

A. P. NICHOLS.  
ELECTRICAL LIQUID HEATER.  
APPLICATION FILED JAN. 13, 1910.

991,877.

Patented May 9, 1911.

Fig. 1.

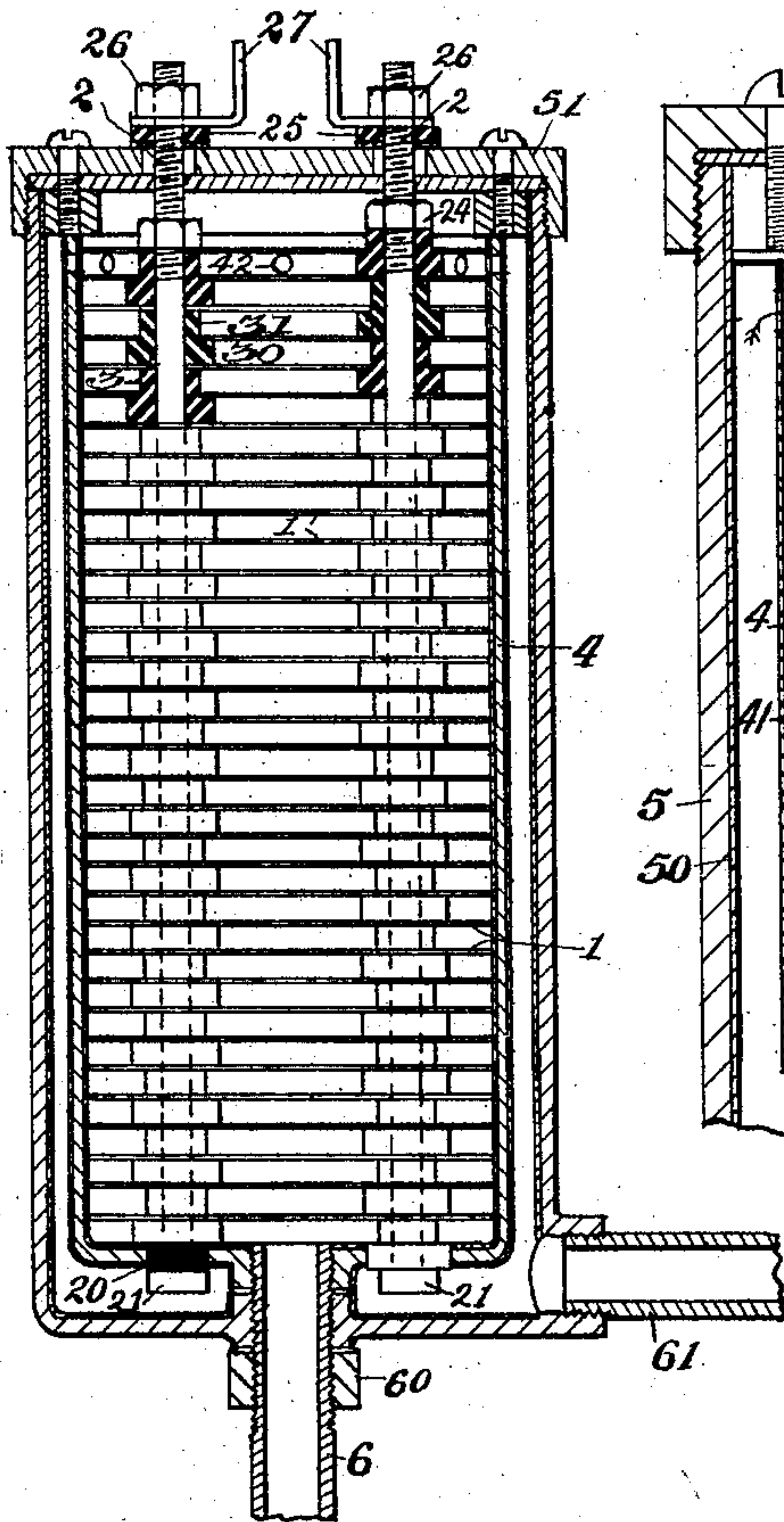


Fig. 2.

