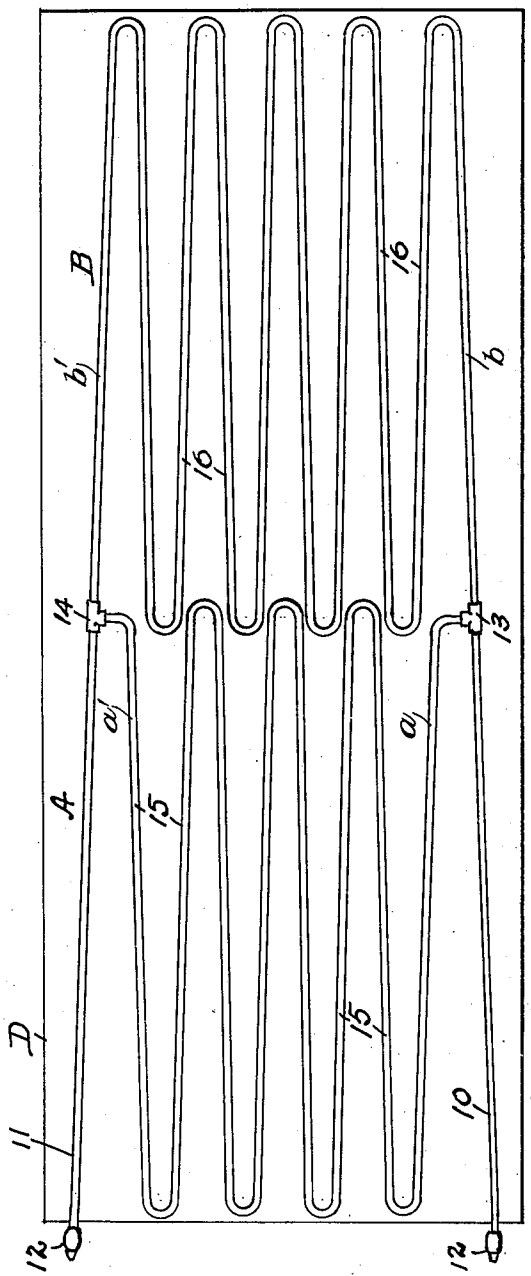

Fig. 1.

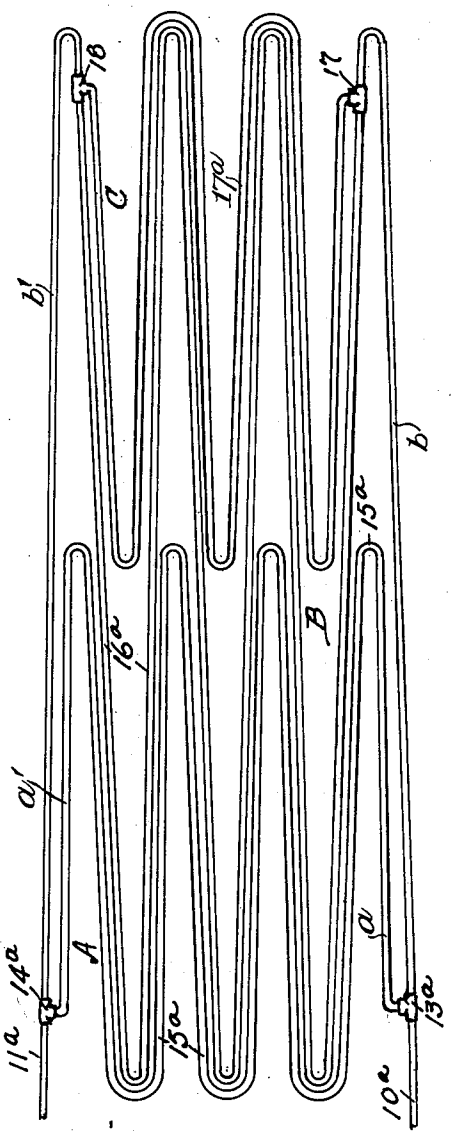

Fig. 2.

