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(54) **Improvements in water heating**

(57) This invention provides an electric water heater (10) which comprises a linear array of heating modules (12, 14) each comprising an inlet, an outlet, and a heater element (34). The inlets and outlets of the modules are arranged such that, when they are placed adjacent one another in the array, the outlet of one module (12) is aligned with the inlet of the adjacent module (14). In use this enables water to flow through the modules (12, 14) in series. (Figure 1)

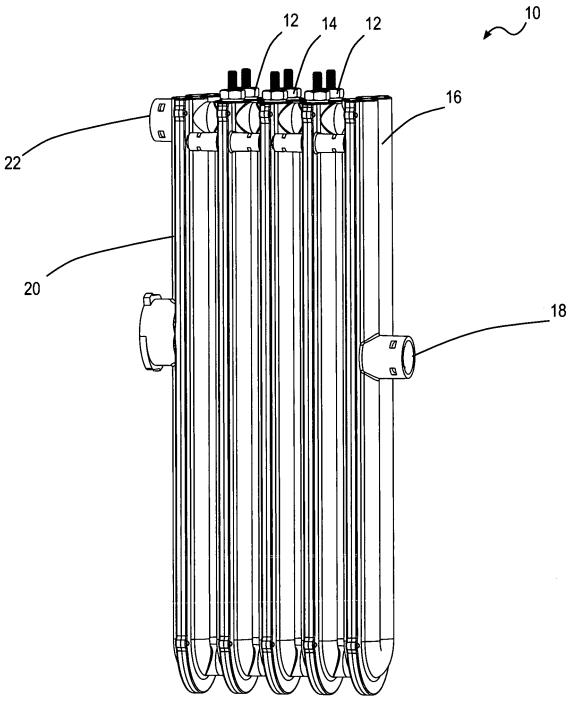


Fig 1

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## Description

**[0001]** The present invention elates to water heaters, in particular to electrical water heaters suitable for use in domestic environments.

**[0002]** Electric water heaters are used in numerous households and currently fall into two known categories, parallel and series heaters.

**[0003]** Parallel heaters generally comprise a manifold having a main flow inlet and main flow outlet, and a number of heater outlets and a number of heater inlets. Electrical heaters, each comprising an electrical element can be connected across an inlet/outlet pair so that in use water flows through the heater.

**[0004]** Series heaters generally comprise a moulded body having an upper and a lower body plate together defining a serpentine flow path from an inlet to an outlet. Heater elements are inserted into the serpentine pathway from the edge of the heater.

**[0005]** Parallel type heaters have the advantage that indivdual heater elements can easily be replaced if they fail by removing them from the manifold and inserting a new one, where as if series type heaters fail generally the whole heater is replaced.

**[0006]** Series type heaters are generally believed to provide a better heating solution but are limited in that they generally are made to a specific size and therefore are not simple to use when flexibility of manufacture is required, and that they are generally replaced if a single element fails.

**[0007]** It is the purpose of the present invention to provide and improved series type heater.

**[0008]** According to the invention there is provided an electric water heater comprising a linear array of heating modules each comprising an inlet, an outlet and a heater element, the inlets and outlets being arranged such that when places adjacent one another in said array the outlet of one module is aligned with the inlet of the adjacent module so that, in use, water flows through the modules in series.

**[0009]** The electric water heater may have an inlet module having a water inlet for connection to a source of piped water and an outlet for connection to a heating module.

**[0010]** The electric water heater may have an outlet module having a water outlet for connection to a source of piped water and an inlet for connection to a heating module.

**[0011]** The inlet module and or outlet module contain a heater element.

**[0012]** The electric water heater preferably comprises at least one heater module having a male connector at each of its inlet and outlet, and at least one heater module having a female connector at each of its inlet and outlet, said male and female connectors engaging with one another to form a watertight seal.

**[0013]** The heater modules may further comprise location means remote from said inlets and outlets to align said modules.

**[0014]** The heater modules comprise a substantially U shaped passageway. Preferably the inlets and outlets are adjacent and opposite one another at one end of the heater modules.

**[0015]** Each heater module may comprise a two part moulding joined along a seam, each part of the moulding having one of the inlet and outlet therein, and a heating element enclosed therebetween such that electrical connectors of the heating element protrude from said module.

**[0016]** Preferably the heater elements are bare wire heaters.

**[0017]** The electric water heater may further comprise a clamping means that clamps adjacent heater modules together in the vicinity of the inlets and outlets.

