May 3, 1949. F. YOKEL 2,469,287

REFRACTORY ELEMENT FOR ELECTRIC HEATERS

Filed Oct. 10, 1945 3 Sheets-Sheet 1

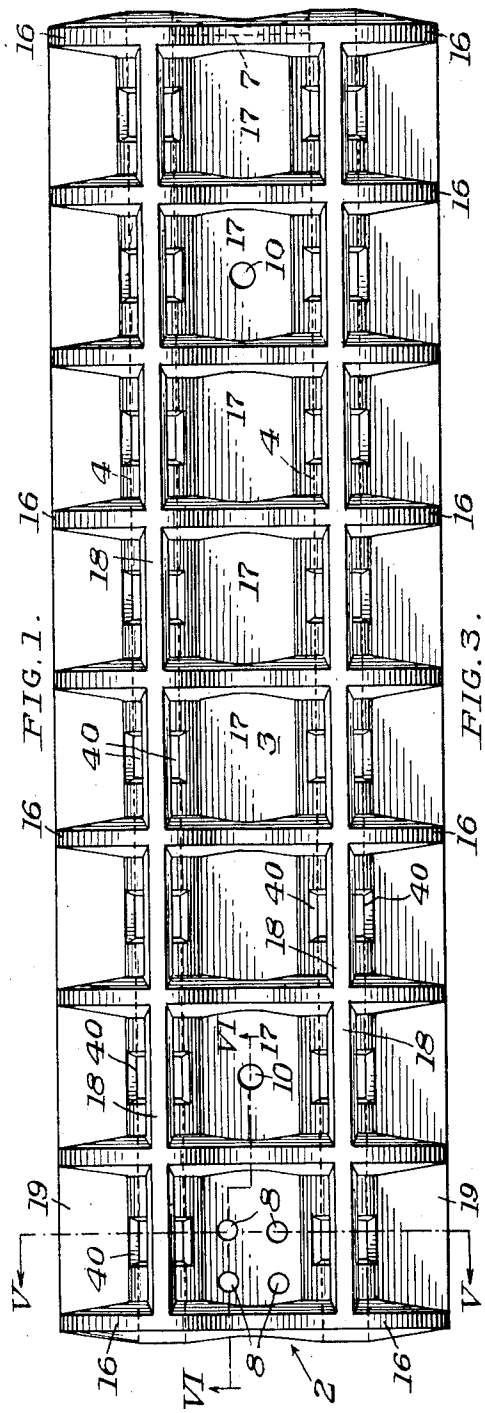


FIG. 1.

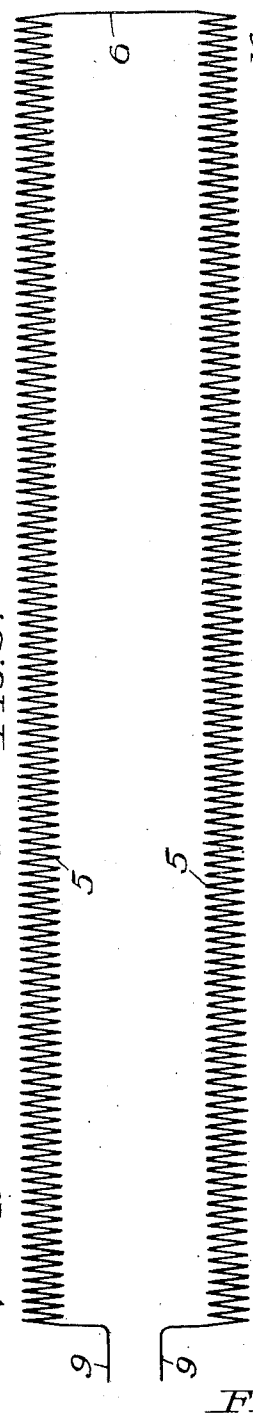


FIG. 3.

