Aug. 23, 1927. 1,640,049

S. D. NESMITH

ELECTRICALLY OPERATED WATER HEATER OR BOILER FOR HEATING PURPOSES

Filed May 22, 1926 2 Sheets-Sheet 1

Fig. 1.

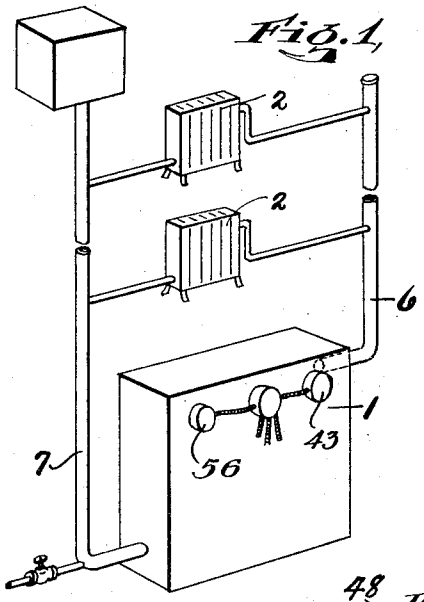


Fig. 8.

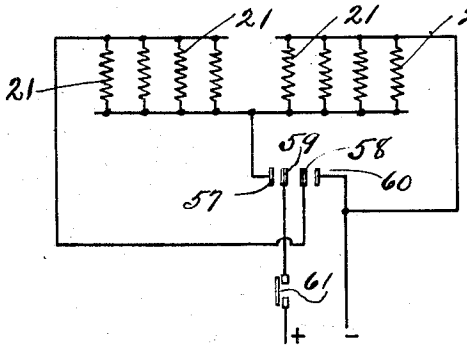


Fig. 7.

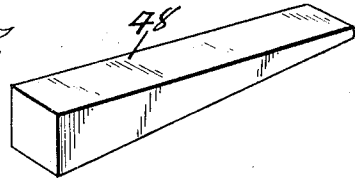
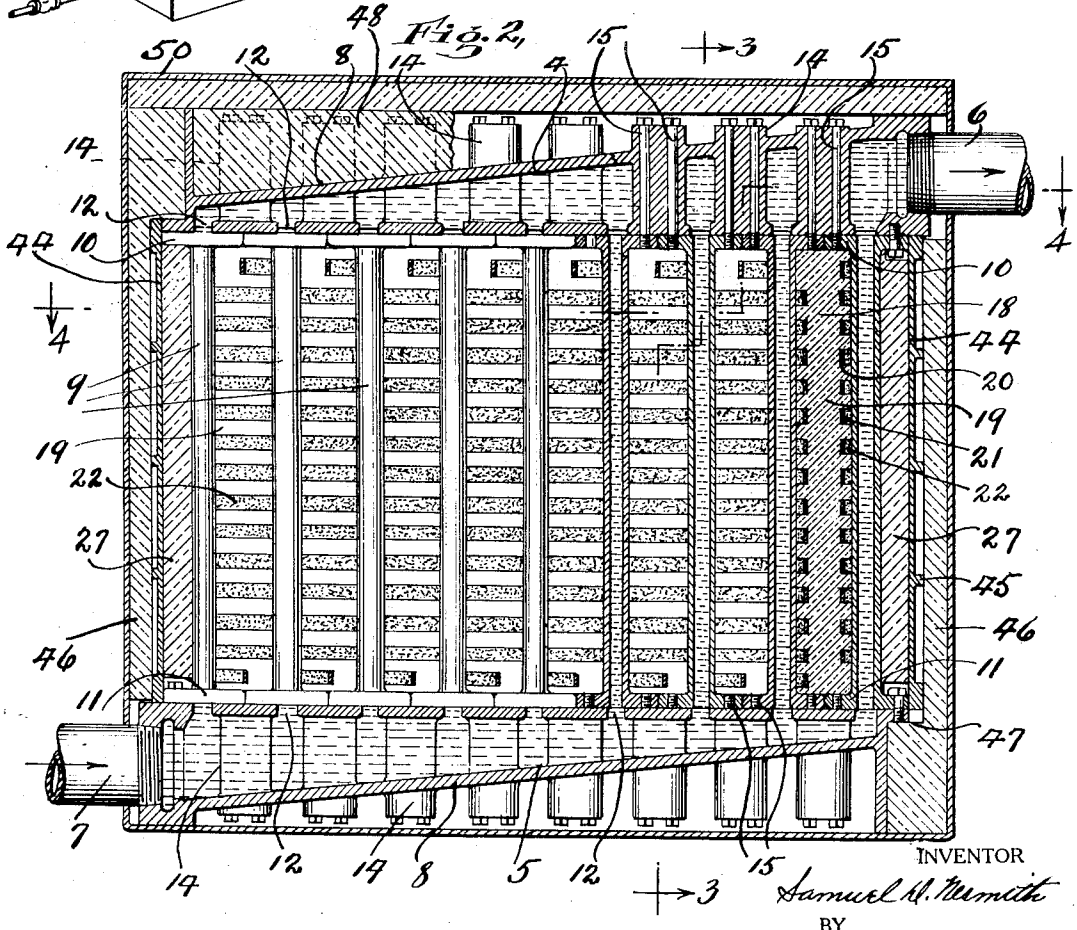


