

E. J. OVINGTON.

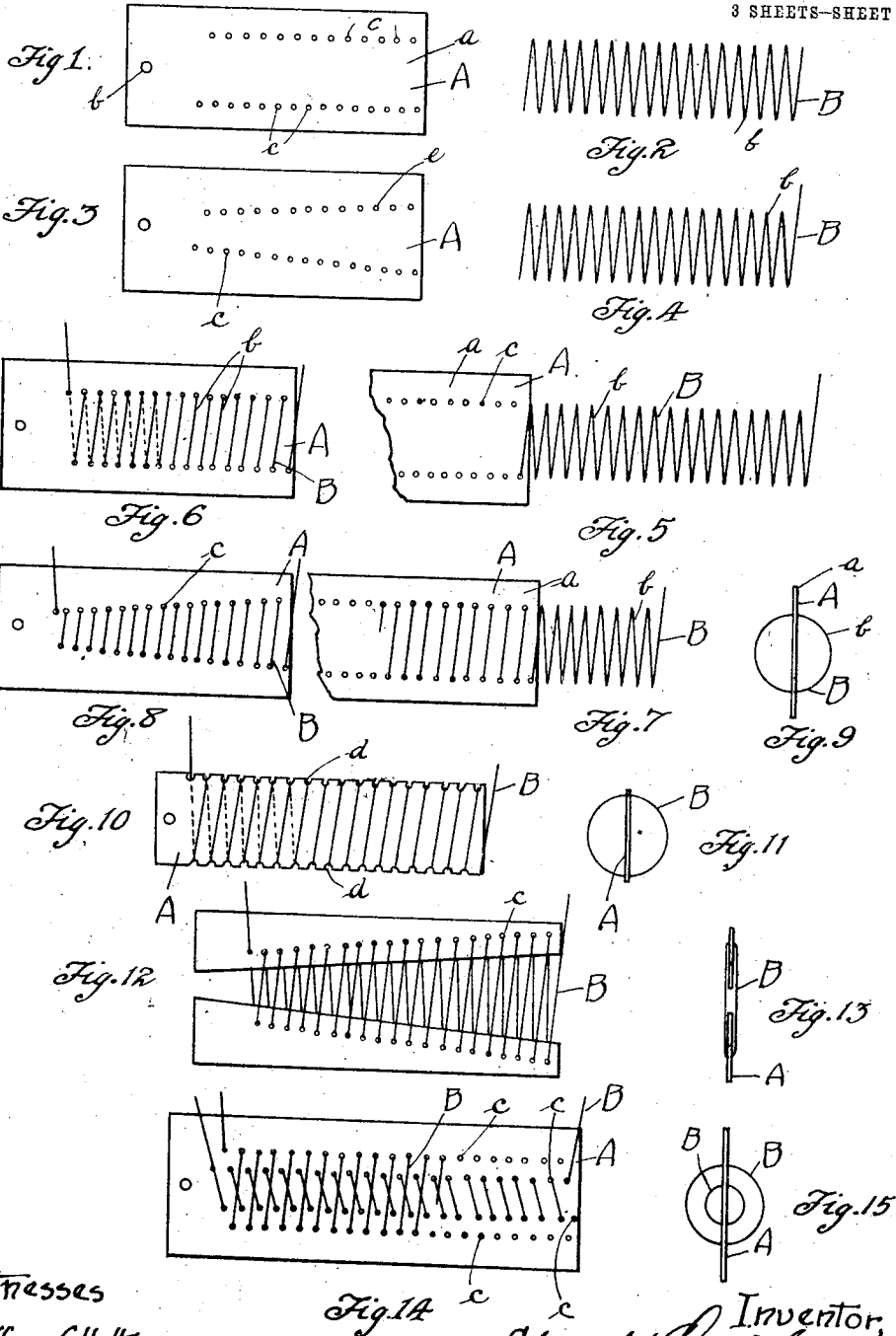
ELECTRICAL RESISTANCE UNIT.