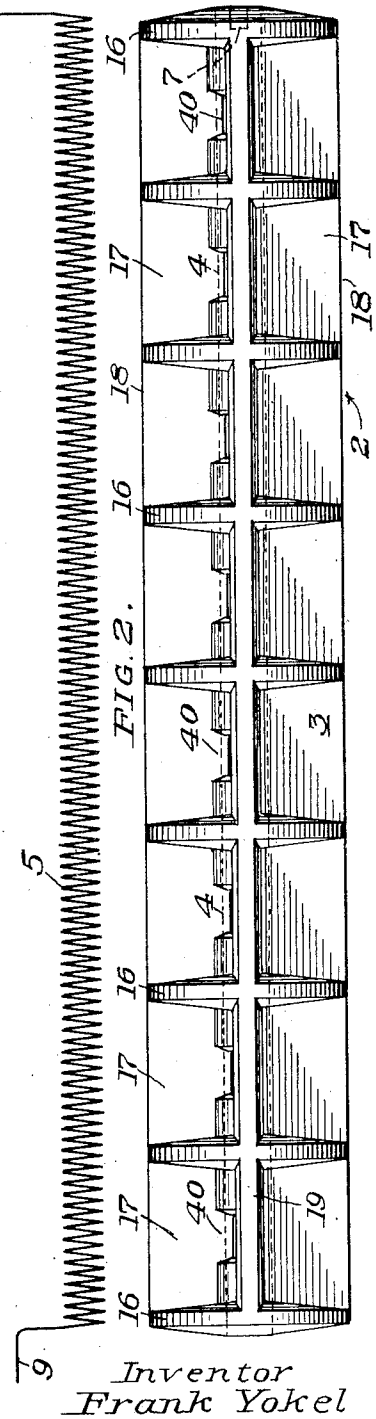


FIG. 2.

Inventor
Frank Yokel
by Christy Parmelee and Strickland
his attorneys

May 3, 1949. F. YOKEL 2,469,287

REFRACTORY ELEMENT FOR ELECTRIC HEATERS

Filed Oct. 10, 1945 3 Sheets-Sheet 2

FIG. 4.

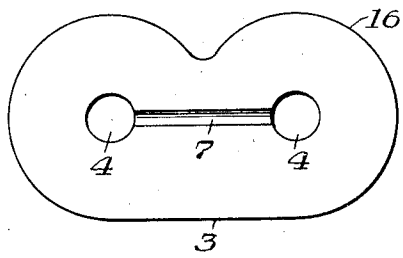


FIG. 5.

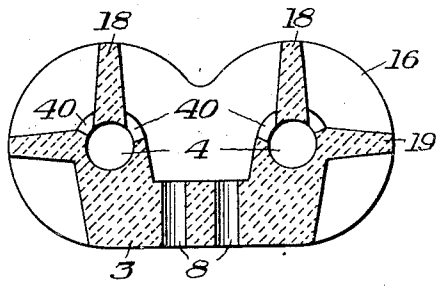


FIG 6.

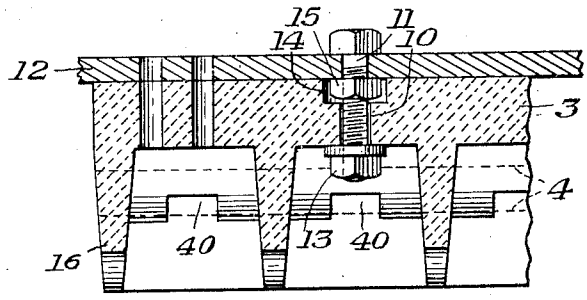


FIG. 8.