Fig. 2.



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Fig. 3,

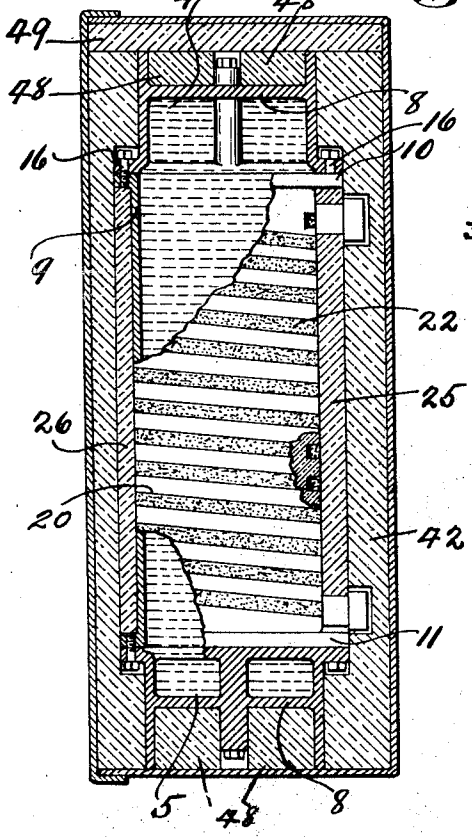


Fig. 6,

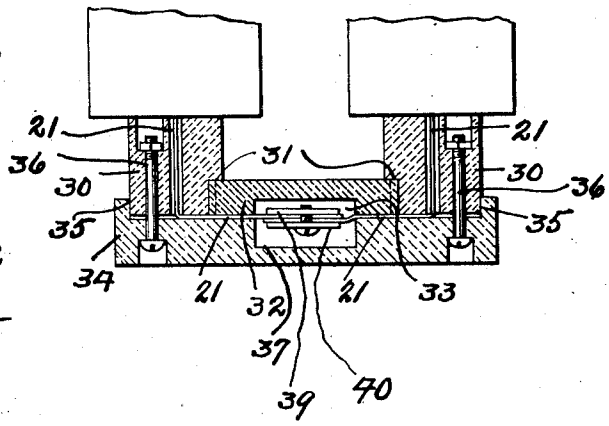


Fig. 5,

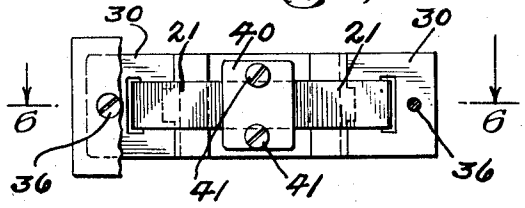
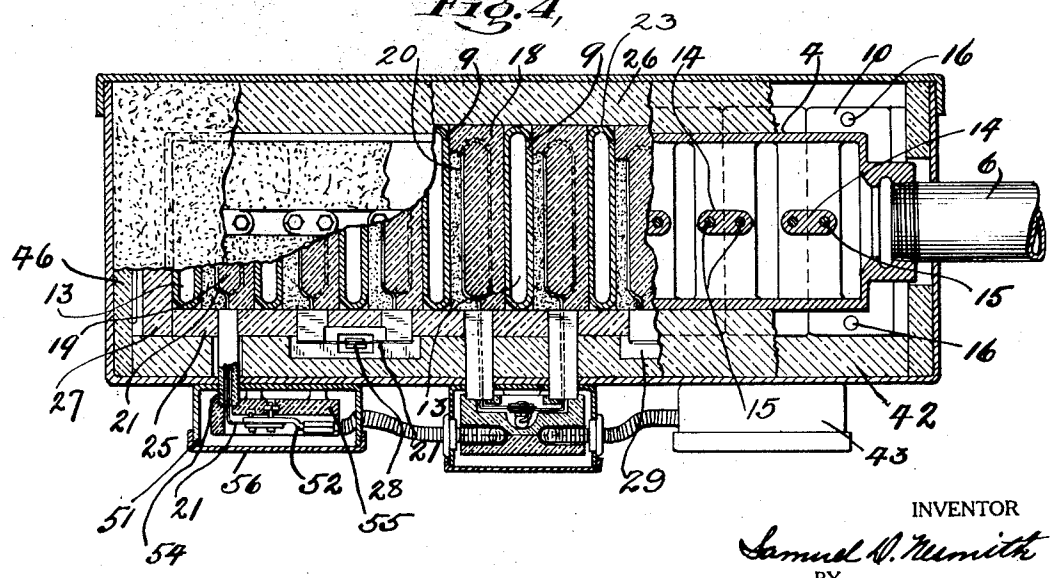


Fig. 4,



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UNITED STATES PATENT OFFICE.

SAMUEL D. NESMITH, OF SAN DIEGO, CALIFORNIA, ASSIGNOR OF PART INTEREST TO GEORGE H. SCHMIDT, WALTER C. STITT, F. F. GRANT, H. M. SAMMIS, PAUL J. HARTLEY, AND R. C. EASOM.

ELECTRICALLY-OPERATED WATER HEATER OR BOILER FOR HEATING PURPOSES.

Application filed May 22, 1926. Serial No. 110,864.

My invention relates to electrically operated water heaters or boilers for house heating purposes, for example, and has for one of its objects the provision of a device of the character above indicated so constructed and arranged as to adapt the same for use in the home, to take the place of coal-fired, oil-fired, or gas-fired, boilers now in use.

A further object of my invention is the provision of an electrically operated water heater or boiler of the character above indicated so constructed and arranged as to reduce the cost of maintenance and upkeep to a minimum.

A still further object of my invention is the provision of an apparatus of the type above referred to which is so constructed and arranged as to reduce the cost of manufacture to a minimum, the various units or members entering into the construction of my improved device being designed and constructed so as to be more or less interchangeable and to greatly simplify the assembling of the device and to permit of the ready replacement of broken and worn out parts without necessitating the employment of skilled labor, and permit of the manufacture of my apparatus in production quantities.

Another object of my invention is the provision of an electrically operated water heater or boiler which may be installed at minimum expense in the home, the construction of the apparatus being such as to promote extremely efficient operation of the device from an electrical point of view, thereby reducing the cost of operation of my apparatus to a point where it is comparable to boilers now in common use and which are coal-fired, oil-fired, or gas-fired.