APPLICATION FILED MAR. 3, 1911. RENEWED MAY 20, 1913.

1,077,635.

Patented Nov. 4, 1913

3 SHEETS—SHEET 1.



Witnesses

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Buel H. Green

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ELECTRICAL RESISTANCE UNIT.

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3 SHEETS—SHEET 2.

Fig. 16

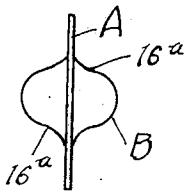


Fig. 17

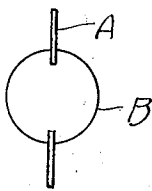


Fig. 18

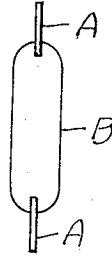


Fig. 19

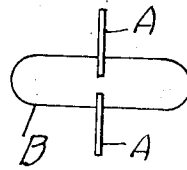


Fig. 20

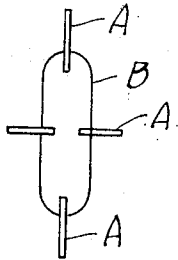


Fig. 21

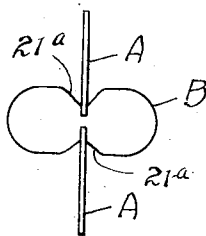


Fig. 22

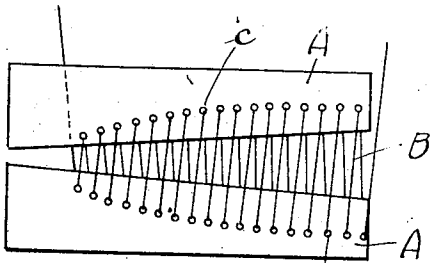
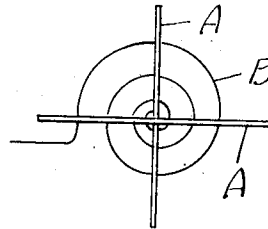


Fig. 23

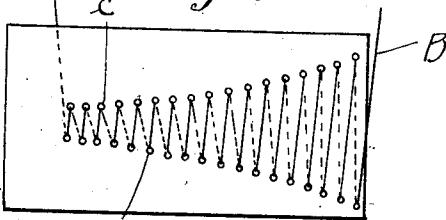


Fig. 24

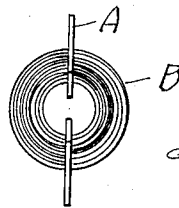


Fig. 25

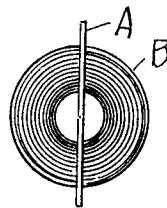


Fig. 26

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3 SHEETS—SHEET 3.

Fig. 27

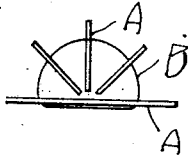


Fig. 28

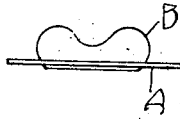


Fig. 29

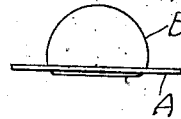


Fig. 30

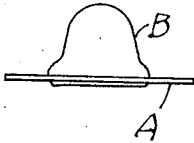


Fig. 31

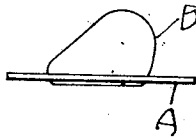


Fig. 32

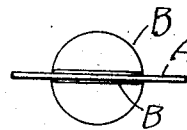


Fig. 34

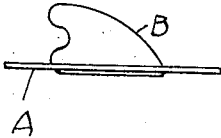
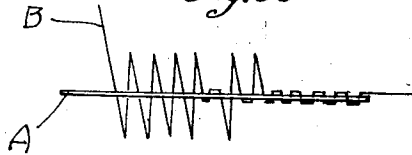


Fig. 33



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UNITED STATES PATENT OFFICE.

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ELECTRICAL RESISTANCE UNIT.

1,077,635.

Specification of Letters Patent.

Patented Nov. 4, 1913.

Application filed March 3, 1911, Serial No. 612,050. Renewed May 20, 1913. Serial No. 768,854.