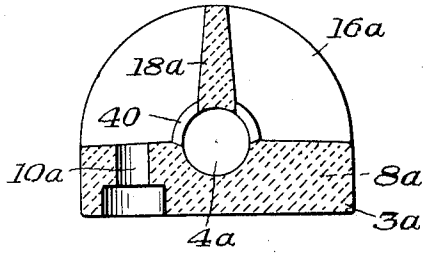
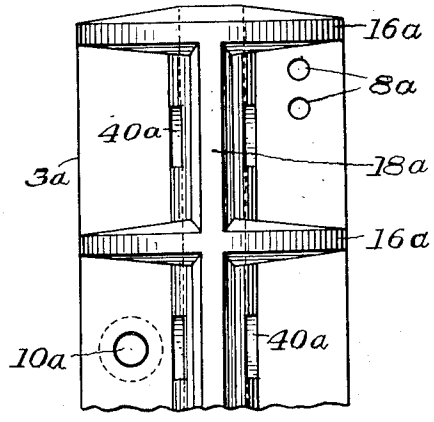


FIG. 7.



Inventor
Frank Yokel
by Christy, Parmelee and Strickland.
his attorneys

May 3, 1949. F. YOKEL 2,469,287

REFRACTORY ELEMENT FOR ELECTRIC HEATERS

Filed Oct. 10, 1945 3 Sheets-Sheet 3

FIG. 9.

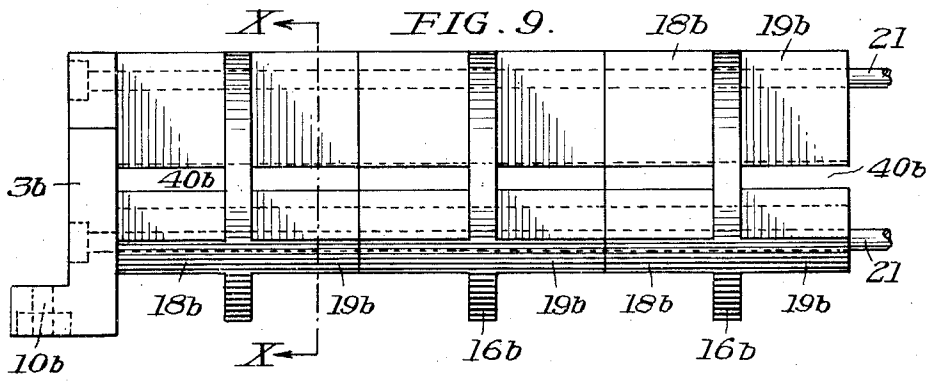


FIG. 10.

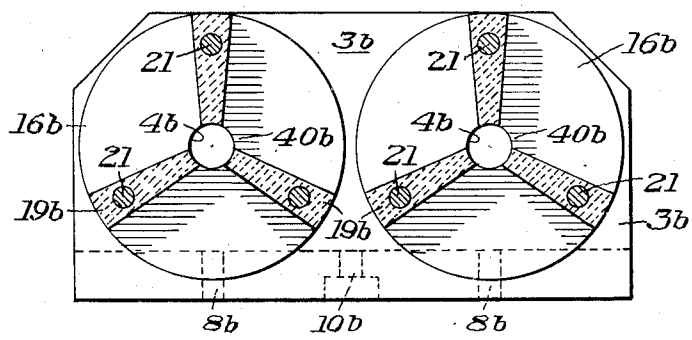
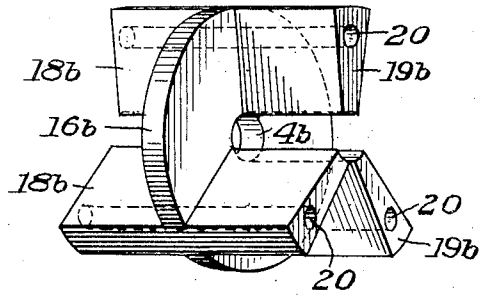


FIG. 11.



Inventor
Frank Yokel
by Christy, Parmelee and Strickland
his attorneys

Patented May 3, 1949

2,469,287

UNITED STATES PATENT OFFICE

2,469,287

REFRACTORY ELEMENT FOR ELECTRIC HEATERS

Frank Yokel, Pittsburgh, Pa.

Application October 10, 1945, Serial No. 621,414

12 Claims. (Cl. 201—63)

1

My invention relates to electrical stoves, heaters, and the like, which contain electrical resistors or filaments that are mounted in refractory supports, sometimes called refractory elements. In service the resistors are electrically energized, and when so energized they generate heat which is radiated and conducted to the atmosphere, or other gaseous, liquid, or solid substance to be heated.