Again, my invention has for an object to provide an electrically operated water heater or boiler well adapted for house heating purposes which may be readily substituted for the boilers now in use without necessitating any change other than the removal of the existing plant or boiler and the substitution of my apparatus; my device is also well adapted for automatic operation, whereby the cost of current for operating the same will be reduced to a minimum, the automatic feature permitting of the current being shut off when no heat is required, as, for instance, at night, as distinguished from coal-fired plants wherein, although the fires may be banked, coal is being consumed at all times.

A further object of my invention is the provision of an automatic control for the current employed in the operation of my improved boiler whereby the water in the boiler may be heated very quickly, in fact, almost instantaneously, when the device is first set in operation, as, for example, when the current is turned on in the early morning, the control system being such that as soon as the temperature of the house or other building being heated has risen sufficiently, the electric circuits of my boiler will be automatically changed so as to very materially reduce the load on the power line and hence very materially reduce the amount of current consumed.

While other and further objects of my invention will appear from the description to follow, I might say at this point that the electrically operated water heater or boiler constituting the subject matter of this application has been designed so as to make all parts of the apparatus readily accessible, thereby facilitating assembly of the apparatus in the first instance and the removal and replacement or repair of broken and worn out parts, care having been taken to insure that the device will be water-tight at all times and that no short circuits will occur in the system which might charge the water passing through the boiler.

In the accompanying drawings, wherein I have illustrated an embodiment of my invention,—

Fig. 1 is a mere diagram or diagrammatic showing of a heating system employing my improved boiler or heater, no attempt having been made to show in this diagram the specific construction of the boiler itself;

Fig. 2 is a sectional side elevational view of my improved boiler;

Fig. 3 is a section on the line 3—3 of Fig. 2;

Fig. 4 is a section taken on the line 4—4 of Fig. 2;

Fig. 5 is a detail of a connector employed

for connecting the various independently removable electrical heating elements of the device to each other:

Fig. 6 is a section on the line 6—6 of Fig. 5;

Fig. 7 is a view in perspective of a heat insulating member employed at the top and bottom of my improved boiler; and

Fig. 8 is a wiring diagram of a circuit arrangement which I may employ in connection with the operation of my boiler.

With reference to the drawings in detail, and first of all with reference to Fig. 1, 1 designates my improved heater or boiler, while 2 designates two radiators connected thereto in parallel. Fig. 2 is shown merely to illustrate an installation in a private home for instance.

Fig. 2, as I have pointed out above, shows an embodiment of my invention in detail, and referring to this figure, 4 and 5 designate horizontally disposed and spaced apart upper and lower headers, respectively, the header 4 being located at the top of my improved boiler and the header 5 at the bottom. The header 4 is provided with an outlet pipe 6 connected to the riser in the heating system illustrated in Fig. 1, while the header 5 is provided with an intake 7 connected to the other side of the water line in the diagram of Fig. 1. It will be understood, of course, by any one skilled in this art that the system is filled with water before operation is started and that there is a circulation of water due to temperature changes through the heater or boiler, the risers and the radiators. The system may be filled with water originally from any suitable source of supply.

Each of the headers 4 and 5 is a hollow unitary or one-piece structure and is so made in order that it may be manufactured cheaply, readily installed, and may be easily removed for the purpose of inspection or repair or for replacement purposes, if necessary. Each of these headers provides a water passageway or conduit of uniformly varying capacity, for a purpose to be pointed out hereinafter, this variation in capacity being assured by providing each of the headers with an inclined or sloping ceiling or roof or outer wall designated 8. The slope of the outer wall of the upper header 4 is downwardly from the outlet end which receives the outlet pipe 6, while the slope of the roof of the lower header 5 is downwardly from the intake end which receives the inlet pipe 7. In other words, the outlet end of the upper header 4 and the intake end of the lower header 5 is the larger end in each instance.