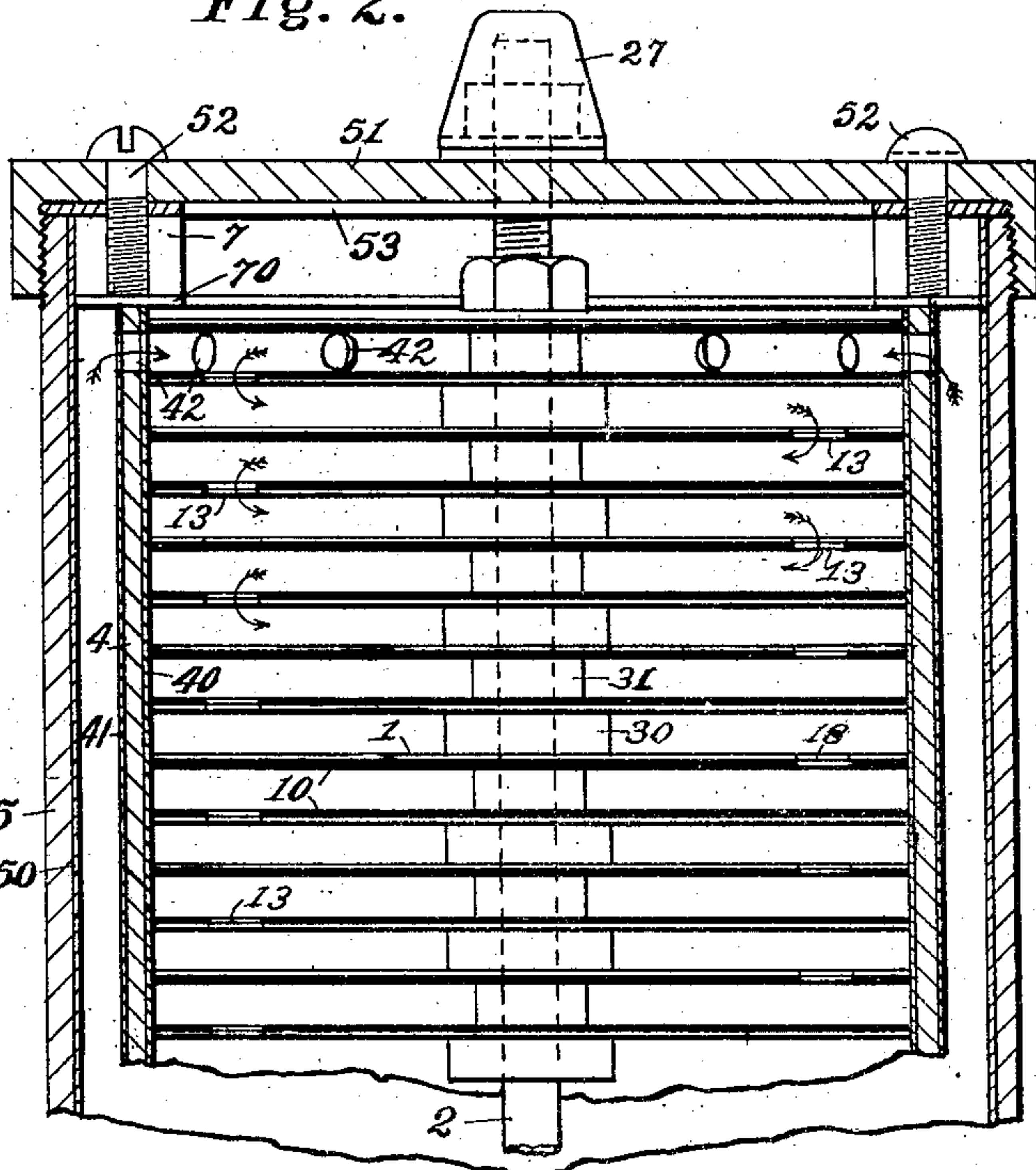


Fig. 3.

