A. H. JESSUP.

STERILIZER.

APPLICATION FILED FEB. 3, 1920.

**1,392,944.** **Patented Oct. 11, 1921.**

2 SHEETS—SHEET 1.

Fig. 2

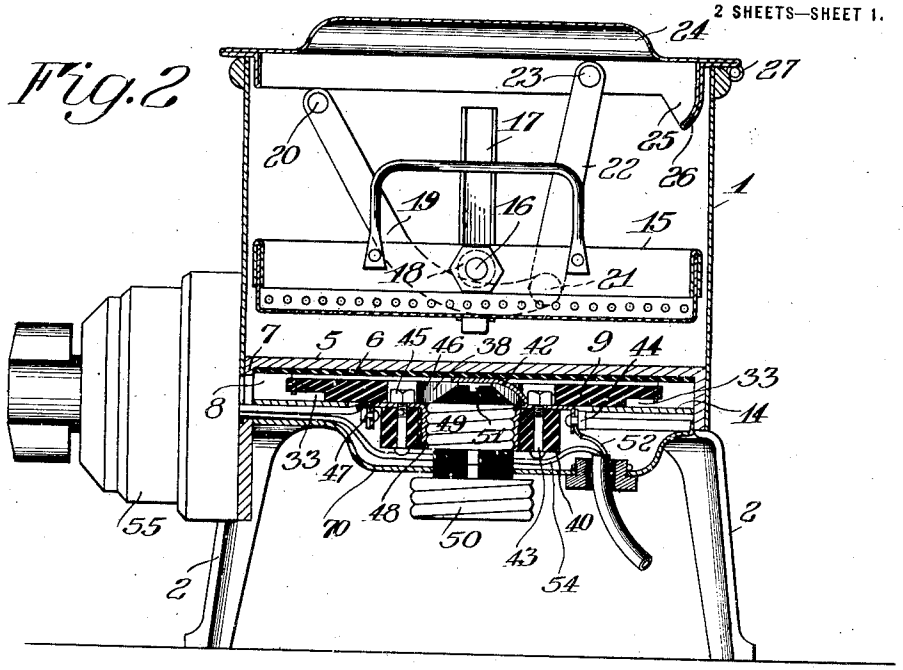
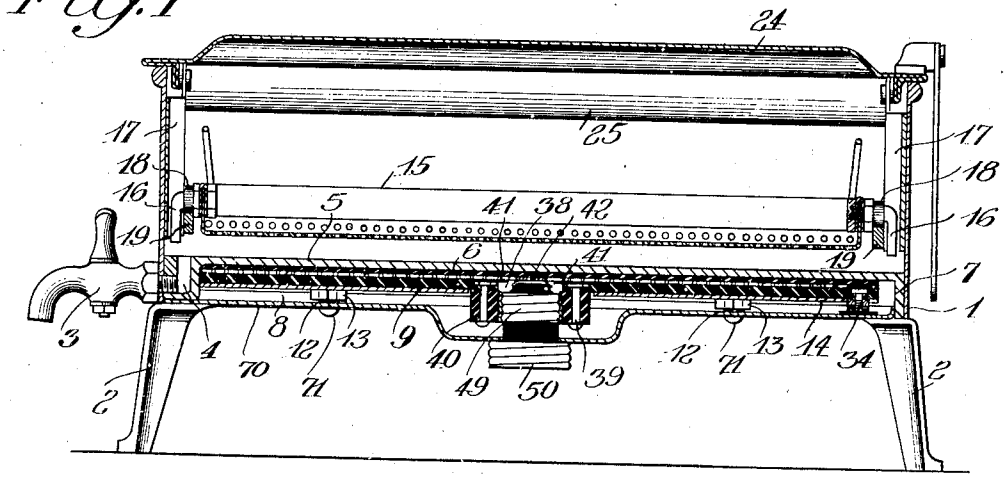