To all whom it may concern:

Be it known that I, EDWARD J. OVINGTON, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Electrical Resistance Units, of which the following is a specification.

This invention relates to improvements in the construction and process of making electrical resistance units, as for the production of light and heat; and the invention has for its object the institution of improvements of the general nature stated, from the utilization and employment of which flow a large number of important advantages relating to facility, convenience, speed and accuracy of operation and a wide range of superior qualities of the resultant product or products.

According to present practice, the production and assembling of units of the general character stated has been accomplished in accordance with a variety of methods related to the nature and character of the media and parts to be dealt with, and there has apparently been no attempt to reduce such acts of production and assemblage to simply and highly effective procedure the operative results of which should constitute a fully qualified and properly organized product adapted to a wide range of uses and applications. According to the present invention, the relatively simple steps employed are each directly related to the accomplishment of definite ends and results which have to do with the highly efficient character and organization of the product or resultant unit. The insulating supporting and sustaining element or elements, and the resistance element or elements, are initially formed with reference to their facile assemblage in accordance with simple operation; and the resultant unit may then be modified in conformation, as desired, to adapt it to any specific character of service, or may be installed, in the organization resultant upon performance of the assembling operation, in any operative position or operative association for which it is structurally adapted.

Before treating specifically of the method of procedure utilized in carrying the invention into effect, it is believed proper and beneficial to enter into a brief discussion of the relation of the improved unit constitut-

ing the product of the invention, with respect to units now in general use for the purposes of converting and dissipating electrical energy, as to the relative merits, or contrasted merits and demerits of the former and the latter.

It has always been the practice, in the utilization of units for converting and dissipating electrical energy, to employ to that end a metallic agency in the form of a ribbon, wire, filament, or other attenuated body. In order to secure a very close energy-couple between the metallic resistance element and the part or body to be heated or lighted, it has been found necessary, in past practice, to hold the resistance element, preferably under pressure, in contact with the body or object to receive the energy. For the purposes of electrical insulation, a non-conducting sheet of varying thickness has ordinarily been interposed between the resistance material and the body to be heated. Asbestos has been determined to be inferior, to that end, to mica, in that mica would more easily transmit the energy; and therefore mica has more recently been used to the practical exclusion of every other insulating material.

In practice and experimentation, I have found that the heating of the resistance medium often becomes so great as to cause anhydration of the mica;—in other words, to partially or entirely expel the water of crystallization. The mica was thus left in a pearly translucent or opaque condition, and afforded increased resistance to transmission of light waves and heat waves. The result was a lessening of the utilizable radiation of energy from the resistance material, causing in turn an increased temperature of the latter which caused the mica to become still more nearly opaque and still less effective in energy transmission. The final result of such alteration of the mica would consist in the prevention of such an amount of dissipation of the heat-units generated by the resistance element, that the latter would be destroyed.

Another objection which I have discovered to the standard theories of past practice as to construction of resistance units, has been as to the high cost of the same. If the resistance element is in the form of a wire, as it most frequently is, the wire has been usually wound or coiled on a metal core usually of brass or copper, which are

expensive materials; or, if the resistance was of flat form, such as ribbon, said ribbon had to be cut so that the electrical energy would traverse an irregular or zigzag path; and the cutting of such ribbons, as by means of dies, is complicated and expensive in performance. These items of expense, entering into the production of units for the conversion and dissipation of electrical energy, have been so great that the principle involved has not been applied to practical purposes as much as the merits of the same, involving convenience and efficiency, should warrant. In practice as well as theory, electrical heating appliances are of approximately 100% efficiency, excepting under circumstances in which a strong magnetic field is maintained, and this is very seldom the case.

Leading up to the present invention, I have endeavored to eliminate all these faults and objections, as above enumerated, and the many attendant defects and objections present and to be met with in the art in accordance with standard practice; and my invention provides a simple and effective method of producing and assembling electrical energy converting and dissipating units, which units in themselves are devoid of the objections urged above. I do not necessarily employ mica or any other insulating material as insulation between the heat-producing element and the heated part or element. On the contrary, I use primarily space insulation. It is true that the heat-producing or resistance material is maintained at a relatively high temperature in service; but resistance materials are now to be had commercially that will withstand such temperatures without deterioration, and which are of relatively low cost.

