United States Patent

Finn

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[54] ELECTRIC HEATER

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[73] Assignee: **Glenn Electric Heater Corporation** Erie, Pa., part interest

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[52] **U.S. Cl.** .....**219/535,** 29/180, 75/123 CB, 165/169, 165/180, 219/530, 219/536

[51] **Int. Cl.**.....**H05b 3/58**

[58] **Field of Search**.....219/535, 301, 456, 536, 552, 219/530, 540; 75/123 CB; 29/180; 165/165, 169, 171, 180, 183, 186

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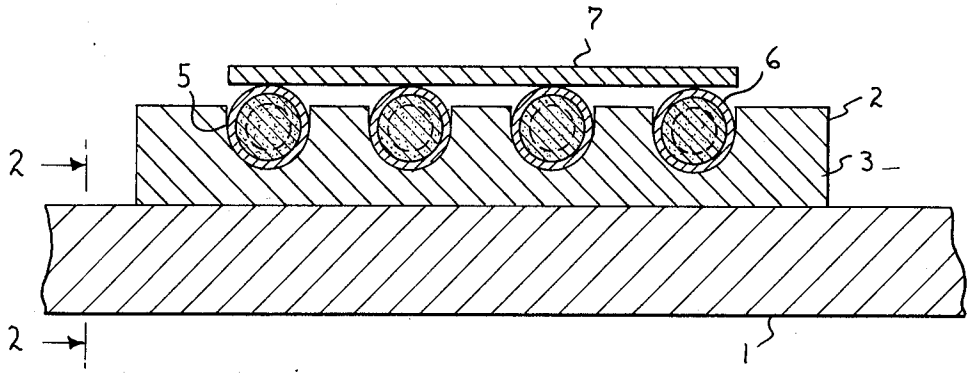
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[57] **ABSTRACT**

An electric heater having a ductile iron heat transfer body adapted to conform to the surface to be heated. The heater operates at temperatures up to 1,100°F and at a higher watt density input than comparable heaters with aluminum heat transfer bodies.