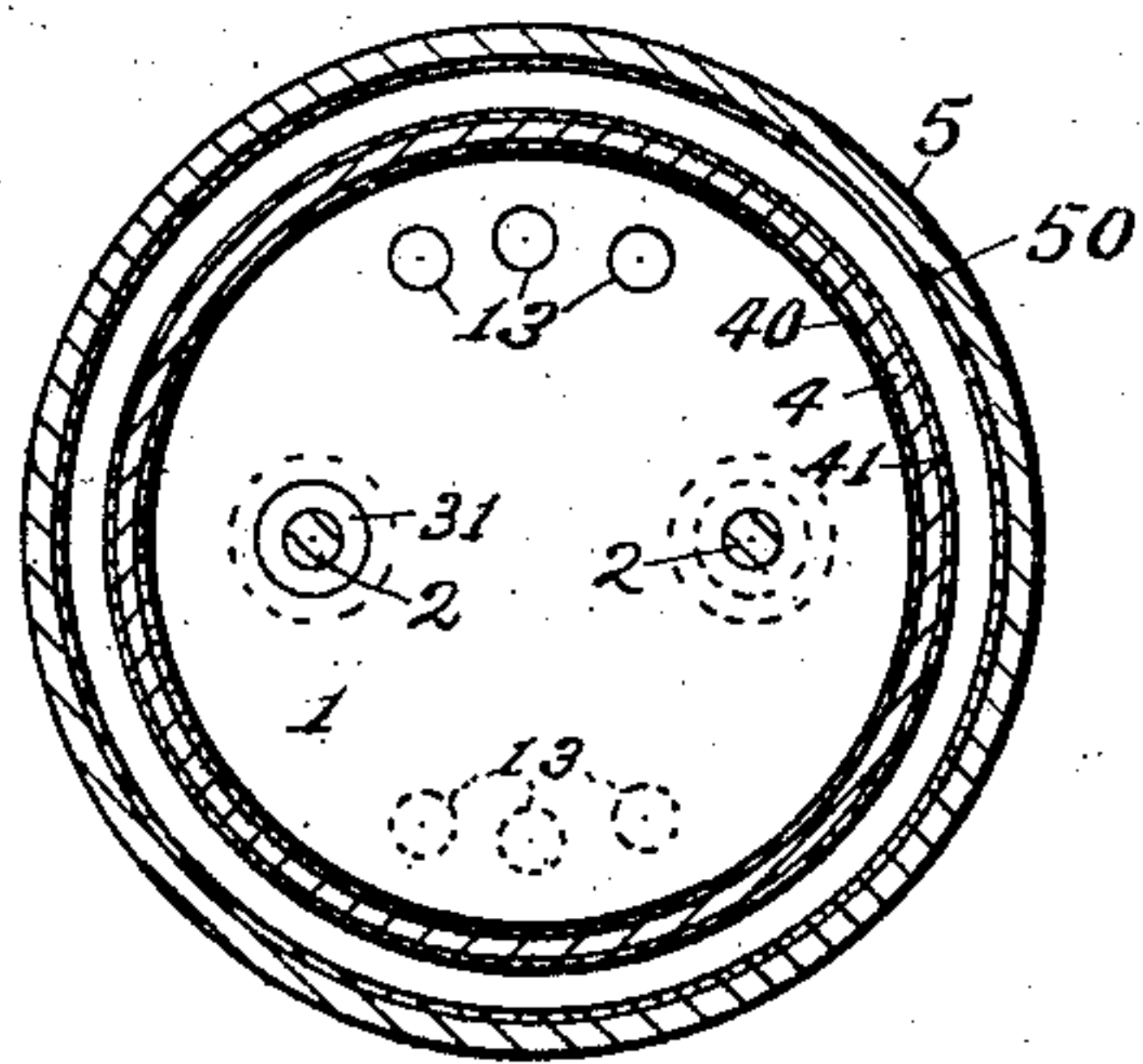


Fig. 6.



Fig. 7.

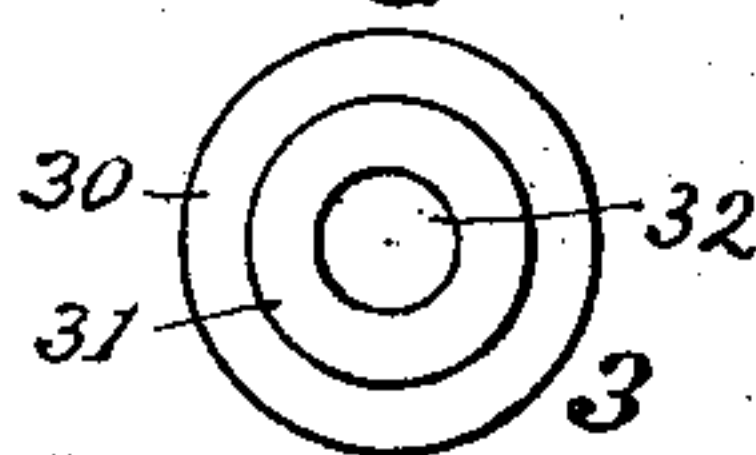


Fig. 4.