Fig. 1




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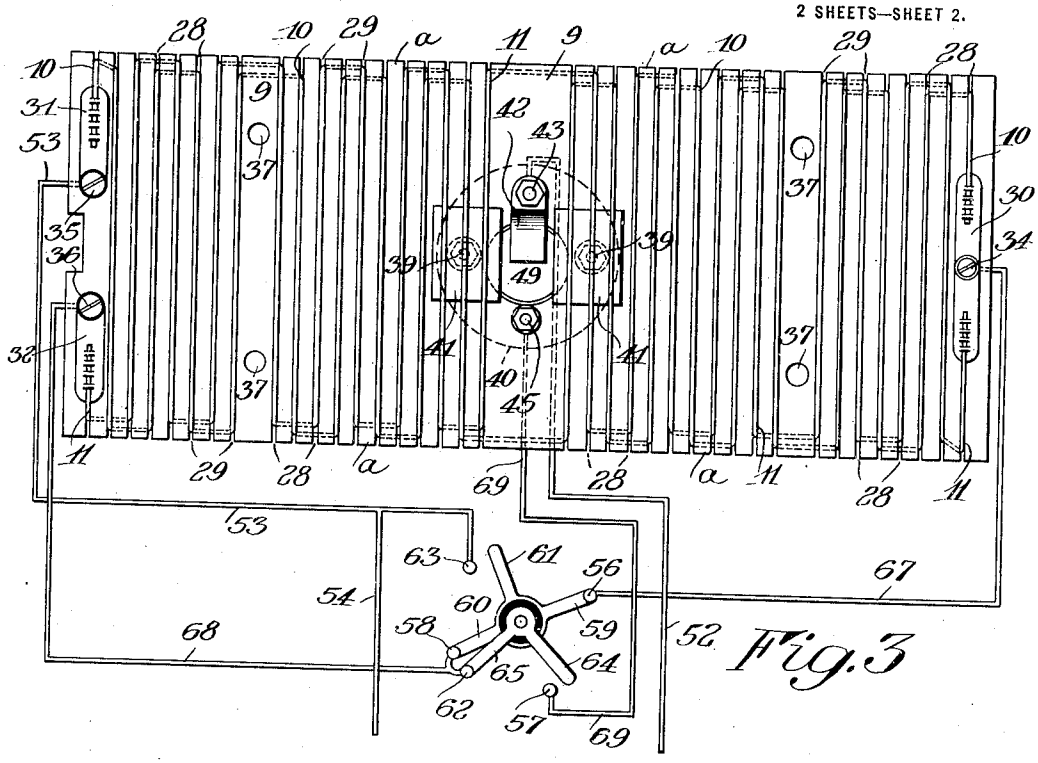



Fig. 3

Fig. 4

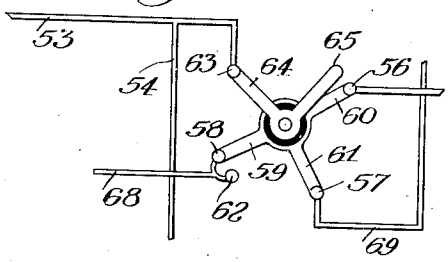



Fig. 5

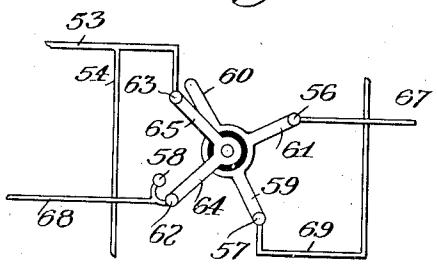
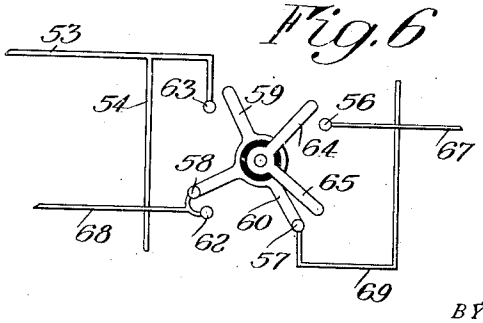



Fig. 6




INVENTOR

BY Albert H. Jessup

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# UNITED STATES PATENT OFFICE.

ALBERT H. JESSUP, OF ERIE, PENNSYLVANIA, ASSIGNOR TO AMERICAN STERILIZER COMPANY, OF ERIE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

## STERILIZER.

1,392,944. Specification of Letters Patent. Patented Oct. 11, 1921.

Original application filed July 5, 1917, Serial No. 178,535. Divided and this application filed February 3, 1920. Serial No. 355,910.

*To all whom it may concern:*

Be it known that I, ALBERT H. JESSUP, of Erie, in the county of Erie and State of Pennsylvania, have invented certain new and useful Improvements in Sterilizers; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the reference-numerals marked thereon.

This invention relates mainly to heating elements such as are used in electrically heated sterilizers adapted for general use, but more particularly designed for sterilizing surgical instruments and dressings.

This application is a division of my copending patent application filed July 5, 1917, and having Serial No. 178,535.