As heretofore stated, the resistance material, in standard practice, has been held very close to the part or object to be heated, and if the latter were of low heat conductivity, the construction was faulty because of the relatively small area of the heated part in thermal contact with the heating element. In accordance with the results obtained in utilizing my invention, and the products thereof, the relation of the surface of the heated part exposed to the light or heat waves from the heat-producing part is greatly increased; and consequently the wattage per square inch is relatively low, and a proper dispersion of heat units over the entire heated part, or the surface thereof, is caused. In accordance with the invention, I coil the resistance material, in attenuated form, through a relatively thin insulating medium, such as mica sheet; and the turns or loops of the coil are held in spaced relation by said sheet. As the wire enters the sheet, or openings or notches therein, substantially at right angles to the

plane thereof, the length of the resistance medium that is covered by the mica, at any one point, is relatively slight. In practice, about 99% of the resistance medium is free to radiate its energy through the ether of space to surrounding objects or parts to be heated, with nothing intervening except space and such atmosphere as may be contained therein. The energy is therefore not dependent upon the insulating sheet or medium for transmission to the part or object to be resultantly heated, and the mica therefore does not oppose any interference to dispersion of the energy, as it does, when it has a transmitting function because of the deterioration which always occurs. And, of course, the generated heat is not retarded by the mica in such manner as to lead to the destruction of the resistance medium in the manner above pointed out when treating of past practice. Nor do I necessarily employ any metallic core, about which to wind or otherwise dispose the resistance element, and thus obviate the expense involved in the provision of such core. The entire volume of heat or light thrown off by the resistance medium is transmitted through space directly to the body or object which is to be resultantly heated, over which latter the energy is properly distributed so as to obtain a highly efficient thermal result, without any thermal contact of the heated part and the heating part.

I am aware that there have been issued Letters Patent, No. 853,892, that disclose a resistance wire sustained somewhat in the manner that I support the same in carrying my invention into effect. From the specification of said patent however, it is very plainly evident that all of the resistance wire, down to the last end of the same, must be passed through one opening or perforation in the insulating sheet, before the passage of the same through successive openings in the sheet. In other words, the resistance wire is sewed through the sheet. This is a very extensive and costly operation, and so much so that it has proved to be impracticable and has not been commercially adopted to any extent during the four years which have elapsed since the issuance of said Letters Patent.

In carrying out the present invention, I first provide a suitably formed insulating body or bodies, relatively thin or consisting of a sheet or sheets, as of mica; and also one or more properly coiled resistance elements, as of wire; and then by suitably holding the same and bringing the same together, and imparting the proper relative movement to the same, I cause the assemblage of the entire electrical energy converting and dissipating unit which is the product of the performance stated. The product may be then given such ultimate conformation as

is desired or necessary or expedient to adapt it to any predetermined condition of service or operative association, and the entirety is completely organized for use and to fulfil all the conditions and requirements above set forth, with the attendant advantages enumerated, and in the use of which are obviated the many disadvantages above set forth with reference to the present standard practice.

With the above and other objects in view, the invention consists in the novel, simple, inexpensive, economical and speedy improvements in the art of producing and assembling electrical energy converting and dissipating units, all as hereinafter described, shown and indicated in the drawings, and finally set forth in the claims.