The headers are arranged in spaced relation with respect to each other and equidistantly throughout their lengths, and interposed between them are a plurality of spaced, vertically-extending, flattened water tubes designated 9, and inasmuch as the inner walls or bottoms of the headers are parallel to each other, these tubes are of equal lengths so as to be interchangeable and to reduce manufacturing costs and cost of assembly. These water tubes may be made of any suitable material but are preferably thin-walled, the combined thickness of the opposite walls of each tube approximating the thickness of the body of water passing therethrough. Each water tube is provided with an annular flange 10 at its upper end and a similar flange 11 at its lower end, and when the tubes are in place these flanges abut as shown in Fig. 2. The floor of each header is provided with slots or ports 12 and these slots, which extend transversely of the adjacent side walls of the headers so as to conform to the arrangement of the openings or water passageways 13 in the water tubes, are so spaced from each other longitudinally of the headers as to provide a slot in the headers abreast of each end of each water tube 9, the material of the headers between the ports 12 overlying the joints between adjacent flanges 10 and 11. Inasmuch as the headers 4 and 5 are provided with water passageways or conduits extending their full length, it will be apparent that when my apparatus is assembled the water tubes 9 will be connected in multiple so that water may flow into the apparatus through the pipe 7 and upwardly through all of the water tubes 9 into the upper header, to be discharged through the outlet pipe 6. The passageways in the headers, which, as above explained, uniformly vary in capacity, are nevertheless so proportioned as to permit of an uninterrupted circulation through the boiler. By varying the capacity of these headers, however, I prevent the collection of steam therein, with a consequent building up of pressure, which might be dangerous.

The headers 4 and 5 are provided with a series of bosses or columns 14 which extend from the bottom or floor of the header and continue up to and through the inclined or sloping outer wall 8. These bosses, of course, in actual practice are cast integral with the header itself, and as will be seen from Fig. 4, are disposed along the longitudinal central axis of the header. Although the outer wall of each header is inclined, the bosses 14 are all of the same length so that the bolts 15, which pass down through these bosses, may be made of equal lengths also. This facilitates assembly and also reduces the cost of manufacture. Referring to Fig. 2 it will be seen that each boss or column is so disposed with reference to the water tubes 9 that one of the bolts 15, passing down through the boss, will be screwed into the flange on a water tube

while the companion bolt in the same boss will pass into the flange on the adjacent water tube. In addition to the bolts 15, each tube 9 is bolted to the headers by two other bolts 16, these two bolts passing through side flanges on the headers and into the top and bottom flanges on the tubes. It is to be understood that the method of attaching the water tubes 9 to the headers is the same at each end of the tubes.

As so far described, then, my improved structure comprises in part two parallel horizontally disposed headers each of which is a unitary or one-piece structure, and a plurality of vertically extending flattened water tubes of equal lengths, these tubes being detachably secured to the headers for independent removal. As a consequence, therefore, should a tube become leaky or should it be desired to remove the same for any other reason, this may readily be done by merely removing the bolts 15 and the bolts 16 by which the particular tube to be removed is attached to the headers 4 and 5, whereupon the tube may be taken out and repaired or replaced with a new tube, as the case may be. The same is true of the headers 4 and 5.