One object of the invention is to provide an improved heating element especially adapted for use in connection with sterilizers. In a preferred embodiment of the invention hereinafter described, I employ a plurality of resistance strips so woven or laced upon and across an insulating support that one strip is never in contact with the other while each strip presents nearly its entire surface for uniform heating effect over practically the entire area of the insulating support which is disposed to hold the strips in close heating contact with a wall of the vessel containing the sterilizing fluid or agent. In some features, the invention is applicable to sterilizers having but one resistance strip laced upon an insulating support. The improved disposal of the resistance strip or strips upon the insulating support avoids loss of electric energy incident to use of helically wound resistance strips and maintains an even distribution of heat over practically the whole area of the opposed receptacle wall. A further object is to provide a system of leads, contacts, switch terminals and wipers adapted to effect either series or parallel connections of the resistance strips with the energizing circuit and to place one strip in circuit and disconnect the other, for regulating the degree of heat imparted to the sterilizing fluid or agent in the sterilizer receptacle. To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Figure 1 is a central longitudinal sectional elevation of a sterilizer embodying the invention;

Fig. 2 is an enlarged central transverse vertical sectional view thereof;

Fig. 3 is a top plan view of the electric heating element and its leads and binding posts, and a diagram of the wiring connections thereto and to the current controlling switch, and

Figs. 4, 5 and 6 show different adjustments of the switch, for varying the electric current to the heating element.

Similar reference numerals throughout the several views indicate the same parts.

In the illustrated development of the invention as embodied in a sterilizer, the numeral 1 indicates the sterilizing fluid receptacle mounted on legs 2, and having at one end a drain cock 3 connected at an outlet 4 in the receptacle bottom plate 5, against the lower face of which is held an electrically insulating but heat conducting sheet or plate 6, preferably of mica, said parts 5, 6, together forming a laminated bottom for the receptacle 1. Said plate 5 preferably has a pendent edge flange 7 forming below the bottom a chamber 8 containing the heating element comprising a plate or support 9 of insulating material and in this instance, two separate resistance heating strips 10, 11, peculiarly wound or woven upon and across the support 9, as hereinafter more fully explained. Said strips 10, 11 are pressed against the mica plate 6 by bolts 12 fixed to the support 9, and having nuts 13 which act upon a cover plate 14 shown closely underlying the support 9, and forming a bottom for the heat conserving chamber 8. The plate 14 may be made of insulating mica or of metal.

Within the receptacle 1 is placed a vertically movable instrument holding tray 15 having opposite end angular connections 16 the vertical parts of which move within guides 17 on the receptacle end walls, and

the horizontal parts of which preferably carry anti-friction rollers 18 under which act curved lever arms 19 pivoted at 20 to said end walls and coupled at 21 to links 22 pivoted at 23 to the hinged receptacle cover 24, so that as the cover is opened and closed the tray will be automatically raised and lowered, and the cover also has a condensation drip pocket 25 provided within a flange 26 formed on or fixed to the cover near its hinge 27, all as described and claimed in my aforesaid companion patent application.

Figs. 2 and 3 of the drawings more clearly show that when two resistance strips are used, the heating element support or grid 9 of insulating material is preferably provided in its opposite edges with two sets of slots or notches 28 and 29, the former being cut relatively deeper than the latter. The deeper slots 28, at each edge of the grid are directly opposite those, 29, of less depth at its other edge, or in other words, the slots at either edge are alternately arranged as regards depth. Wound upon the grid 9 within the slots are the two above mentioned strips 10 and 11, which are preferably made of high resistance ribbon material such as "nichrome." One end of each strip 10, 11 is connected with a single resistor lead 30 held at one end of the grid, and the opposite ends of the strips 10, 11 are respectively connected with independent resistor leads 31, 32, held at the other end of the grid.

By far the larger portions of the two resistance strips 10, 11 traverse the grid only on one side or face as comparatively little of their length passes angularly underneath the tongues *a*, formed between any two adjoining slots of like depth at opposite edges of the grid, and therefore practically all of each resistance strip is in heating contact with the mica sheet 6 of the receptacle bottom, and as the strips 10, 11 are each passed from the respective leads 30, 32, alternately through deep and shallow pairs of slots 28, 29 at opposite edges of the grid 9, the two strips are always safely held out of contact with each other at all portions of the grid, as clearly shown in Fig. 3. Along its opposite slotted edges the grid 9 is cut away or rabbeted at 33 at its lower face to give room for passage of short portions of the resistance strips 10, 11, under the tongues *a* between pairs of slots 28, 29, without causing contact of the strip loops with the opposed cover plate 14 of the grid holding chamber 8, as shown in Fig. 2.