**[0018]** Specific example of the invention will now be described, by way of example, with reference to the drawings in which:

Figure 1 shows a perspective view of an electrical water heater according to the invention;

Figure 2 shows a partially exploded view of the water heater of Figure 1;

Figure 3 shows an exploded view of a heater module of the invention.

**[0019]** Referring to the Figures an electrical water heater 10 is shown. The heater 10 has a plurality of heating modules 12, 14 aligned in a linear array. An inlet module 16, having an inlet orifice 18 by which the heater can be attached to a source of water is attached to one end of the array of heating modules 12, 14 and an outlet module 20 , having a water outlet 22 for attachment to a downstream use of heated water is attached to the other end of the array of heating modules.

**[0020]** The heating modules 12 each have a male inlet 24 on one side and a male outlet 26 on the other side. When assembled these mate with female inlets 28 and female outlets (not shown) on heating module 14. Seals 38 are provided to ensure a water tight seal between the inlets and outlets. The inlet module and the outlet module are attached to the heating modules in the same manner.

**[0021]** The heating modules each comprise a substantially U shaped flow path 40 leading from the inlets 24, 28 to the outlets 26. Each module comprises a two part moulding which comprises two module shell parts 30, 32 which are assembled together so as to enclose a bare wire heater element 34, which in this embodiment is in the form of a coiled wire heater, therebetween. Connection terminals 36 for the bare wire heater element 34 extend from the top of the heater module when assembled. The two module shells of the heater module may be connected together by any suitable means which may include ultrasonic welding and chemical bonding.

**[0022]** Mating male and female location pins orientate

the heater modules 12, 14 and keep them aligned while they are connected together.

**[0023]** A clamping means, for example in the form of a threaded rod, may pass through the body of the heating modules 12, 14, albeit preferably not through the flow paths therein, and tightened so as to compress the modules together in the region of the inlets/outlets between adjacent modules. Preferably this clamping only occurs in the vicinity of the inlets and outlets and the distil end of the heating elements is not clamped. In this manner the heating elements may thermally expand and contract independently from one another along their longitudinal axis.

**[0024]** The invention provides a series water heater that can easily have a defective module removed and replaced. Furthermore, due to the modular nature of the design, and the avoidance of the need for modules, during manufacture any size or power water heater can be achieved by increasing or decreasing the number of standard heating modules therein.

**[0025]** It will be appreciated by the skilled person that the specify description only describes one embodiment of the invention ants that the claims may cover other embodiments within the scope of the claims.

## Claims

1. An electric water heater (10) comprising a linear array of heating modules (12, 14) each comprising an inlet, an outlet, and a heater element (34), the inlets and outlets being arranged such that when placed adjacent one another in said array the outlet of one module (12) is aligned with the inlet of the adjacent module (14) so that, in use, water flows through the modules (12, 14) in series.

2. An electric water heater (10) according to claim 1 comprising an inlet module (16) having a water inlet (18) for connection to a source of piped water and an outlet for connection to a heating module (12).

3. An electric water heater (10) according to claim 1 or claim 2 having an outlet module (20) having a water outlet (22) for connection to a source of piped water and an inlet for connection to a heating module.

4. An electric water heater (10) according to claim 2 or claim 3 wherein the inlet module (16) and or outlet module (30) contain a heater element (34).

5. An electric water heater (10) according to any previous claim comprising at least one heater module having a male connector at each of its inlet and outlet, and at least one heater module having a female connector at each of its inlet and outlet, said male and female connectors engaging with one another to form a watertight seal.

6. An electric water heater (10) according to any previous claim wherein the heater modules (12, 14) further comprise location means remote from said inlets and outlets to align said modules.

7. An electric water heater (10) according to any previous claim wherein said heater modules comprise a substantially U shaped passageway.

8. An electrical water heater (10) according to claim 7 wherein the inlets and outlets are adjacent and opposite one another at one end of the heater modules.

9. An electric water heater (10) according to any previous claim wherein each heater module (12, 14) comprises a two part moulding joined along a seam, each part (30, 32) of the moulding having one of the inlet and outlet therein, and a heating element (34) enclosed therebetween such that electrical connectors (36) of the heating element protrude from said module (12, 14).

10. An electric water heater (10) according to any previous claim wherein the heater elements are bare wire heaters.

11. An electric water heater (10) according to any previous claim further comprising a clamping means that clamps adjacent heater modules (12, 14) together in the vicinity of the inlets and outlets.