More particularly, the invention relates to the refractory elements for the resistors, and the invention consists in certain new and useful improvements in the mechanical design and construction thereof, whereby, without sacrifice of economy in manufacture, the refractory elements provide for improved heat delivery, and provide protection against the overheating of the refractory body of the support.

The invention will be understood upon reference to the accompanying drawings, in which:

Fig. 1 is a view in front elevation of a refractory element which in exemplary way embodies the invention;

Fig. 2 is a view in side elevation of the element;

Fig. 3 is a view in plan of an electrical resistor of the sort that may be carried by the element in service;

Fig. 4 is a view in end elevation of the element;

Fig. 5 is a view in cross section of the element, as seen on the plane V—V of Fig. 1;

Fig. 6 is a fragmentary sectional view of the element, as seen on the plane VI—VI of Fig. 1, and showing additionally a section of the body of the stove, or the like, which mounts the element and its resistor for service;

Fig. 7 is a fragmentary view, showing in front elevation a modified form of the element of the invention;

Fig. 8 is a view in cross section of the modified form of the element;

Fig. 9 is a fragmentary view in side elevation of another modified form of the element of the invention, in which the element body is constructed of a plurality of preformed sections;

Fig. 10 is a view in cross section, on the plane X—X of Fig. 9; and

Fig. 11 is a view in perspective of one of the preformed sections of which the modified element body is constructed.

The article of the invention consists, as has been already mentioned, in an improved element for resistors or electrical heating filaments. The reference numeral 2 indicates a typical element of the invention in the attached drawings. The body is essentially formed of a refractory

2

material which is a non-conductor of electricity. The art is familiar with clays or ceramic mixes of which the element may be integrally molded, dried, and then brought to vitreous state by firing. So far as the composition of the refractory material, of which the element 2 is formed, and the method of its production are concerned, it will suffice to remark that the prior art is well versed on such matters, wherefore further detail herein is needless to a full understanding of the invention. The invention consists in the particularly effective design and construction of the element per se.

The refractory body of the element 2 comprises an elongate base portion 3, including two laterally spaced, parallel bores 4 which in this case extend throughout the length of the body, to receive each a helically coiled resistor of conventional metallic composition. Preferably, but not necessarily, the exposed wall of each bore includes two longitudinal lines of windows 40, of which more will be said later.

A typical resistor is shown in Fig. 3, including two reaches 5 of coiled wire, interconnected at one end by means of a section 6 of straight wire. The resistor will be seen to be in the shape of the letter U laid on its side, with the two legs of the U formed by the coiled reaches 5 of the wire, and the base of the U formed by the straight section 6. The entire resistor may thus be constituted of a continuous length of wire, coiled in the reaches 5 and straight in the reach or section 6.

The body of the element 2 at one end includes a channel 7 that extends laterally between the ends of the bores 4, and it will be perceived that the U shaped resistor may be assembled in the element, with one coiled reach of wire 5 in each bore 4 and the straight section 6 inset in the channel 7 at one end of the element body. At the opposite end, the element body is provided with four holes 8, by means of which any of the known types of metal clamps (not shown) may be bolted or otherwise secured to the body, to receive in electrical union both the terminals 9 at the distal ends of the coils 5 and the terminals of the conductor wires (not shown) that deliver electrical current through the component parts of the resistor in series.

The body of the element includes two holes 10, through which the bolts 11, as indicated in Fig. 6, of the supporting frame or panel 12 of a stove or the like may be passed and security effected, as by means of nuts 13. The body of the refractory element includes a socket 14 at the inner end of each hole 10 to receive the nut 15

which may be provided rigidly to unite or lock each bolt 11 to the frame or panel 12. As thus mounted on the frame or panel of a stove, any desired number of elements 2 and their resistors may be arranged side by side, and such element-resistor units may extend horizontally or vertically, depending upon the size and the structural design of the stove. And, of course, the resistors of the several units may be electrically connected, either in series or in parallel, to the source of electrical power.