The resistor lead 30 is secured to the upper face of the grid 9 by a binding post 34, and the leads 31, 32 are respectively secured to the opposite end of the grid by binding posts 35, 36. The grid has holes 37, shown in Fig. 3, and through these holes pass the externally threaded ends of the above named bolts 12 which also pass through the cover plate 14. When the bolt nuts 13 are tightened below said plate they press it to the grid 9 and force its strips 10, 11 into intimate contact with the insulating mica plate 6 which imparts the heat of the energized strips uniformly from its entire area to the heavy cast metal bottom 5 of the receptacle 1, thus insuring more perfect radiation of the heat from the strips through the receptacle bottom than would otherwise be obtained.

The grid 9 has a central opening 38 at which is secured by bolts 39, a collar 40 of insulating material, and the retaining nuts or heads of the bolts are insulated from the grid coils 10, 11 by mica plates 41 placed over the bolts below the coils. The collar fastening bolts 39 are shown in Figs. 1 and 3, and the mica plates 41 are more clearly shown in Fig. 3. A contact finger 42 is held to the collar 40 by a bolt 43 passing through the base portion of the contact which has a pendent outer end to which a binding post 44 is secured. A diametrically opposite bolt 45 holds to the collar 40 a contact plate 46 to the outer pendent end of which a binding post 47 is secured. The inner portion of plate 46 carries a pendent threaded metal sleeve 48 which enters the collar 40. Into this sleeve is screwed a conductive ring 49 fixed to a fuse carrying plug 50 of insulating material. A fusible element 51 on the plug 50 may be put in circuit with the ring 49, and a portion of said element passes over the inner end of the plug and may connect, through the contact 42 with the grid strips 10, 11 and the line circuit. When the plug 50 is screwed fully into the sleeve 48 the fusible element 51 forces the contact 42 snugly to the bottom of the receptacle 1, so that if the latter be electrically overheated because of evaporation of its sterilizing fluid contents, the heat imparted to the fusible element 51 will melt it and thus break the circuit leading to the resistance strips 10, 11, irrespective of any possible overload of current on the line. The arrangement of the fusible plug relatively to the receptacle 1, and the resistance strips and the contacts is shown in my aforesaid companion application, No. 178,535, and is herein recited only because of its relation to the hereinafter described and claimed system of leads and switch terminals for varying the character and intensity of current passed through the heating element strips 10, 11.

One side of the line or circuit is connected with the binding post 44 through a conductor 52, while the other side is connected with the strip 10 through the binding post 35 and conductors 53, 54. A switch 55 is held to the front of the receptacle 1 for controlling the supply of current to one or both of the resistance strips 10, 11 to provide the maximum, minimum, or intermedi-

ate heat, or to discontinue the current to both strips.

The switch 55 comprises the contacts 56, 57 and 58 arranged to be engaged by the movable switch arms or brushes 59, 60 and 61, and the contacts 62 and 63 arranged to be engaged by the movable switch arms 64 and 65 which are insulated from the arms 59, 60 and 61. One end of the resistance strip 10 is connected with the contact 63 and also with the main line conductor 54 through the wire 53 while the opposite end of said strip is connected with the contact 56 through the wire 67. One end of the strip 11 is also connected with the contact 56 through the wire 67, the latter having one end connected to the lead 30 to which both strips 10, 11 are connected. The contacts 58, 62 are both connected with the other end of the strip 11 by means of the wire 68, while the contact 57 is connected with the binding post 47 by means of the wire 69.

The switch in Fig. 3 is shown in open position. When the brushes 64 and 65 are moved into engagement with the contacts 62 and 63 respectively, as shown in Fig. 4, brush 59 will engage contact 57 and brush 61 will engage contact 56, at which time the two strips or windings 10, 11 will be connected in parallel and the resistance brought to its maximum heating capacity. With the switch in this position, current will flow through main line conductor 52, fuse 51, wire 69, brushes 59 and 61, wire 67, strips 10 and 11, wires 53 and 68 through brushes 65 and 64 respectively, and thence through main line conductor 54. The next succeeding position of the switch is indicated in Fig. 5 in which only the strip 10 is in circuit. With the switch in this position the capacity of the heater is reduced to an intermediate point between "high" and "low" in which current passes through wire 69, brushes 61 and 60, wire 67, strip 10, wire 53 and thence through conductor 54. The next succeeding position of the switch is indicated in Fig. 6, in which position the minimum capacity of the heater is reached. In this case the strips 10, 11 are connected in series and current will flow through main line conductor 52, wire 69, brushes 60 and 61, wire 68, strip 11, lead 31, strip 10, wire 53 and thence through main line conductor 54. With the coils connected in series the heater is capable of bringing water to the boiling point within the receptacle, although in this position the coils are reduced to their minimum heating capacity.

