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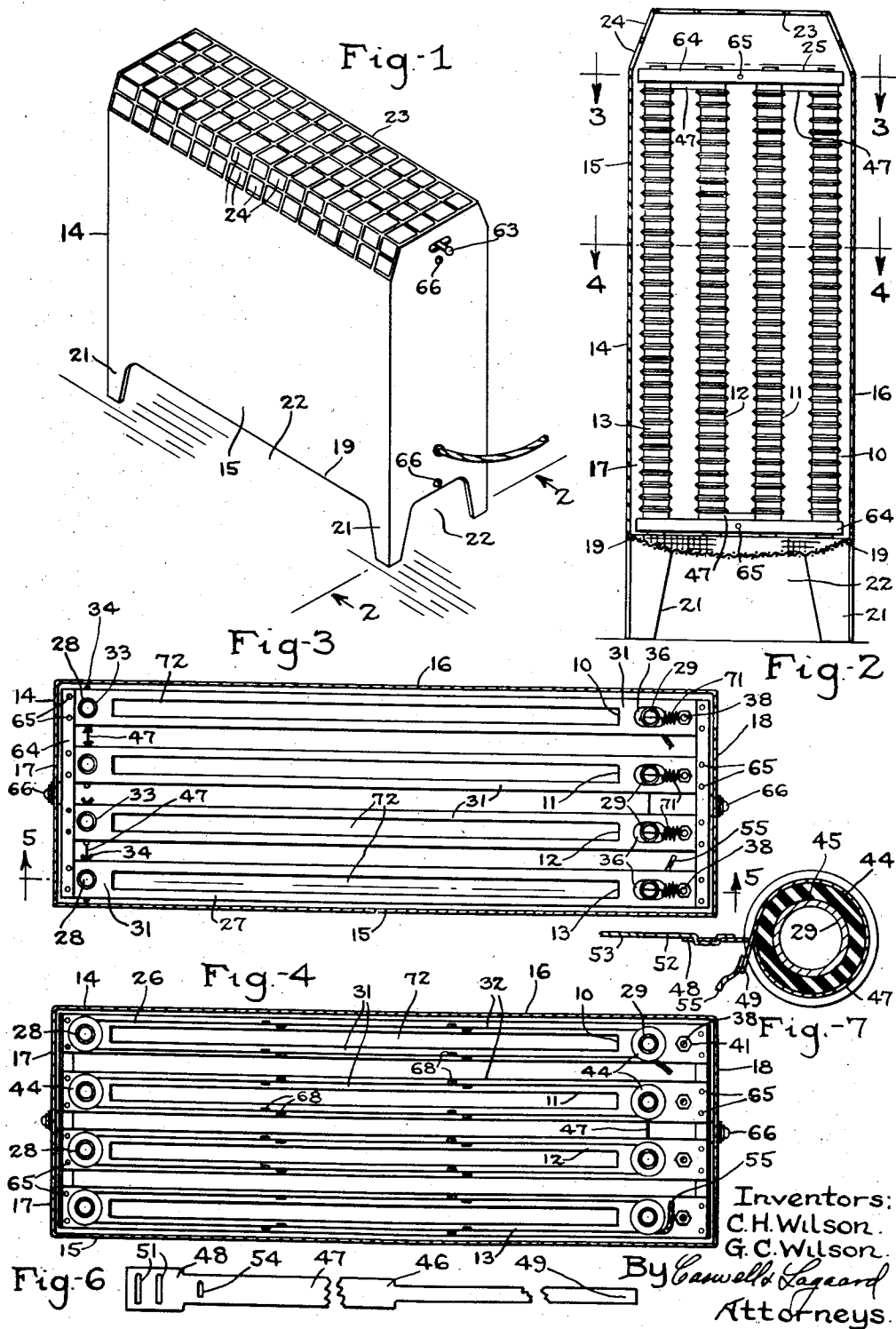
C. H. WILSON ET AL