Turning now to the features in which the invention is more particularly centered, it is to be understood that the structure of the refractory support 2 is so constituted that heat radiation may be obtained with maximum overall heating efficiency. This heat liberation is effected from the extended areas of the finned or webbed refractory body of the element heated, under the influence of radiation, conduction and convection, by the resistor portions within the bores 4.

It will be observed that the body of the refractory element is so particularly fashioned as to provide maximum radiating surface per unit of mass of the refractory body, it being understood that the limitations imposed by the low structural strength of the vitreous composition of the refractory body result in certain restrictions in the area of radiation that may be obtained per unit of mass of the body. With these circumstances in mind, it is to be noted that the mechanical form of the refractory element 2 is exceedingly effective.

At each end of the element 2 and at spaced intervals longitudinally thereof web-like portions 16 are formed integrally with the refractory body of the element. These outstanding web portions 16 extend circumferentially of the bores 4, and the circumferential web portions of one bore are in this case paired and united, as one, with the web portions 16 outstanding from the wall of the other bore. These web portions are nine in number in the structure herein shown, and they are effective to provide within the exposed face of the support eight recesses or pockets 17 that extend transversely of the element body and of the bores 4 formed therein. The number of web portions may be varied as may be deemed advisable in particular instances, and the number of recesses will be correspondingly modified in number.

Advantageously, the windows 40 open from the bores into these transverse recesses, and from these windows lines or channels of direct heat radiation are established by the web portions, while such web portions, themselves becoming heated, provide extended areas for indirect surface radiation of heat to the ambient atmosphere.

The structure is further advantageously refined by the provisions of longitudinal web portions 18 that stand on the axial plane of each bore that extends between the two lines of windows 40 opening from the bore. Additionally, another longitudinally extending web portion, 19, projects radially from each bore, and each web portion 19 will be seen to be disposed, relatively to the axis of the associate bore, at an angle of ninety degrees from the plane of the web portion 18. These longitudinal web portions 18 and 19 intersect and integrally interconnect the circumferential web portions 16, not only structurally reinforcing the whole, but also dividing the transverse heat-radiating recesses or pockets 17 into a plurality of compartments that are directed

radially outward from the windows 40. Thus, the body portion of the element which is exposed in the face of the stove, or the like, in which service assembly is made, is divided by circumferential web portions 16 into a succession of transverse recesses, which in turn are divided into radial compartments by means of the web portions 18 and 19. Maximum heat radiation is by such structure obtained, with the valuable concomitant effect that the refractory body of the support is protected from harmful over-heating.

Radial compartments are provided between each longitudinal web portion 19 and the central or basal body portion of the element. Since these latter compartments will not ordinarily be positioned for unobstructed heat-radiation when the resistor-support unit is assembled in a stove, windows 40 will not ordinarily open from the bores 4 into such compartments. However, these latter compartments have a definite beneficial effect, in that they promote the dissipation of heat that would otherwise tend to over-heat and injure the refractory body of the support.

Figs. 7 and 8 illustrate a modification, in which the refractory support is constructed with a single bore 4*a*. The circumferential web portions 16*a* and longitudinal web 18*a* form the counterparts of the web portions 16 and 18 of the structure first described, while the basal portion 3*a* of the modified support is laterally extended to receive the holes 19*a* for the mounting bolts on the stove frame, and holes 8*a* for connector clamps at each end of the body. The laterally extending portions of the base 3*a* also provide the functional counterparts of the web portions 19.

While the modified structure of Figs. 7 and 8, as well as the structure of Figs. 1 to 6, is shown to be fashioned as a molded monolithic article, it will be perceived by the artisan that the bodies of the supports may be made in sections adapted to be assembled to form the completed article, of the same utility as though made in one piece as herein described.