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SOLAR WATER HEATER

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4 Claims. (Cl. 126—271)

This invention is a coil structure particularly designed for use with solar heaters.

It is well known with respect to the operation of solar heaters, that it is necessary to have each line of coil so arranged that the water to be heated will travel upwardly. The customary practice is to run the water through a coil extending the entire length of the heating cabinet. This is objectionable, however, because it is necessary to maintain the spacing of the convolutions at a substantial distance, in order to get the proper pitch of the coil convolutions, so as to insure free circulation. One of the objects of the present invention is to overcome this objection by providing a coil structure in which the convolutions may be brought closer together, and thereby provide a compact structure with increased heating surface. A further object is to provide a coil structure in which a plurality of coil sections lead from a common cold water inlet in such manner that the coil convolutions may be placed closer together than heretofore, and still have sufficient pitch to allow the proper flow of water.

The invention will be hereinafter fully set forth and particularly pointed out in the claims

In the accompanying drawing:—

Figure 1 is a side elevation of a coil structure arranged in accordance with the invention. Figure 2 is a similar view illustrating a slight modification.

Referring to Figure 1, 10 designates a cold water inlet pipe and 11 a hot water outlet pipe, these pipes having suitable couplings 12 by which they may be connected to supply and return pipes (not shown). The outlet end of the cold water pipe 10 is provided with a coupling 13 having a plurality of branches, i. e. an inlet branch and two outlet branches. The inlet end of the delivery pipe 11 is connected with a similar coupling 14, i. e. an outlet branch and two inlet branches. Leading from one inlet branch of the coupling 13 is the inlet portion *a* of a heating tube 15, said tube being bent into a plurality of zig-zag convolutions to form the heater unit A, the outlet portion *a'* of said tube being connected with one of the branches of the coupling 14. It will be observed that the convolutions of the tube 15 lie between the pipes 10 and 11. Connected with the other outlet branch of the coupling 13 is the inlet portion *b* of a heating tube 16, said tube being bent into a plurality of zig-zag convolutions to form the heater unit B, the outlet portion *b'* of said tube being connected with one of the inlet branches of the coupling 14. Where two heater units are employed, the tubes 15 and 16 may be arranged side by side with the adjacent smaller bends of their convolutions placed in staggered relation, as shown in Figure 1, or one of the units may be wider than the other, and arranged as shown in Figure 2, omitting the unit C.

It will be noted that in the form illustrated in Figure 1, the tubes 15 and 16, the pipes 10 and 11, and the connections 13 and 14 all lie in the same common plane, and that both pipes 10 and 11 are inclined so that they are respectively in axial alignment with the inlet portion *b* and the outlet portion *b'* of the tube 16. In practice, the tubes 15 and 16 are secured in suitable manner, such as by soldering to a metal backing D preferably in the form of sheet copper, so that the coils and the inlet and outlet pipes all lie in approximately the same plane.

In operation, the effect of the heat of the sun upon the sheet metal backing and the tubes connected thereto is such that water supplied by the pipe 10 is caused to circulate through the coils and to flow upwardly through the respective tubes 15 and 16, and out of the pipe 11, in a manner which is well understood in the art relating to solar heaters.

Referring to Figure 2, the heater units A and B and their connections with the supply and discharge pipes are substantially the same as in Figure 1, except that the unit B is much wider than the unit A, as above indicated. As shown in said Figure 2, 10^a designates the cold water inlet pipe and 11^a the warm water outlet pipe. These pipes are respectively provided with the multiple couplings 13^a and 14^a. The zig-gaz or sinuous tube 15^a is connected at one end with one of the outlet branches of the coupling 13^a and at its other end with one of the inlet branches 14^a. It will also be observed that the convolutions of tube 16^a are connected at one end to an outlet branch of the inlet coupling 13^a and at the other end to one of the branches of the coupling 14^a. As thus far described the construction is approximately the same as that shown in Figure 1. The form of the invention illustrated in Figure 2 differs from that illustrated in Figure 1, primarily in the provision of a third unit C consisting of a tube 17^a, the convolutions of which are connected by multiple branch couplings 17 and 18 respectively, with lower and upper convolutions of the coil 16^a. It is preferred to so arrange the convolutions of the coils A and C that the adjacently located small bends of the two coils are in staggered relation, and that the coil B is made of a width approxi-

mately equal to the combined widths of coils A and C, with the convolutions of the coil B fitting inside of the convolutions of the coils A and C. The operation is the same as described in connection with Figure 1.