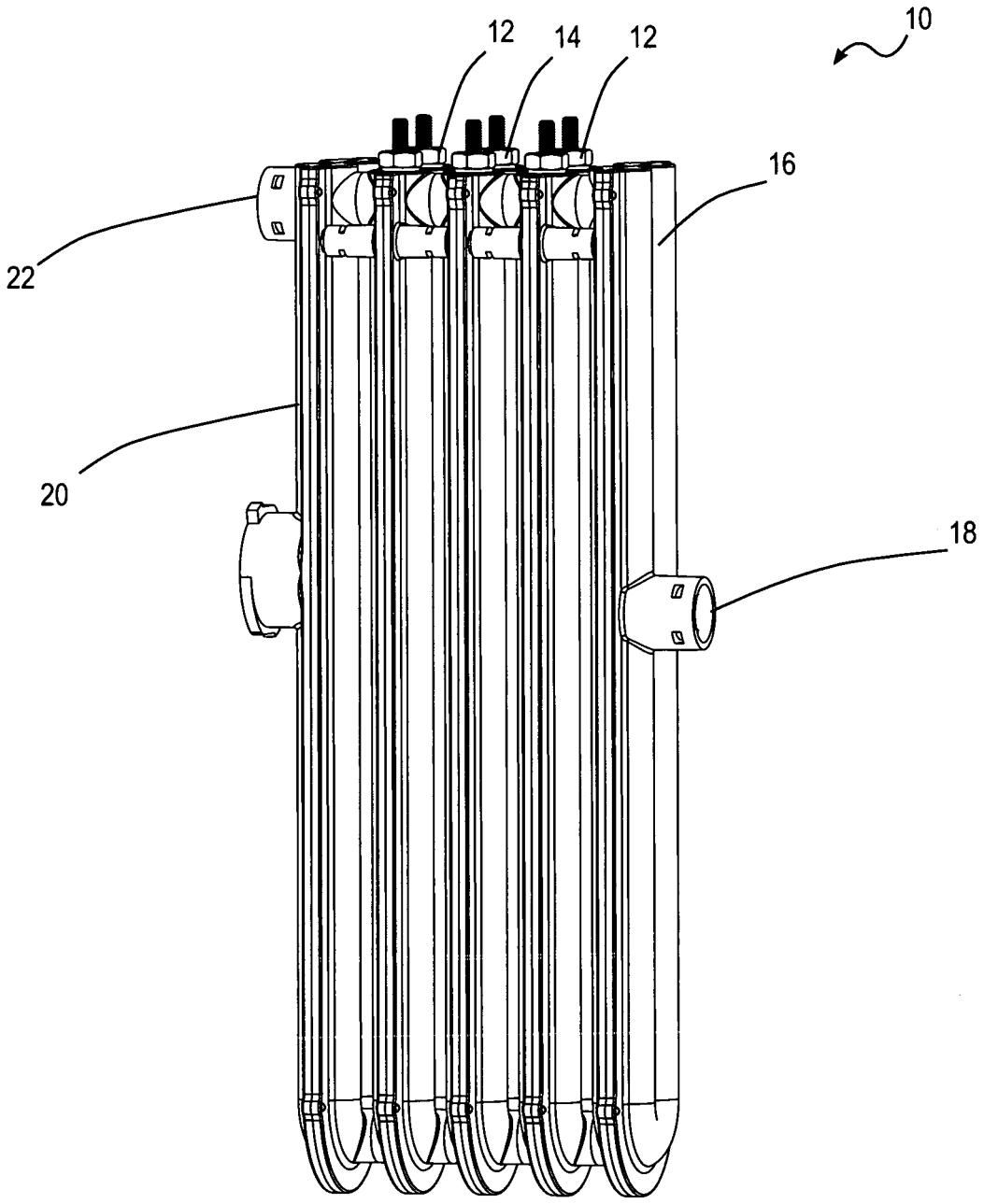


Fig 1

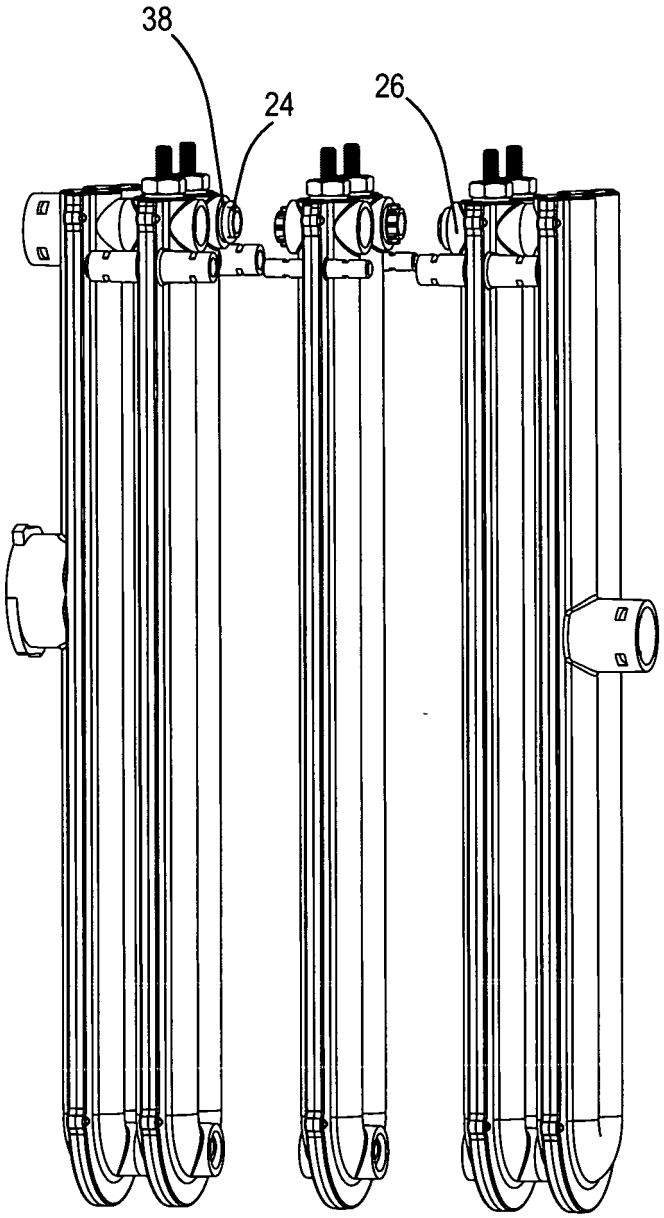