In exemplification of the various modified constructions in which the refractory element of the invention may be produced, I show in Figures 9 to 11 that the body of the element may consist of a plurality of preformed refractory sections, one of which is shown in perspective in Figure 11, comprising a disk or circumferential web portion 16*b*, including a central perforation 4*b*, and vanes or longitudinal web portions 18*b* and 19*b*. These vanes or longitudinal web portions are each perforated, as at 20, on a line paralleling the axis of the perforation 4*b*, and by means of such perforations a series of the preformed sections may be "strung" upon three wires or rods 21, and such rods anchored in refractory bracket members 3*b* at each end of the series, as indicated fragmentarily in Figure 9. The bracket members 3*b*, arranged at each end of the series of preformed web sections, may be of L-shape in section, and the holes 10*b* for bolting the assembled structure upon the frame of a stove may be formed in the feet of the L-shaped bracket members, while holes 8*b* may be provided for mounting the usual connector clamps.

In Figures 9 and 10 the assembled refractory structure is shown as having two series of the preformed sections strung upon rods 21 and assembled with end bracket members 3*b*, but it will be understood that a single series, or more than two series, of such preformed sections may be supported by rods 21 between bracket mem-

bers of appropriate contour. It is significant to note that, as thus assembled on three rods 21, each series or line of preformed sections affords a structure which in general is the like of that first described herein. The vanes 18b and 19b, respectively, meet in end-to-end abutment, forming in the assembly the counterparts of the webs 18 and 19 first described, and the aligned perforations 4b at the centers of the circumferential web portions 16b form, in conjunction with the radial inner edges of the longitudinal web portions 18b and 19b, the bore which receives a coiled resistor wire. The spaces between the inner edges of the web portions 18b and 19b provide windows 40b in the comparted recesses formed by and between the circumferential and longitudinal web portions 16b and 18b, 19b.

In the case of the double-bore structure shown in Figures 9 and 10, it will be perceived that the straight section of wire (cf. 6, Fig. 3) that interconnects the two coiled reaches 5 of the resistor may extend through openings 40b between the webs 18b and 19b at one end of the assembly, and thereby avoid the necessity of forming a channel (such as the channel 7 of Fig. 4) in the body of the adjacent bracket 3b.

Within the terms of the appended claims it will be understood that various other modifications of the structure of the invention are held in contemplation without departing from the spirit of the invention.

I claim:

1. An article of the class described comprising a refractory body including a bore for an electrical heating element, said body having a plurality of fin portions extending circumferentially of the wall of said bore and arranged in spaced-apart relation longitudinally thereof to provide a plurality of heat-radiation-directing recesses extending transversely of said bore, and a web extending longitudinally between the successive circumferential portions and dividing said recesses into radial compartments.

2. An article of the class described comprising a refractory body including a bore for an electrical heating element, said body having a plurality of fin portions extending circumferentially of the wall of said bore and arranged in spaced-apart relation longitudinally thereof to provide a plurality of heat-radiation-directing pockets extending transversely of and open radially outward from the wall of said bore, and plurality of webs spaced apart on the circumference of said bore and interconnecting the circumferential portions first named and dividing said pockets into compartments.

3. An article of the class described comprising a refractory body including two elongate substantially parallel bores, said body provided with outstanding web portions extending circumferentially of each bore and spaced apart longitudinally of the bores and providing heat-radiation-directing pockets that extend transversely of said body and the bores therein and open radially outward from the walls of said bores, and a longitudinally extending web associated with each bore in said body and arranged to interconnect said transverse web portions to divide said pockets into compartments.

4. An article of the class described comprising a refractory body including two elongate substantially parallel bores, said body provided with outstanding web portions extending circumferentially of each bore and spaced apart longitudinally of the bores and providing heat-radiation-directing pockets that extend transversely of said body and the bores therein and open radially outward from the walls of said bores, and a plurality of longitudinal webs associated with each bore in said body, the longitudinal webs associated with each bore being spaced apart circumferentially of the bore to compart said transverse pockets.