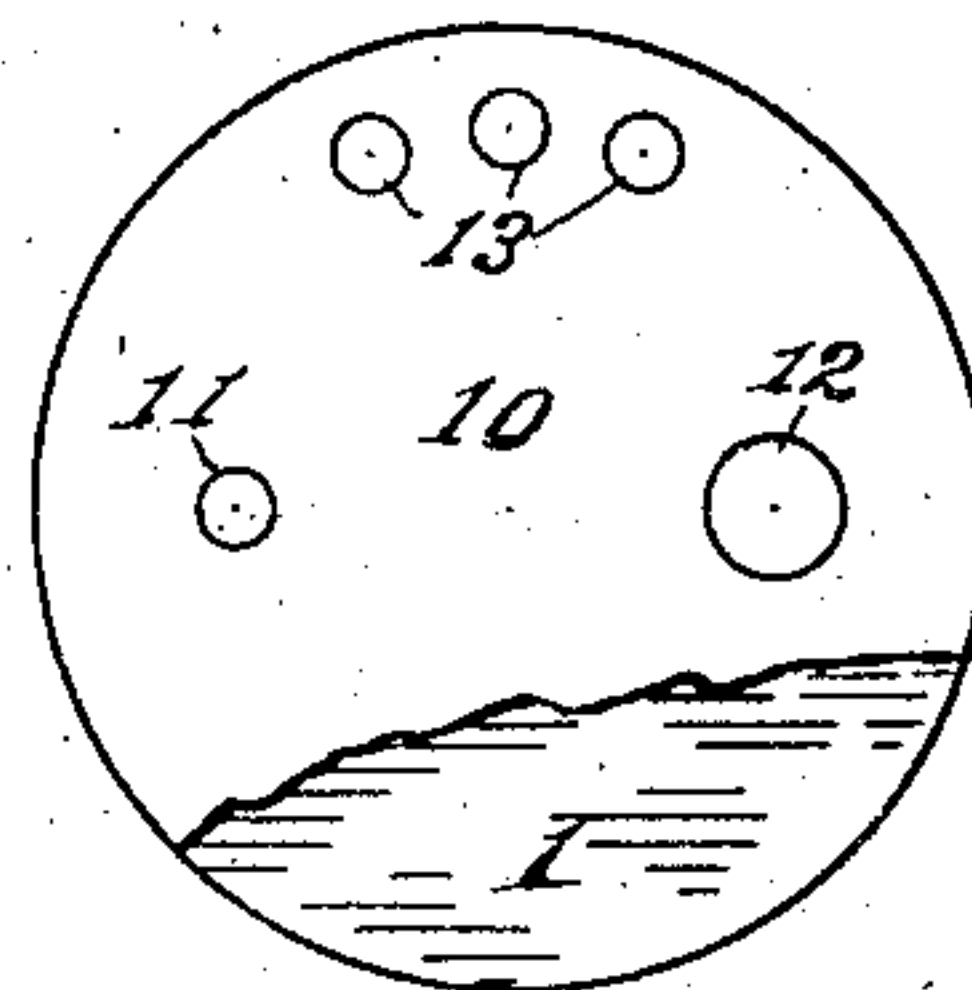
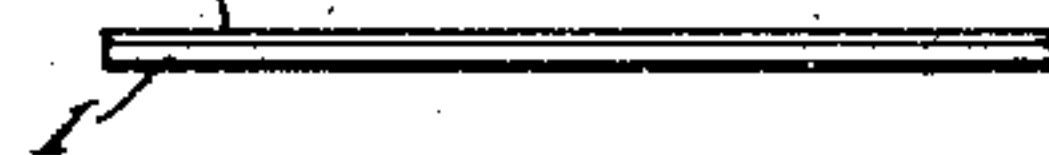


Fig. 5.



WITNESSES.

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# UNITED STATES PATENT OFFICE.

ANDREW P. NICHOLS, OF SEATTLE, WASHINGTON, ASSIGNOR TO CENTRAL MANUFACTURING COMPANY, OF SEATTLE, WASHINGTON, A CORPORATION OF WASHINGTON.

## ELECTRICAL LIQUID-HEATER.

991,877.

Specification of Letters Patent.

Patented May 9, 1911.

Application filed January 13, 1910. Serial No. 537,935.

*To all whom it may concern:*

Be it known that I, ANDREW P. NICHOLS, a citizen of the United States, and resident of the city of Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Electrical Liquid-Heaters, of which the following is a specification.

My invention relates to an improvement in electric liquid heaters, and comprises the novel parts and combinations of parts which will be hereinafter described and particularly pointed out in the claims.