In the drawings: Figure 1 is a side view of an insulating element formed for association with a resistance element having the form shown in side elevation in Fig. 2; Figs. 3 and 4 are similar views of similar elements formed for the production of a slightly different resultant product; Fig. 5 is a side elevation of the elements shown in Figs. 1 and 2, just after the commencement of the operation of assembling the same; Fig. 6 is a side elevation of the elements shown in Fig. 5 after completion of the assemblage; Fig. 7 is a similar view of the elements shown in Figs. 5 and 6, during the operation of assembling the same; Fig. 8 is a view similar to Fig. 6 showing the elements in Figs. 3 and 4 in finally assembled association; Fig. 9 is an end view of the assemblage shown in Fig. 6; Fig. 10 is a side elevation similar to that of Fig. 6, showing another form of insulating element; Fig. 11 is an end elevation of the same; Fig. 12 is a side elevation of the product shown in Fig. 8, the same being altered by longitudinal severance of the insulating element, to produce a transversely flattened formation of the entirety, as shown in end elevation in Fig. 13; Fig. 14 is a side elevation of an assemblage similar to that shown in Fig. 6, a plurality of resistance elements being shown in association with a single insulating element; Fig. 15 is an end elevation of the assemblage shown in Fig. 14; Fig. 16 is a view similar to Fig. 9 showing the resistance element in condition subsequent to distortion from perfect helical form; Figs. 17, 18, 19, 20 and 21 are views similar to Fig. 9, showing a single resistance element in assemblage with a plurality of insulating elements, the resistance element being developed or distorted into various final operative forms or conformations, with the exception of Fig. 17 in which the normal helical form is retained; Fig. 22 is a view similar to Fig. 9 showing a true spiral resistance element assembled with a plurality of insulating elements in rectangular relation; Fig. 23 is a view similar to Fig. 8, the in-

insulating element being split longitudinally, and the resistance element being associated therewith in a form at variance with a true helix; Fig. 24 is an end elevation of the showing in Fig. 23; Fig. 25 is a view similar to Fig. 23, the insulating element being at variance with a true helix, according to an arbitrary conformation essentially the reverse in nature of that of the showing in Fig. 23; Fig. 26 is an end elevation of the showing in Fig. 25; Figs. 27, 28, 29, 30, 31 and 32 are respectively end views or elevations of varied products resultant upon practice of the present invention, and showing the resistance element distorted or contorted, or peculiarly disposed as to the turns, or bends, or portions thereof, in connection with and with relation to the insulating element; Fig. 33 is an edge view or side elevation of the product shown in Fig. 32; and, Fig. 34 is an edge view of a further varied product.

Corresponding parts in all the figures are denoted by the same reference characters.

Referring with particularity to the drawings, in each figure of the same the insulating element or element-part is designated by the general reference character A, and the resistance element or element-part is designated by the general reference character B. In producing each and all of the resultant forms of units disclosed in the several figures, the insulating element or element-part is suitably formed by notching, recessing or perforating, to receive the several turns or loops or coil-parts of the resistance element or element-part, which latter is or are suitably formed or shaped or contorted or twisted to permit of assemblage or final association of the resistance element or element-part with the insulating element or element-part resultant upon bringing said elements or element-parts together and causing relative movement of the same upon a common axis; whereupon the resistance element or element-parts enter the openings or perforations or recesses or notches in the insulating element or element-part, with the final result that the turns or loops or coil-portions of the resistance element or resistance element-parts are held in spaced relation in connection with the insulating element or element-part.

Referring specifically to Figs. 1, 2, 5, 7, 6 and 9 will serve to make clear the sequence of operations above specified, and the nature of the same and of the product resulting from the performance thereof. The showing in each and all of the other figures departs from the showing in the figures last referred to only as relates to specific modification as to step-performance and resultant product, together with the addition of merely incidental and secondary operations upon which the ultimate variations of product-conformation and organization are dependent.

These incidental factors and variations and features will be referred to briefly farther on.