The particular manner of winding and overlapping the strips upon the grid as shown in Fig. 3 affords an even distribution of heat over the entire bottom of the receptacle 1, regardless of whether or not the strips are in series or in parallel, or whether only one of said strips is in circuit. The object in this case is to provide a plurality of strips or windings extending over a given area in such a manner that regardless of whether or not one or more of the strips is in circuit, the radiation therefrom will be evenly distributed over the entire surface which the strips are intended to heat.

It will be observed that the electric resistance heating strips are woven across the upper face of the support, so that practically the entire radiating surface of each strip is used, thus avoiding the loss in energy which occurs where the resistance elements are wound helically around their supports, whereby more than one-half of their length is out of contact with the surface to be heated. Another point to which attention is directed is the fact that the convolutions of the two strips alternate from end to end of the support, thus causing an even distribution of the heat when one strip alone is utilized. In other words, where a plurality of strips is employed the convolutions of each are so disposed that all of the strips cover, or are spread over, the same given area, the intent and purpose being to heat the bottom of the sterilizer equally at all points, as this insures a quicker heating of the water, or other sterilizing medium which may be placed in the receptacle and maintains it at the desired temperature with the minimum amount of current consumption.

A second lowermost cover plate 70, preferably has an upturned edge flange fitting closely within the pendent edge flange 7 of the receptacle bottom plate 5, and also has a cupped central portion which accommodates the insulating collar 40 and has a central opening through which is passed the body portion of the fuse plug 50, and also has a small opening for passage of the line circuit wires 52, 54, all as best shown in Fig. 2. The plate 70 is shown secured by screws 71 passing upwardly into the grid fastening bolt ends 12. The plate 70 guards from dust and injury the wire connections to the grid strips 10, 11 and to the switch 50, and also assists in preventing objectionable downward radiation of heat from the apparatus.

It will be understood that within the scope of this invention the heating element insulating support or grid 9 is not necessarily slotted at opposite edges which may simply have protruding tongues *a* under and across which a single resistance strip may be looped prior to its passage from a tongue at one edge of the support, and thence over only one face thereof, to and beneath a tongue at its opposite edge. It will be obvious, however, that when a plurality of resistance strips is used the use of slots between closely arranged tongues *a* is desirable for assuring the greatest possible area of heating resistances on a grid of

comparatively small area thus producing an electrical heating element which for its size has maximum efficiency.

I claim as my invention:

1. An electric heater element comprising a support having tongues at its opposite edges, and an electric resistance strip looped under and across the tongues and traversing but one face of the support in its passage from a tongue at one edge of the support to a tongue at its opposite edge, said support having face rabbets or recesses making the tongues thinner than the main body of the support and accommodating the tongue crossing portions of the resistance strip loops.

2. An electric heater element comprising a support having tongues at its opposite edges, and an electric resistance strip looped under and across the tongues and traversing but one face of the support in its passage from a tongue at one edge of the support to a tongue at its opposite edge, said support having face rabbets or recesses making the tongues thinner than the main body of the support and accommodating the tongue crossing portions of the resistance strip loops, and a cover plate held at that face of the support not traversed by the resistance strip and clear of said strip where its loops cross the lower faces of the tongues.

3. An electric heater element comprising a support and a plurality of electric resistance strips each formed into a plurality of spaced convolutions, the convolutions of one strip being located between but out of electrical contact with the convolutions of the other strip, said convolutions extending principally upon but one face of the support.

4. In an electric heater, the combination with a support, a plurality of resistance strips each looped into a plurality of spaced convolutions overlying one face of the support, the convolutions of one strip being located between those of the other strip, said support having provision for the loops of the convolutions to hold those of one strip out of contact with those of the other strip.

5. In an electric heater, the combination with a support having alternate deep and shallow slots in its opposite edges, of electric resistance strips looped into alternate convolutions, the loops of each strip being passed through alternate pairs of deep and shallow slots and by them held out of contact.

6. In an electric heater, the combination with a support having alternate deep and shallow slots in its opposite edges, of an electric resistance strip passed over the face of the support and looped through adjacent shallow slots at one edge of the support and adjacent deep slots at the other edge, and a second resistance strip passed over the face of the support between the convolutions of the first strip and looped through the pairs of slots unoccupied by the first strip.

7. In an electric heater, the combination with a support composed of a sheet of insulating material having two parallel edges each provided with open ended alternately disposed shallow and deep slots, the deeper slots in one edge being each located in opposition to a shallow slot in the other edge, of two electric resistance heating strips disposed in alternate convolutions across one face of the support, said convolutions being held in spaced relation and out of contact by looping them alternately through the shallow slots at one edge and the deep slots at the other edge of the support.

ALBERT H. JESSUP.