As above explained, my boiler is electrically heated or operated, and to this end, therefore, I interpose a heating element 18 between adjacent tubes. These heating elements are alike in construction, and each element comprises an alundum form or body portion 19 spirally slotted at 20, a copper tape 21 or other suitable electric conductor being wound in these slots from one end of the heating element to the other, the slots 20 being of a proper depth so that when the conductor 21 is wound about the form or body portion it will lie below the surface thereof. After the conductor has been placed in position, the slot above the face of the conductor is filled in with alundum as indicated at 22 so as to provide a brick-like heating element with an electric conductor encased therein. I have mentioned alundum as forming the body portion of the heating elements inasmuch as I have found that this material is an excellent electric insulator, and yet will retain heat for a long time, much better, for instance, than porcelain, so that even after the electric current passing through the conductors 21 is turned off, the form will remain heated for some time to thereby maintain the water circulating in the tubes 9 in a heated condition. These heating elements 18 are so shaped and so proportioned as to snugly fit and substantially fill the space between adjacent tubes and yet they may be independently and readily removed. This snug fit is desirable inasmuch as it reduces to a minimum the air space between the form or heating element and the metal of the water tubes, to thereby bring the heating element into intimate contact with the metal of the tube, which is, of course, necessary for most efficient operation. By this arrangement of heating elements, it being understood that there is a heating element disposed between each pair of adjacent water tubes, I provide a structure in which the conductors 20 are thoroughly electrically insulated from the water passing through the tubes and yet the heating elements themselves are brought into such intimate contact with the metal of the tubes that the water passing through the tubes will be heated almost instantaneously and without any unnecessary consumption of current.

Along the front side of the boiler and in contact with the front edge 23 of each of the water tubes and the front edge 24 of each of the heating elements, and fitting snugly between the inside faces of the flanges 10 and 11, I provide a removable sheet or board 25 of heat and electric insulating material such as transite or other suitable material. On the back of the boiler structure I provide a similar board or sheet 26, lying against the back edges of the heating elements and water tubes and extending between the flanges 10 on the latter. This structure is clearly illustrated in Fig. 3, and provides a flat smooth front and rear surface at the exterior of the tubes and heating elements.

At the ends of the heater I provide a slab or board 27 of transite or other suitable heat and electric insulating material, these members lying snugly against the sides of the end water tubes 9 between the flanges 10 and 11 on these end tubes. I have provided, therefore, a structure in which the water tubes 9 and the heating elements 18 are encased along the sides and ends in an electric and heat insulating casing so that not only is the heat of the heating elements confined, but by reason of the close proximity of the heating elements to the tubes, it is most efficiently applied to the water passing through the tubes.

The conductors 21 of the heating elements may be connected in series, in parallel or in series parallel, as will be explained hereinafter, and it is therefore necessary to provide connectors for connecting the conductors of adjacent heating elements. Two of these connectors are shown at 28 and 29 of Fig. 4 and the details thereof in Figs. 5 and 6. Each of the connectors 28 and 29 consists of two pieces of porcelain or other suitable electric insulating material 30, set into the board or slab 25 in spaced relation to each other, each one of these members 30 being provided with a recess 31 for receiving a small insulating block 32 which may likewise be made of porcelain for example. The block 32, or rather, the front face thereof, is

recessed as indicated at 33. Abutting the front faces of the members 30 is a small rectangular porcelain block 34 recessed at 35 so as to receive the members 30 and being held to these members 30 by bolts 36 as indicated in Fig. 6. The member 34 is provided with a recess 37 abreast of the recess 33 in the member 32, these two recesses providing an opening for receiving a clamp or connector. The conductors 21 of adjacent heating elements are led through a slot provided for that purpose in the porcelain or insulating members 30, are passed over toward each other across the ends of the members 30 and their ends brought together in the opening provided by the recesses 33 and 37. These ends are clamped to each other at that point by two plates 39 and 40 held together by screws 41. The block 34 may then be secured in position. The whole apparatus, therefore, shown in section in Fig. 6 may be considered a connector for attaching the adjacent ends of adjacent heating elements to each other.

The insulating blocks 34 are let into the rear face of a slab or board 42 extending across the boiler from top to bottom and end to end, as plainly indicated in Fig. 3. This board is of a suitable electric and heat insulating material, as, for example, transite. Accordingly, therefore, when making the connections between adjacent heating elements, it is merely necessary to remove the board 42 and take out the bolts 36, whereupon the block 34 may be removed and access be had to the clamping plates 39 and 40 to either make or break a connection.