Fig 2

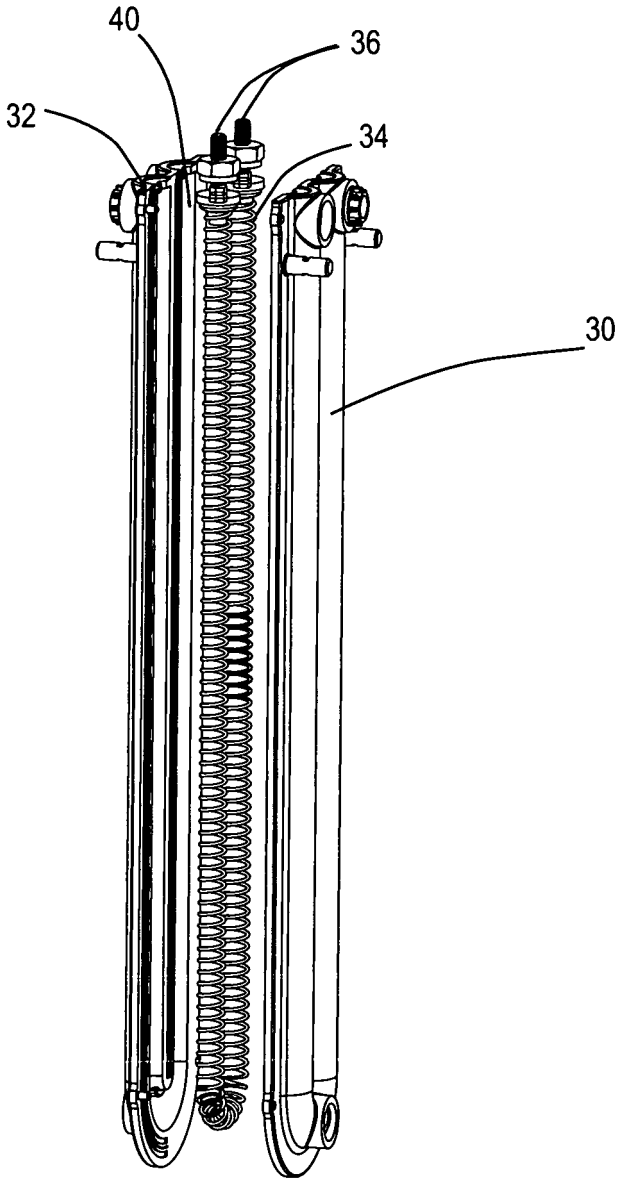


Fig 3