In Figs. 1, 3, 5, 6, 7 and 9 is shown a relatively thin insulating body, or sheet, adjacent to one end of which is produced a transverse perforation *b*, which may serve to accommodate attachment or supporting means; and two parallel spaced rows of perforations *c* are produced through the sheet *a*, longitudinally of the same. The resistance element *B* consists of a single length of suitable resistance wire, or equivalent attenuated material *b*, which is suitably formed into a helix, the diameter of the cylindrical formation of which is equivalent to the distance between the spaced rows of perforations *c* in the insulating sheet *a*; and the perforations *c* are arranged in staggered relation, as between the two rows of the same, in conformity with the relative spacing of the turns or loops of the helical coil into which the resistance wire *b* is formed. The coil of resistance element *b* is then brought into end-to-end relation with the insulating sheet *a*, as shown in Fig. 5, so that the longitudinal central axis of the coil *b* is in alignment with a longitudinal axis of the sheet *a* lying between and equi-distant from the rows of perforations *c*. The coil and the sheet are then relatively rotated, upon such common axis, as by holding the sheet and rotating the coil, and the turns of the coil take into or successively enter and traverse the opening *c* of both rows of the same, in a continuous progression as indicated in Fig. 7, until all of the perforations *c* are occupied by minute portions of the turns of the coil *b*, as shown in Figs. 6 and 9. Each complete turn of the coil is now sustained or supported by the insulating sheet at two diametrically opposed points or portions of the same, and the intermediate portions of the turns of the coil passing through the sheet at substantially right angles to the plane of the sheet, only very small portions of the coil and the turns thereof are covered by the insulating material.

In practice, as above stated, nearly 99% of the resistance material is freely suspended, so that it may radiate its energy through surrounding space to surrounding objects, through the ether of space, and not necessarily through the insulating sheet. The complete dispersion of the heat-energy produced upon electrically energizing the resistance element, prevents the over-heating of the resistance element to an extent which would cause its disintegration or combustion were the dispersion of such heat units dependent upon transmission through the insulating sheet. The resultant product, shown in Figs. 6 and 9, may now be installed in working position in connection with any object or part to be

heated; and the surface portions of such heated part or parts may be predetermined with relation to the heat-units dissipated by the resistance material, so that the proper effective absorption of heat units may occur, and highly efficient heating occurs with a very low wattage per square inch of heated surface. Manifestly, I do not depend upon sustaining the resistance element directly in contact with or very close to the object or part to be heated; but by employing space insulation I am enabled to predetermine the heat-unit-supply per surface-unit of the object or part to be heated and to do away with the interposition of any insulating medium such as mica, between the resistance element and the object or part to be heated.

It will be noted that I do not depend upon any such elaborate performance as sewing the resistance element through the insulating element, to produce the resultant unit which I conveniently and perfectly obtain in accordance with the simple and expeditious and accurate performance or sequence of operations above set forth. Any suitable means may be employed for holding the resistance element and the insulating element during the relative movement whereby I bring the same into assembled relation. Preferably when openings through the insulating element are employed, as in a majority of the figures, the insulating element is suitably held at the margins of the latter element, where such holding does not interfere with the assembling operation. And when such elements are thus assembled the unit product is completed, unless it be desired to contort or bend or alter the same structurally, into any of the forms suggestively shown in Figs. 16, 18, 19, 20, 22, 30, and 21, or any other forms, whereby the dispersion of the energy of the heat-units may be adapted to specific working conditions to be met with. In Figs. 16 and 21 I have shown at 16^a and 21^a respectively, bends or distortions in the resistance element *B* which serve to confine the turns of the resistance coil to exact and fixed positions, as against relative movement of the same and the insulating element or element parts *A*.

In Figs. 17, 18, 19, 20, 21, 23, 27 and 24 I have shown the resistance element *B* as assembled with a plurality of insulating elements or element-parts *A*, enabling the distortion or bending of the turns of the coil in each instance by relatively moving or separating the insulating element-parts after assembling the same with the resistance element.

In Figs. 10 and 11 I have shown the insulating element as provided with spaced rows of marginal notches *d*, in substitution for the spaced rows of perforations *c*.

In Figs. 3 and 8 I have shown a converg-

ent relation as between rows of perforations *c* corresponding to the perforations *c*, whereby the resultant assemblage of the helical resistance coil B and the insulating element A is that of a modified spiral formation of the resistance element in the completed product.

In Figs. 12 and 13 I have shown the product illustrated in Fig. 8 in the form assumed after longitudinally splitting the insulating sheet A and then flattening the resistance coil B.