2,268,233

HEATER

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HEATER

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Fig-5

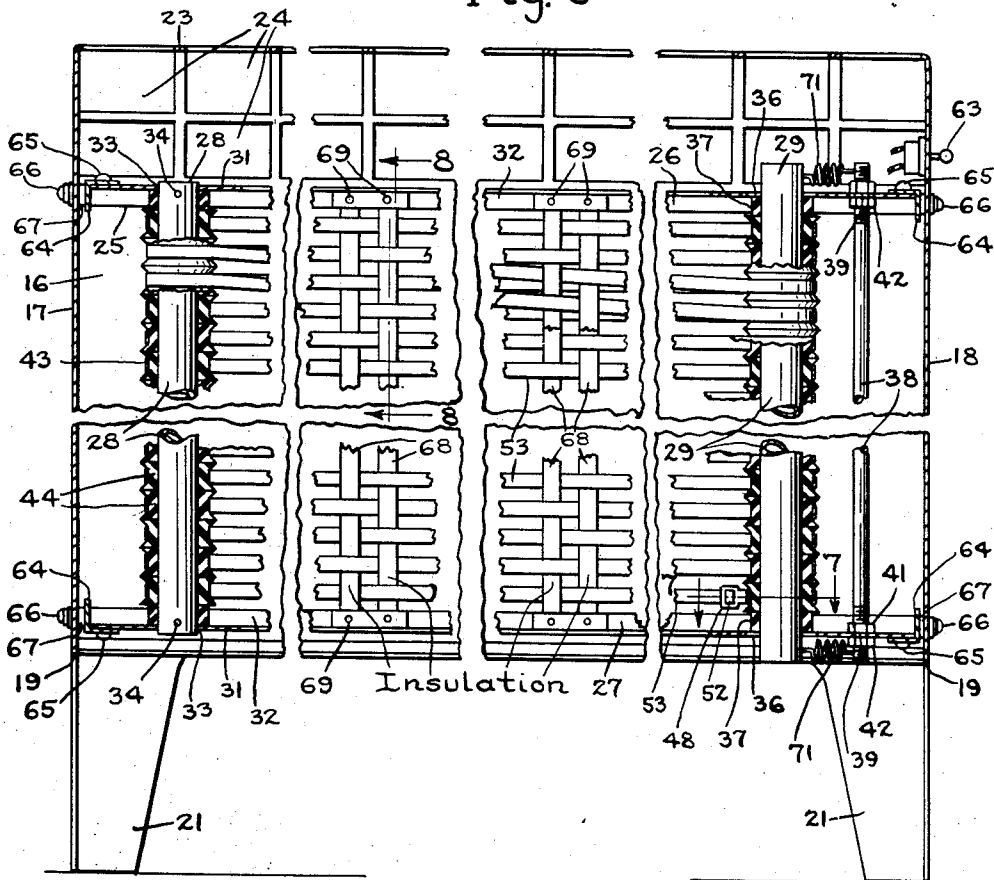
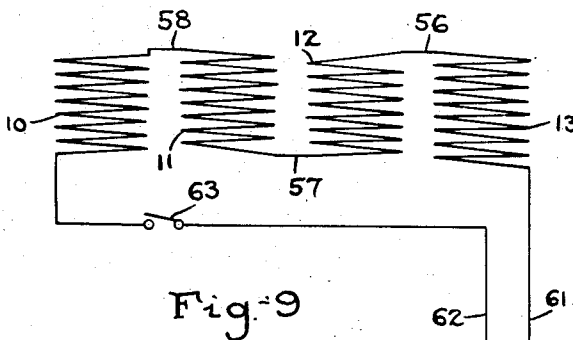
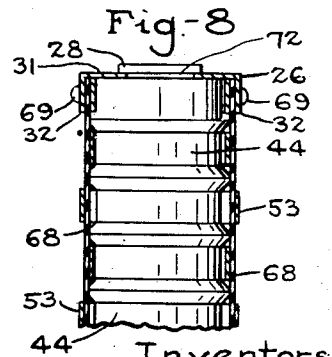


Fig-9



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UNITED STATES PATENT OFFICE

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HEATER

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12 Claims. (Cl. 219—38)

Our invention relates to space heaters and particularly to space heaters heated by electricity and has for an object to provide an extremely simple and practical construction for the purpose.

Another object of the invention resides in providing a space heater which is extremely efficient in operation.

A still further object of the invention resides in providing a space heater particularly adapted to be used for heating rooms in buildings and which will operate to produce relatively great heat transfer at room temperatures.

Another object of the invention resides in providing a space heater using a heating element of extremely low electrical resistance and having an extremely great area to which the air to be heated is subjected.

A feature of the invention resides in constructing the heating element of the heater preferably from a ribbon and having an electrical resistance of not over 20 ohms per mil foot.