The object of my invention is to produce a device for heating water or other liquids, which may be connected with a convenient source of supply of electricity so as to heat water or other liquid which is passed there-through.

In the drawings accompanying I have shown my invention embodied in the form which is now preferred by me.

Figure 1 is an elevation showing parts in section, of my device. Fig. 2 is a sectional elevation, upon a larger scale showing the upper portion of my device. Fig. 3 is a transverse section. Fig. 4 is a plan view of one of the plates showing the insulating covering which is contemplated for one side, as broken away. Fig. 5 is an edge view of one of the heating plates, such as is shown in plan in Fig. 4. Figs. 6 and 7 are respectively elevation and plan of the insulating spacer used between the heating plates.

One of the objects in view in designing my present heater is to secure a form of construction which would combine high efficiency and heating capacity with cheapness of construction, durability and ready accessibility. As contributing largely to these results I have adopted a circular disk form for my heating elements, the same in a preferred form being shown separately in Figs. 4 and 5. These consist of thin metal disks 1 which are adapted for assembly in superposed form and spaced apart sufficiently to form a series of water circulating spaces between successive disks, through which spaces the water or other liquid being heated is passed. These disks are assembled by passing through a superposed series thereof, of two binding bolts or rods, 2, which rods also serve as terminal rods to

connect the disks in sets of opposite electrical character. Spacers 3 are used in connection with the rods 2 to keep the disks at proper distances. These spacers are of glass or other suitable insulating material, and are made circular in cross-section, having two parts, 30 and 31 of different diameter and having an axial hole 32 through which the binding bolts 2 pass.

The plates or disks 1 are provided, toward opposite sides, with holes 11 and 12, the former being of a size to permit the insertion of the bolts 2 and the latter of a size to permit the insertion of the smaller section 31 of the spacers.

In assembling the plates 1 they are alternately reversed in position, so that the binding bolts 2 pass successively through a small and then a large hole, as is clearly shown in the upper portion of Fig. 1. The spacers 3 have their smaller section 31 inserted through the large hole 12 of the plates 1 and their ends abutting against the surfaces of the plates at each side of this plate. In this way the rods or bolts 2 are each connected with alternate plates or disks 1, those which are connected with one bolt alternating with those which are connected with the other bolt.

The disks or plates 1 are provided with holes 13 located at one side from the diameter passing through the holes which receive the binding bolts. In assembling these plates they are arranged so that these holes 13 are, in alternate plates, toward opposite sides of the chamber, as is shown by the dotted lines in Fig. 3 and by the arrows in Fig. 2. These latter indicate the course of the water as it passes through the device.

The binding bolts 2 are provided with heads 21, at one end, insulated by washers 20 and nuts 24 at the other end, insulated where needed by washers, by tightening which nuts the disks or plates 1 may be bound together into a compact mass. The disks or plates thus bound together are placed within a casing 4 which is of a size to snugly fit about the disks. At its lower end it is provided with an opening which receives the pipe 6, which pipe passes through the outer case 5, and serves either as the admission or discharge passage for the water being heated.

Surrounding the case 4 is a case 5 which



is preferably provided at its upper end with means to close the annular space between the two cases. The means shown for doing this consist of a ring 7 and packing 5 70, the ring 7 being secured to a cap 51 by screws 52 and is screwed to the outside of the outer case 5. The cap may also have a packing disk or ring 53 to seal its joint with the outer case 5. The binding bolts 2 10 pass through this cap 51 and are provided with insulating washers 25, nuts 26 and metal lugs 27 to which the feed wires may be attached. The inner case 4 is provided with holes 42 registering with the space be- 15 tween the upper pair of plates 1, or with the space above the plates, as is desired or convenient, through which the water flows. The outer casing is shown as provided with a pipe connection 61 for water.

20 The circulation of water may be either in through the pipe 61, through the annular space between the two cases, through the holes 42 into the inner case, through the holes 13 in a zigzag course among the plates 25 1 and finally out through the pipe connection 6; or the course may be the exact reversal of this, as is desired or most convenient.

The disks or plates 1 may be plain metal 30 of such kind and quality as is found best for such service, or, as I have found to sometimes be preferable, they may be provided with an insulating coating upon one surface, as has been indicated in Figs. 2 and 4. The 35 coating or layer 10 may be a glass-like glaze, such as is often given metal and commonly called enamel, but may be of any character which possesses the insulating feature. In using plates which are insulated upon one 40 side I reverse the plates so as to have bare surfaces of adjacent plates facing and insulating surfaces facing. That is I have surfaces of like character upon consecutive plates facing toward each other. Begin- 45 ning with a plate having its insulating surface upward, the next plate above it would have its insulated surface downward, and the next above that would have its insulated surface upward. I have found by such an 50 arrangement of such plates that the heating effect is improved.