5. An article of the class described comprising a refractory body including a windowed bore for an electrical heating element, said body having a plurality of portions extending circumferentially of the wall of said bore and arranged in spaced-apart relation longitudinally thereof to provide a plurality of transverse heat-radiating pockets into which the windows of said bore open, and a web extending longitudinally between the successive circumferential portions and dividing said pockets into compartments that open radially outward from the wall of said bore.

6. An article of the class described comprising a refractory body including a windowed bore for an electrical heating element, said body having a plurality of portions extending circumferentially of the wall of said bore and arranged in spaced-apart relation longitudinally thereof to provide a plurality of transverse heat-radiating pockets into which the windows of said bore open, and plurality of webs spaced apart on the circumference of said bore and interconnecting the circumferential portions first named and dividing said pockets into compartments that open radially outward from the wall of said bore.

7. An article of the class described comprising a refractory body including two elongate substantially parallel windowed bores, said body provided with outstanding web portions extending circumferentially of each bore and spaced apart longitudinally of the bores and providing heat-radiating pockets that extend transversely of said body and the bores therein that open radially outward from the walls of said bores, with the windows of the bores opening into said pockets.

8. An article of the class described comprising a refractory body including two elongate substantially parallel windowed bores, said body provided with outstanding web portions extending circumferentially of each bore and spaced apart longitudinally of the bores and providing heat-radiating pockets that extend transversely of said body and the bores therein and open radially outward from the walls of said bores, with the windows of the bores opening into said pockets, and a longitudinally extending web associated with each bore in said body and arranged to interconnect said transverse web portions to divide said pockets into compartments.

9. An article of the class described comprising a refractory body including two elongate substantially parallel windowed bores, said body provided with outstanding web portions extending circumferentially of each bore and spaced apart longitudinally of the bores and providing heat-radiating pockets that extend transversely of said body and the bores therein and open radially outward from the walls of said bores, with the windows of the bores opening into said pockets, and a plurality of longitudinal webs associated with each bore in said body, the longitudinal webs associated with each bore being spaced apart circumferentially of the bore to compart said transverse pockets.

10. An article of the class described comprising a refractory body having a longitudinal bore for the reception of an electric heating element and including a plurality of outstanding spaced transverse web portions and at least one longitudinal web portion providing on opposite sides of said bore a plurality of heat-radiating compartments, said longitudinal web portion extending with its base contiguous to said bore, and the wall of said bore on opposite sides of the base of the longitudinal web portion being windowed to provide near the bottoms of the compartments on opposite sides of the latter web portion open communication with said bore.

11. An article of the class described comprising a refractory body including two elongate substantially parallel bores for the reception of electric heating elements, said body being provided with outstanding web portions extending transversely of each bore and spaced apart longitudinal of the bores to provide a plurality of heat-radiating pockets that extend transversely of said body and the bores therein, and a partition web portion extending longitudinally of each of said bores and between the successive web portions first mentioned to divide said pockets into compartments, the walls of said bores being windowed on opposite sides of said partition webs adjacent to the points where said partition webs join said refractory body to provide open communication between the bores and said compartments.

12. An article of the class described comprising a refractory body including a plurality of elongate substantially parallel bores for the reception of electric heating elements, said body being provided with outstanding web portions extending transversely of said bores and spaced apart longitudinally thereof to provide a plurality of heat-radiating pockets that extend transversely of said body and the bores therein, partition web portions extending longitudinally of said bores severally and between the successive web portions first mentioned to divide said pockets into compartments, the walls of said bores being windowed on opposite sides of the partition webs severally associated therewith and adjacent to the points where said partition webs join said refractory body to provide open communication between the bores and said compartments.

FRANK YOKEL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,475,162	Abbott	Nov. 27, 1923
1,555,334	Vaughan	Sept. 29, 1925
1,614,321	Smalley	Jan. 11, 1927
1,617,916	Kercher et al.	Feb. 15, 1927
1,662,771	Whittingham	Mar. 13, 1928
1,935,163	Parsons	Nov. 14, 1933
1,997,146	Hynes	Apr. 9, 1935