Another object of the invention resides in constructing the heating element with a superficial area of not less than two square feet per ohm.

A still further object of the invention resides in constructing the heating element of a metal ribbon formed from copper, aluminum, or some alloy using either copper or aluminum.

An object of the invention resides in constructing the ribbon of a thickness between .001 and .005 of an inch and of a width of not less than one-eighth of an inch when the element is formed of copper or a copper alloy.

A still further object of the invention resides in providing a frame for supporting the heating element, said frame including four frame members, two of said frame members having supporting insulators thereon about which the heating element is wound and in constructing one of said frame members non-magnetic.

A feature of the invention resides in providing means for compensating for expansion and contraction of the convolutions of the heating element.

Another object of the invention resides in constructing the frame so that air passes over both surfaces of the convolutions of the heating element.

Another object of the invention resides in constructing the heating element from a copper ribbon plated with silver.

A still further object of the invention resides

in applying to the plated copper ribbon a dead black coating.

A feature of the invention resides in weaving in between the convolutions of the ribbon insulating strips serving to support the same intermediate the frame members on which the insulators supporting the convolutions are carried.

An object of the invention resides in providing a case for the heating units arranged to permit of rapid circulation of air past the heating elements.

Other objects of the invention reside in the novel combination and arrangement of parts and in the details of construction hereinafter illustrated and/or described.

In the drawings:

Fig. 1 is a perspective view of a space heater illustrating an embodiment of my invention.

Fig. 2 is an elevational sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a plan sectional view taken on line 3—3 of Fig. 2.

Fig. 4 is a plan sectional view taken on line 4—4 of Fig. 2.

Fig. 5 is a longitudinal elevational sectional view taken on line 5—5 of Fig. 3.

Fig. 6 is an elevational view of one of the fasteners for the heating element.

Fig. 7 is an elevational sectional view taken on line 7—7 of Fig. 5 and showing the manner of attaching the end of the heating element to the insulator on which it is supported.

Fig. 8 is an elevational sectional detail view of one of the heating units taken on line 8—8 of Fig. 5 and drawn to a greater scale.

Fig. 9 is a wiring diagram of the invention.

In the heating of space by electrical heaters it has been the custom to utilize heaters having resistance coils of relatively high resistance constructed of nickle-chromium alloy wire operated at relatively high temperatures. Heaters utilizing such resistance elements have been found to require an exceedingly great current consumption for the amount of heat delivered to the space so that the use thereof has been exceedingly limited and the cost becomes exorbitant when compared with coal, petroleum oil and gas used for heating purposes. We have found that by utilizing a heating element having an extremely low resistance such as copper and similar metals and in constructing such an element with an extremely great surface to which the air to be heated is subjected and by greatly increasing the length of the heating element that results far in advance of the results procured by

the ordinary form of heater have been possible. We have found that, where rooms are maintained at a predetermined temperature, only a part of the current consumption is required to maintain the room at the desired temperature when utilizing our invention as compared with electrical heaters such as are now in common use.

The invention comprises a number of heating units 10, 11, 12 and 13 which are all mounted in a case 14 in a manner so that the air to be heated passes upwardly through the case and past the various heating elements of the units. Inasmuch as the heating units 10, 11, 12 and 13 are all similar in construction, only the heating unit 13 will be described in detail which is best shown in Figs. 3, 4 and 5.

The case 14 is constructed with a front wall 15, a rear wall 16 and end walls 17 and 18. These walls may be formed of sheet metal and are connected together in accordance with the usual practice by welding or folded seams or in any other suitable manner. The lowermost portions of these walls are cut away as designated at 19 to form legs 21 at the corners of the case and leave openings 22 between the legs which provide inlets for air into the case. The case 14 is provided with a top 23, which, as illustrated, is reticulate in form and provides numerous openings 24 from which the heated air may escape into the room in which the heater is used.