In Figs. 14 and 15 I have shown the insulating element as provided with two pairs of spaced rows of perforations *c*, in parallel relation, whereby two concentrically disposed resistance element coils B oppositely turned, may be accommodated thereby.

In Figs. 23 and 25, the modified spiral formation of the resistance element coil B is shown as still further modified, the showing in each of Figs. 24 and 26 being respectively related thereto. The rows of perforations *c* are relatively extended properly to produce the results shown in said figures.

In Fig. 22 I have shown the resistance element coil B as spirally disposed in connection with two rectangularly connected insulating elements A.

In Figs. 27 to 34 inclusive I have shown products organized in practising the invention in which more radical distortions or contortions or arbitrary dispositions of the bends or portions of the coils of resistance elements are shown, such results being obtained after the assemblage of the insulating element or element-parts and the resistance element, in each case. In all of said figures but Figs. 32 and 33, the resistance element is shown as disposed in particular and peculiar arrangement so that all the free projection of the portions of the coils thereof is at one side of the insulating sheet, whereby the major portion of heat-energy radiations occurs at that side of the sheet; and the peculiar conformation or disposition given the parts of the coil in each instance determines the projection of the heat units, all as may be predetermined with respect to the nature of service concerned.

In Fig. 27 a plurality of insulating sheets are shown divergently projecting from the main or supporting sheet. The supplemental sheets act as spacing insulators or carriers for the turns of the coil of the resistance element, which latter is assembled in connection with the same in the same manner as with the main insulating body or carrier.

In Figs. 32 and 33 is illustrated the radical alterations which may be made as to disposition and arrangement of the portions of the turns of the coil initially assembled with the insulating element, by flat-

tening the turns and advancing the resistance element farther through the openings in the insulating sheet and distorting the turns of the coil laterally in a predetermined manner all as may best serve the purposes of the particular utilization of heat units 70 involved.

It is manifest that a wide variety of means may be employed in carrying the invention into effect; and the invention is not dependent upon the employment of any certain means to that end; and I reserve the right to a wide range of procedure without departing from the spirit of the invention and the terms of the following claims.

Having thus described my invention, I claim and desire to secure by Letters Patent:

1. An electrical resistance unit including a flat insulating sheet having rows of perforations therein, the said perforations of the rows having a staggered relation to each other and being spaced from the edges of the insulating sheet to provide marginal portions of the sheet adapted to be grasped for supporting the same, and a coiled resistance element associated with the perforated insulating sheet and supported thereby, the convolutions of the resistance element passing through the perforations of the two rows and the coiled resistance element being applied to the insulating sheet by screwing the same into the perforations.

2. An electrical resistance unit including relatively movable insulating members having corresponding rows of perforations therein, and a coiled resistance element associated with the insulating members, the convolutions of the resistance element being applied to the insulating members by screwing the same into the perforations thereof, the relative movement of the insulating members serving to bend the convolutions of the resistance element so as to prevent axial rotation thereof.

3. An electrical resistance unit including a flat insulating sheet having a plurality of pairs of rows of perforations therein, the distance between the rows of perforations of the various pairs being different, and a coiled resistance element for each pair of rows of perforations, the diameter of each resistance element corresponding to the distance between the rows of perforations of the corresponding pair and the said resistance elements being associated with the insulating sheet and supported thereby with the convolutions of the resistance elements passing through the perforations of the corresponding rows, the said resistance elements being applied to the insulating sheet by screwing the same into the perforations and the rows of perforations being so ar-

ranged that the smaller coiled resistance element is located within the larger coiled resistance element.

4. The process of producing electrical resistance units which consists in screwing a coiled resistance member through rows of openings formed in an insulating element, severing the insulating element between the rows of perforations, and then producing relative movement of the severed portions of

the insulating member to bend the convolutions of the resistance coil.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

EDWARD J. OVINGTON.

Witnesses:

C. P. WARDEN,

RAYMOND I. BLAKESLEE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."