At the ends of the heater are metal plates 44 which lie against the end insulating slabs or boards 27. These plates are ribbed as indicated at 45 and on the exterior of these plates are heat and electric insulating boards or slabs 46. These two boards or slabs are cut out as indicated at 47 so as to enable the same to lie snugly against the end plates 44 and against the ends of the headers. It will be understood that these two boards are arranged in reverse order for an obvious reason. At the top of the heater and lying upon the outer wall 8 of the header 4 are two removable bricks or wedge-shaped members 48 illustrated in perspective in Fig. 7, and at the bottom of the heater I employ similar members lying upon the lower header 5, so as to fill up the space left in the tops of the headers due to inclining the walls 8, to thereby provide a rectangular structure as indicated in Fig. 3, these bricks coming up to the top of the headers and to the ends of the bosses or columns 14. Superimposed upon the upper part of the heater is a heat and electric insulating board 49. The exterior of my improved heater or boiler is therefore truly rectangular in form, and I encase this structure in a metal sectional casing or box 50 so that the entire heater is enclosed. It will be understood, of course, that the pipes 6 and 7 are led into this box so as to enter the headers 4 and 5. To the front side of this casing I attach a connector box 51 which may be bolted thereto or fastened to it in any other convenient manner, and into this box I lead the ends of the end conductors 21. These end conductors are connected to the conductors 52 which lead through an armored cable over to the switch box 43. The connection of the end conductors consists in part of a porcelain tube 54 passing through the connector box 51, the front wall of the casing 50 and the boards 42 and 25. The conductors are led through this tube and through a porcelain member 55 which is attached to the rear wall of the connector box 51. This member 55 may be composed of any suitable insulating material other than porcelain, it being understood, however, that this member 55 is insulated from the connector box 51. The insulation member 55 carries suitable connections for attaching the conductors 21 to the conductors 52 so that all danger from shock at the connector box 51 is eliminated. The box 51 is provided with a cover 56 to prevent tampering with the interior mechanism.

Switch box 43 contains proper switch mechanism for effecting the desired connections of the conductors of the various heating elements. In Fig. 8 I have shown a diagram of the electrical connections, from which it will be seen that I provide two fixed contacts 57 and 58 and a pair of thermostatic contact strips 59 and 60. A push button switch 61 is located in one side of the power line in any convenient location. With the push button open, and no current flowing, the thermostatic contact 59 will engage fixed contact 58. Contact 60 will be open. If the push switch be operated, current will flow through the conductors 21 of the heating elements in series multiple to furnish the maximum heat. This operation is ideal when the building being heated is cold, as in the morning, for example. As soon as the temperature has risen sufficiently, the contact 59 will close on fixed contact 57, and thermo contact 60 will close on fixed contact 58, to connect the heating elements in multiple. Should for any reason the temperature drop below that required for the multiple connection, the series multiple connection will be automatically made again. The foregoing arrangement is ideal for house heating purposes, inasmuch as it is capable of furnishing an even heat, that is to say, maintaining an even temperature with the minimum consumption of current. I wish it to be understood that connections other than those described may be employed if desired, an electrically operated water boiler being ideal for whatever method of automatic control may be found desirable.

It will be seen from the foregoing that I have provided an electrically operated boiler or heater well adapted for house heating, for instance, and to be substituted for coal, gas or oil-fired furnaces now employed, in which a most efficient operation will be obtained and in which repairs and renewals may be easily effected and without the necessity for employing skilled labor. The heating elements, the water tubes, the headers, in fact, practically every unit entering into the construction of my improved boiler, is removable without necessitating the removal of other parts of the apparatus, which, of course, enables any part to be repaired or replaced when desired without destroying the entire apparatus, or in fact, without taking down the entire apparatus. For instance, in making repairs or effecting a renewal of a heating element, all that is necessary is to take off the casing on the outside of the heater, remove the two insulating boards in the front of the heater, disconnect the conductors at the connectors illustrated in Fig. 6 and pull the heater out to repair it or replace it. On the other hand, a water tube may be readily removed by merely taking out the bolts which hold that particular tube in place, lifting the tube out, repairing it or replacing it as the case may be. Likewise, the headers may be removed readily by the mere removal of the bolts by which the water tubes and headers are attached to each other.