The heating unit 13 comprises a rectangular frame 25 formed with upper and lower horizontal frame members 26 and 27 and vertical frame members 28 and 29 connected thereto. The frame members 26 and 27 are channel shaped having webs 31 and flanges 32 issuing outwardly therefrom. The frame members 28 and 29 are tubular and are attached to the frame members 26 and 27 in the following manner: The frame member 28 extends through two openings 33 in the webs 31 of the horizontal frame members 26 and 27. Cotter pins 34 project through the flanges 32 of said frame member and also through the ends of the tubular frame member 28. The frame member 29 is slidably mounted in two slots 36 formed in the webs 31 of the frame members 26 and 27. Two collars 37, secured to the frame member 29, slide along the facing surfaces of the webs 31 and hold the ends of the frame member 29 projecting through the slots 36. The slots 36 are inwardly of the extreme ends of the frame members 26 and 27, as best shown in Fig. 5. Outwardly beyond the frame member 29 is a stay-bolt 38 which passes directly through suitable openings 39 in the said frame members. Nuts 41 and 42, screwed upon the ends of the stay-bolt 38, rigidly secure said stay-bolt to the frame members 26 and 27 and hold the ends of said frame members in fixed relation so that the frame member 29 may slide in the slots 36.

The heating unit 13 includes a heating element 43 which is constructed from a ribbon of some suitable metal such as copper, aluminum or some alloy of either of these metals. This ribbon is supported on a number of insulators 44 which are in the nature of spools and which are rotatably mounted one above the other on the two frame members 28 and 29. The ribbon from which the heating element 43 is constructed is attached to the lowermost spool 45 on the frame member 29 by means of fastener 46 shown in Fig. 6. This fastener is constructed from a relatively thick sheet of copper or other elec-

trical conductor which is provided with a body portion 47. At one end of the said body portion is formed an enlarged part 48 and at its other end a tongue 49. The head 48 has two slots 51 therein through which the end 52 of the ribbon 53 is threaded. The extreme end of the ribbon may be soldered to the fastener 46 or the same may be merely bent over and thus held in place. The body 47 of the fastener 46 is wound about the spool 45, as shown in Fig. 7, and the tongue 49 thereof threaded through another slot 54 formed in the body 47. A suitable conductor 55 is connected to the tongue 49 by means of which current may be furnished to the ribbon 53. The ribbon 53 is wound successively about the various insulators 44 so that a number of convolutions are provided, one above the other, as shown in Figs. 2 and 5. The uppermost end of the last convolution of the ribbon 53 is then anchored to the uppermost insulator in the same manner.

In Fig. 9 I have shown the method of connecting the heating units together from which it will become evident that the units are connected in series by means of conductors 56, 57 and 58. The ends of the heating elements of the heating units 10 and 13 are connected to a line 61-62 from which electrical energy may be derived. A switch 63 included in the circuit serves to energize and de-energize the heating units.

The heating units 10, 11, 12 and 13 are supported in the case 14 in the following manner: Extending transversely across the upper and lower ends of the various frame members 26 and 27 of the respective heating units are angle supports 64. These supports are attached by means of rivets or screws 65 to the ends of the webs of the frame members 26 and 27. These supports hold the units in spaced relation, as shown in Figs. 3 and 4, so that air may circulate upwardly freely therebetween. The angle supports 64 are attached by means of bolts 66 to the end walls 17 and 18 of the case 14, which bolts pass through suitable rubber bushings 67 carried by said walls. The bushings 67 prevent vibration being set up in the case and eliminate noise from the heating unit.

To further reduce noise, in the various heating units, one of the frame members 26, 27, 28 or 29 is made of non-magnetic material. Due to the great number of convolutions utilized in each heating element, a magnetic flux is set up within the same. When the various frame members are all constructed out of iron and alternating current is utilized to energize the heating element, a hum is produced which is quite undesirable. By constructing one of the frame members of brass, copper or aluminum or some other non-magnetic material, the core structure through which the flux passes is so broken up that the hum is almost entirely eliminated. We have found that constructing either of the frame members 28 or 29 of non-magnetic material will produce the desired results.

In order to support the convolution of the ribbon 53 intermediate the ends thereof, we utilize pairs of insulating strips 68 preferably formed of mica which are woven between the various convolutions of the heating element and which are attached to the flanges 32 of the frame members 26 and 27 by means of rivets 69. Where the heater is relatively short one pair of such insulating strips is all that is required. Where the heater is long any number of pairs of such strips may be used as become

necessary. These strips prevent the heating elements from coming in contact with one another and prevent sagging thereof particularly when the heater is in operation.