While I have shown the heating plates as circular disks, their circular character has nothing to do with the principles of their 55 action, but is only a desirable constructive feature. The other and more important features of construction may be embodied in plates of other forms.

While I prefer to use the two cases after 60 the manner illustrated and described, a single case might be used, the inlet being at one end and the outlet at the other. The principal constructional features of my invention comprise the superposed plates al- 65 ternately connected to opposite terminals

and the zigzag course of the water through the plates. Also the means for assembling the plates to secure these results, and the insulating of one side of the plates.

The inner case 4, I prefer to make of ma- 70 terial and in such manner that it is insulated from the liquid and the plates or disks 1, as by making it of glass, lava, porcelain or other insulating material, or by making it as I have shown, of metal having a coating 75 upon both surfaces of insulating material. The case as shown consists of an inner body 4 of metal having a glass-like glaze 40, 41 upon inner and outer surfaces, such as is employed for similar purposes and commonly 80 spoken of as "enamel." Any suitable insulating coating would answer. The outer case 5 I also prefer to have insulated from the liquid, which may be done by making it of metal having an inner insulating 85 "enamel" or coating 50 as shown in the drawing. The outer surface does not need such coating as it is not exposed to the liquid.

When the plates 1 are glazed and placed 90 in consecutively reversed position, these must be made rights and lefts, so far as the location of the water circulating holes 13, but when not glazed upon one side the same 95 plates may be used for all by simply turning them half around when assembling the plates of the two series.

The forms of all the parts which comprise the heater are such that they are cheaply 100 made and the design and assemblage is such that they may be quickly assembled with the minimum expense for labor. The plates 1 may be stamped out of sheet metal and may be very thin. The weight of metal re- 105 quired is thus slight and the device may be made so as to be small in size and weight and yet have very large heating surfaces so as to quickly heat up a considerable amount of water.

What I claim and desire to protect by 11 Patent is:

1. In an electric liquid heater, in combination, a superposed series of conductive plates spaced apart, and having an insulating covering upon one side, said plates being arranged 115 with like surfaces of successive plates opposed and having openings permitting passage of the liquid successively through the spaces between said plates, and means for connecting alternate plates with opposite 120 poles of an electric generator.

2. In an electric liquid heater, in combination, a series of superposed and spaced conductive plates having an insulating covering on one side and arranged to oppose like sur- 125 faces of successive plates, a casing surrounding said plates and having an insulating inner surface, said plates having openings for conducting the liquid to be heated successively through successive spaces between 1



the plates, and means for connecting alternate plates with opposite poles of an electric generator.

3. In an electric liquid heater, in combination, a casing having an insulating inner surface, a series of superposed conductive plates having an insulating covering upon one side and of a size to form obstructive diaphragms in the casing, said plates being arranged with like surfaces of successive plates opposed and having liquid passages arranged to lie upon opposite sides of the casing in successive plates, and means for connecting alternate plates with opposite poles of an electric generator.

4. An electric liquid heater having a series of superposed conductive plates spaced slightly apart, two binding rods each passing through all of said plates and being each electrically connected with alternate plates, said plates having holes permitting passage of the liquid to be heated between said plates.

5. An electric liquid heater comprising a series of conductive plates having an insulating covering upon one side and arranged in superposed position with like surfaces of consecutive plates facing each other,

insulating spacers between said plates, two binding rods passing through the plates and electrically connected, each with alternate plates, said plates alternating for the respective rods, and having circulation openings positioned to cause the liquid to be heated to pass through successive spaces between said plates.

6. An electric liquid heater comprising a series of conductive plates having an insulating covering upon one side and arranged in superposed position with like surfaces of consecutive plates facing each other, and also having liquid circulating openings toward opposite sides of consecutive plates, insulating spacers between said plates, two binding rods passing through the plates and electrically connected, each with alternate plates, said plates alternating for the respective rods, and a casing surrounding said plates.

In testimony whereof I have hereunto affixed my signature this sixth day of January, 1910 in the presence of the subscribing witnesses.

ANDREW P. NICHOLS.

Witnesses:

JOHN A. DOUGLAS,  
C. R. BARNEY.