It will be seen, furthermore, that in addition to the novel and practicable feature just mentioned, I have provided an electrically operated water boiler in which every effort has been made to conserve the heat generated and to apply it to the water to be heated as efficiently as possible and yet safely, thereby reducing the current consumption to the minimum and safeguarding the operator.

It is to be understood that those skilled in this art may make changes in the details of construction, arrangement of parts and mode of operation above described within the purview of my invention.

What I claim is:

1. In an electrically operated water heater or boiler, the combination of a pair of unitary spaced headers, a plurality of spaced water tubes interposed between and removably attached to said headers, heating elements independently removable and interposed between adjacent water tubes, each of said water tubes being flanged at each end, said flanges projecting beyond the sides or edges of the tubes and said heating elements, and a sheet or slab of electric and heat insulating material at each side of the boiler and fitting between the upper and lower flanges on the tubes and lying against the edges of the tubes and heating elements.

2. In an electrically operated water heater or boiler, the combination of spaced apart unitary headers, flanged water tubes positioned between and secured to said headers for independent removal, heating elements positioned for independent removal intermediate adjacent water tubes, the edges of said heating elements and water tubes being flush with each other to provide a substantially rectangular structure, the flanges on said water tubes projecting beyond the edges of said tubes and heating elements, an insulating slab or board interposed between the upper and lower flanges on said tubes and lying against the tubes and heating elements, and insulating means set in said slabs or boards for receiving the ends of the conductors of the heating elements whereby the conductors of the heating elements may be attached to each other substantially as described.

3. In an electrically operated water heater or boiler, the combination of a plurality of water tubes, a heating element interposed between and adjacent each pair of tubes, a heat and electric insulating slab or board lying against the edges of the tubes and heating elements, said slab or board being provided at intervals with openings, an insulator in each opening, each insulator being provided with a passageway or orifice for receiving the conductor of an electric heating element, an insulating slab or board at the outer side of said first mentioned board, an insulator set into said last mentioned board abreast of the first mentioned insulators, and means intermediate the two sets of insulators for attaching the conductors of certain of said heating elements to each other.

4. In combination, a pair of spaced insulators each of which is perforated for the reception of an electric conductor, an insulating block set into said insulators and provided with a cut out portion intermediate its ends, a third insulator or insulating block attached to the two first mentioned insulators and provided with a cut out portion abreast of the first mentioned cut out portion, bolts for attaching all of said insulators to each other, and a connector in the space provided by said cut out portions for connecting together the ends of two electric conductors passing through the two spaced insulators first mentioned.

5. In an electrically operated water heater or boiler, the combination of a pair of hollow unitary spaced-apart headers, a plurality of water tubes each of which is provided at each end with a flange interposed between said headers and attached thereto for independent removal, said tubes being arranged in spaced relation to each other, an electric heating element interposed in and substantially filling the space between

adjacent water tubes and insulated therefrom, said tubes and heating elements being so arranged as to provide a substantially rectangular structure, an electric and heat insulating slab or board lying along the front side and the back side of said heater, insulating means carried by said boards or slabs through which the electric conductors of certain of said heating elements are passed and attached to each other, an insulating board or slab at the exterior of said first mentioned slabs or boards, one of said last mentioned boards being provided with an insulator for the passage of a conductor of one of said heating elements to the exterior of the heater, and a casing on the exterior of the heater for enclosing or encasing the entire structure.

This specification signed this 11th day of May, 1926.

SAMUEL D. NESMITH.