When the heating element of the heating unit is energized, the length of the ribbon from which the same is constructed greatly increased due to expansion occurring through increase in temperature. To compensate for such expansion, the frame member 29 is slidably mounted in the slots 36 in the frame members 26 and 27, as previously pointed out. Two springs 11 are anchored on the ends of the stay-bolt 38 and are also attached to the protruding ends of the frame member 29 and serve to draw the frame member in a direction away from the frame member 28 and toward the stay-bolt 38. This takes up the slack occasioned through the expansion of the heating element and maintains the convolutions of the heating element taut during operation of the heater.

We have found in experimenting with our invention that a ribbon constructed from copper and of a thickness between .001 and .005 of an inch and of a width not less than one-eighth of an inch operates satisfactory. The length of the ribbon used in the heater is such that the temperature of the heater during operation is maintained at approximately 283° F. When the heater is operated at a temperature between 250° F. and 300° F. the maximum amount of air flows past the convolution of the ribbon constituting the heating element and an extremely great heat transfer is procured. The ribbon is preferably plated with silver and a dead black coating applied to the exterior of the same. This produces transfer of heat by radiation as well as by convection so that maximum heat transfer occurs. We have found that satisfactory results are produced where the electrical resistance of the heating element is not over 20 ohms per mil foot and where the superficial area of the ribbon from which the heating element is constructed, is not less than two square feet per ohm. In a number of heaters constructed and satisfactorily tested by us we employed silver plated copper ribbon of a thickness of .002 of an inch and one-quarter of an inch wide and coated with a coating of lamp black in Japan.

To assist in circulating the air past both surfaces of the ribbon 53 forming the heating elements of the various heating units the webs 31 of the frame members 26 and 27 of the frames 25 are formed with longitudinally extending slots 72. The air on entering the case 14 through the openings 22 passes upwardly between the various heating units to contact the heating elements on the outer surfaces of the ribbons forming the same and also upwardly through the slots 72 in the frame members 26 and 27 and past the inner surfaces of the said heating elements. In this way the air is rapidly conducted past both surfaces of the heating elements to cause an extremely rapid transfer of heat.

In the operation of our invention we have found that rooms could be heated with only a portion of the current consumption necessary in heating with ordinary types of heaters utilizing nickel-chromium heating elements. In one such case a room of 2400 cubic feet was first heated with a nichrome heater drawing 1350 watts. At the time the outside temperature was 55 degrees and wind velocity 12 miles per hour in a northeasterly direction. With the inside temperature at 72 degrees, it took exactly 50 minutes to raise

the temperature to 77 degrees, a rise of 5 degrees. A heater embodying our invention and drawing 1250 watts was then installed in the same room and at the same locality; the outside temperature had, however, dropped to 46 degrees, the wind velocity remaining the same at 12 miles per hour in a northeasterly direction. The inside temperature was again 72 degrees. With the heater constructed in accordance with our invention, it took exactly 24 minutes to bring the temperature from 72 degrees to 77 degrees, a 5-degree rise in temperature. Since the cooling of the room back to 72 degrees would be the same, regardless of which heater was used, as long as the heater were turned off it would become evident that the heater utilizing our invention would be on for less than one-half the time required by the heater using nickel-chromium wire.

The advantages of our invention are manifest. The heater is extremely simple and practical in construction and can be readily manufactured at a nominal expense. The materials used in the construction of the heater are relatively inexpensive. With our improved heater there are no parts to get out of order and the heater will operate indefinitely without attention. The heater of our invention is extremely compact and a heater of relatively small dimensions will operate to heat a relatively large room or space. Due to the arrangement of the heating elements and the construction of the heater, the flow of air past the heating elements is quite rapid so that a minimum amount of time is required in which to heat a room and so that uniformity of heat results. Due to the relatively low temperatures at which the heating units are operated danger of burning the occupants of the room is entirely eliminated. The odor usually arising from the heating of air by heaters operating at relatively high temperatures is entirely eliminated with our improved heater. By means of the particular construction employed our heater is entirely noiseless. At the same time the heater does not emit visible light rays so that the same may be used in sleeping rooms without disturbing the occupants.

Changes in the specific form of our invention, as herein disclosed, may be made within the scope of what is claimed without departing from the spirit of our invention.

Having described our invention, what we claim as new and desire to protect by Letters Patent is:

1. An electric space heater comprising a heating element constructed of a metal having an electrical resistance of not over twenty ohms per mil foot and plated with silver.