The advantages of the invention will be readily understood by those skilled in the art to which the invention belongs. It will be particularly observed that by arranging a plurality of coils side by side in lieu of using one long coil, the convolutions may be brought closer together, thereby increasing the coil surface exposed to the thermal action of the sun, and without any reduction in the capacity of the heater. A further advantage is that the coils are so connected with each other that there is a substantially equal distribution of the circulating medium.

Having thus explained the nature of the invention and described an operative manner, of constructing and using the same, although without attempting to set forth all of the forms in which it may be made, or all of the forms of its use, what is claimed is:—

1. A heat exchanger for solar heaters comprising two water heating tubes, each tube embodying a plurality of continuous, unbroken zig-zag convolutions all lying in the same common plane, and each provided with an inlet end and an outlet end, portions of the convolutions of one coil being extended into positions which overlap and lie between convolutions of the other coil, a common connection between said inlet ends, a common connection between the outlet ends, said outlet ends being higher than the inlet ends, a supply pipe connected with both coils at the common connection between said coils, said supply pipe being arranged in alignment with the first convolution of one of said coils, and a discharge pipe connected with said coils at the common connection between them, said discharge pipe being arranged in alignment with the last convolution of one of said coils.

2. A heat exchanger for solar heaters comprising water heating tubes arranged laterally with respect to each other, each of said tubes embodying a plurality of continuous unbroken zig-zag convolutions all lying in the same plane and provided with an inlet end and an outlet end, the convolutions of one of said tubes being of greater length than those of the other tube, portions of the convolutions of the longer coil being in nested relation with complemental convolutions of the other coil, a common connection between the inlet ends of said tubes, a common connection between the outlet ends of said tubes, said outlet ends being higher than the inlet ends, a supply pipe connected with said inlet ends at the common connection thereof, and a discharge pipe connected with said outlet ends at the common connection thereof.

3. A heat exchanger for solar heaters comprising two water heating tubes arranged laterally with respect to each other, each tube embodying a plurality of continuous unbroken zig-zag convolutions provided with an inlet end and an outlet end, said outlet ends being higher than the inlet ends, and a third water heating tube also embodying a plurality of convolutions of zig-zag form, the convolutions of the third tube being of approximately the same length as the combined lengths of the other tubes and in alternating nested relation with respect to the latter, the inlet and outlet ends of the first mentioned tubes being respectively connected with convolutions of the longer tube, a supply pipe connected with the lower end of the longer tube, and a discharge pipe also connected with the longer tube, said tubes and said pipes all lying in the same common plane.

4. A solar heater comprising a flat metal backing and two laterally spaced water heating tubes spread laterally with respect to each other and so supported as to lie in physical contact with the surface of said backing, each tube embodying a plurality of continuous, unbroken convolutions of zig-zag form, a third water heating tube also embodying a plurality of continuous, unbroken convolutions of zig-zag form but longer than the convolutions of either of the other tubes, the convolutions of the said third tube being nested between and alternating with convolutions of both of the first mentioned laterally spaced tubes, so that the longer tube occupies a space which is approximately within the area occupied by the two shorter tubes, each tube having an inlet portion and an outlet portion, the outlet portions being higher than the inlet portions, a cold water supply pipe, a common connection between said supply pipe and the longer tube and one of the first mentioned tubes, a hot water discharge pipe, a common connection between said longer tube and the same one of the two first mentioned tubes, and supply and discharge connections between the other one of the two first mentioned tubes and the longer tube, said pipes and said tubes all lying in the same common plane.

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