2. An electric space heater comprising a heating element constructed of a metal having an electrical resistance of not over twenty ohms per mil foot and coated with a dead black coating.

3. An electric space heater comprising a rectangular frame having four frame members, insulators carried by two of the opposite frame members of the frame, and a heating element comprising a plurality of turns of an electrical conductor wound about said insulators, one of said frame members being constructed of a non-magnetic material.

4. An electric space heater comprising a heating element constructed of a metal ribbon formed from copper plated silver.

5. An electric space heater comprising a heating element constructed of a metal ribbon

formed from copper plated with silver and coated with a dead black coating.

6. An electric space heater comprising a rectangular frame having upper and lower horizontal frame members and vertical frame members connecting the horizontal frame members at the ends thereof, insulators carried by the vertical frame members, and a heating element comprising an electrical conductor wound about the insulators in convolutions one above the other, and a number of vertical insulating strips woven between the convolutions and disposed intermediate the vertical frame members for supporting the heating element intermediate the vertical frame members.

7. An electric space heater comprising an upper frame structure and a lower frame structure spaced therefrom, each frame structure comprising spaced channel-shaped frame members disposed with their webs in common planes, a connecting member at each end of each frame structure connecting the frame members together at their ends and holding the same in spaced relation, a plurality of vertical frame members extending between the upper and lower frame structures, there being one vertical frame member for each upper and lower frame member, said vertical frame members being disposed at the ends of the upper and lower frame members, insulators on said vertical frame members, and a heating element extending about said insulators, said upper and lower frame members being spaced to provide air passageways therebetween.

8. An electric space heater comprising an upper frame structure and a lower frame structure spaced therefrom, each frame structure comprising spaced channel-shaped frame members disposed with their webs in common planes, a connecting member at each end of each frame structure connecting the frame members together at their ends and holding the same in spaced relation, a plurality of vertical frame members extending between the upper and lower frame structures, there being one vertical frame member for each upper and lower frame member, said vertical frame members being disposed at the ends of the upper and lower frame members, insulators on said vertical frame members, and a heating element extending about said insulators, said upper and lower frame members being spaced to provide air passageways therebetween, said webs of said upper and lower frame members having openings therein for providing additional air passageways through said upper and lower frame structures.

9. An electric space heater comprising a rectangular frame having spaced upper and lower frame members channel-shaped in cross section and arranged with their webs in parallel planes, a vertical frame member extending between said upper and lower frame members at one end of each of said frame members, a vertical frame member attached to said upper and lower frame

members at the other ends thereof, said upper and lower frame members being constructed with longitudinal slots in the webs thereof disposed adjacent said fixed frame member, a movable vertical frame member slidable in said slots, resilient means for urging said movable frame member away from the first named frame member, insulators on said first named frame member and said movable frame member, and a heating element extending about said insulators.

10. An electric space heater comprising a rectangular frame having spaced upper and lower frame members channel-shaped in cross section and arranged with their webs in parallel planes, a vertical frame member extending between said upper and lower frame members at one end of each of said frame members, a vertical frame member attached to said upper and lower frame members at the other ends thereof, said upper and lower frame members being constructed with longitudinal slots in the webs thereof disposed adjacent said fixed frame member, a movable vertical frame member slidable in said slots, said movable frame member and said fixed frame member projecting outwardly beyond the webs of said upper and lower frame members, resilient means acting between the portions of said movable and fixed frame members disposed beyond the webs of said upper and lower frame members and urging said movable frame member away from said first named vertical frame member, insulators carried by said first named vertical frame member and said movable frame member, and a heating element extending about said insulators.

11. An electric space heater comprising a rectangular frame having upper and lower frame members, two vertical cylindrical frame members extending between said upper and lower frame members, one of said cylindrical frame members being constructed of a non-magnetic material, insulators carried by said cylindrical frame members, and a heating element comprising a plurality of turns of an electrical conductor extending about said insulators.

12. An electric space heater comprising a rectangular frame having upper and lower horizontal frame members and vertical frame members connecting the horizontal frame members at the ends thereof, insulators carried by the vertical frame members, a heating element comprising an electrical conductor extending about the insulators in convolutions disposed in a common plane, a pair of vertical insulating strips disposed adjacent each other, said strips being disposed alternately in front of and behind the successive convolutions, the one strip being arranged in reverse order with respect to the convolutions, and means for securing the ends of said strips together.

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