3 Claims, 2 Drawing Figures



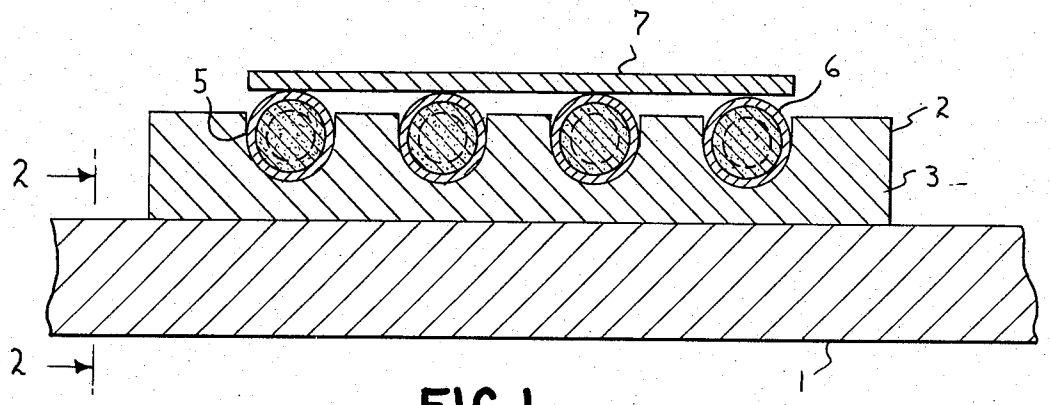


FIG. 1

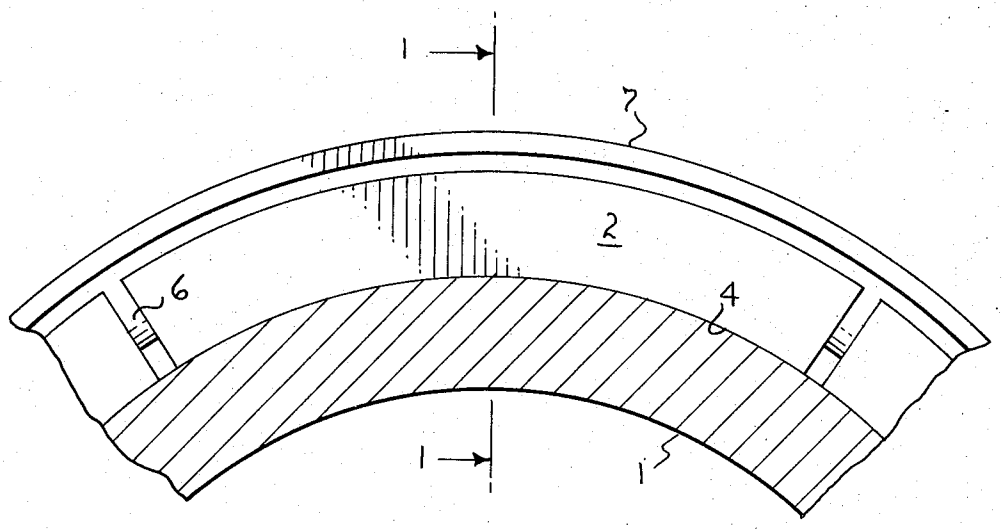


FIG. 2

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ELECTRIC HEATER

This invention is a high temperature electric heater in which the heating elements are carried by a plate like ductile iron body which transfers heat to the surface to be heated. The heater operates at temperatures up to 1,100°F and when operated at the 1,100°F temperature conforms or mates with the surface to be heated, thereby improving the heat transfer.

In the drawing,

FIG. 1 is a fragmentary section through the barrel of an extruder taken on line 1—1 of FIG. 2, and

FIG. 2 is a section on line 2—2 of FIG. 1.

In the drawing, 1 indicates the barrel of an extruder for plastics and the like and 2 indicates a section of an electric strip or band heater applied to the outer surface of the barrel. The heaters are made in arcuate sections arranged end to end around the circumference of the barrel and each section comprises a plate like body 3 of ductile iron having a smooth inner surface 4 contacting the outer surface of the extruder barrel and having in its outer surface a plurality of longitudinal grooves 5 receiving tubular type electric heating elements 6. A clamping member or metal tension band 7 clamps the heating elements against the bottoms of the grooves 5 and clamps the body against the outer surface of the barrel. Since under some conditions it may be necessary to cool the barrel 1 to prevent temperature overshoot, a cooling coil may be substituted for one or more of the heating elements 6. The bodies 3 are of substantially the configuration of the aluminum extrusions heretofore used in strip or band heaters. Like the aluminum extrusions, the bodies 3 are conveniently made in flat strips which are subsequently bent to conform with the surface to be heated. The forming can be done with the same equipment used to form the aluminum extrusions. Strip or band heaters as described above but with bodies 3 of aluminum are commercially available products and are described in prior U.S. Pats., e.g. Nos. 2,875,312 and 2,959,661.

The ductile iron, as compared to aluminum, has the following advantages. First, the operating temperature is greatly increased. With aluminum, the operating temperature must be kept below about 600°F to prevent flowing of the aluminum. The flowing of the aluminum usually starts locally at one or more spots and the flow of aluminum away from the heating elements reduces the rate of heat transfer at these spots and causes overheating and failure. With ductile iron, the operating temperature can be raised to 1,000° to 1,100°F and higher without causing local flowing of the metal away from the heating elements. On the contrary, if the heaters are tightened against the barrel while hot, the ductile iron bodies 3 bend into intimate contact with the barrel and produce even better heat transfer. There is no local flow or creep of the ductile iron and no loss of heat transfer which could result in failure of the heating elements. One surprising result of the high temperature operation of the ductile iron heating members is that the ductile iron during its first operation at the 1,000°–1,100°F temperature becomes hard and brittle so that it retains its shape and can no longer be bent or formed. It is matched or mated to the barrel.

Another advantage of the ductile iron heating element is higher watt density. It is possible to increase the watt density one third or more as compared to heaters

with aluminum bodies. When attempts are made to increase the watt density in heaters with aluminum bodies, even though the overall temperature is kept to a safe value, there is local overheating resulting in failure. This local overheating does not take place with the ductile iron bodies.

As compared to strip or band heaters with aluminum bodies, the heaters with ductile iron bodies of the same physical dimensions will operate at approximately one-third higher watt input without failure. This means that even if the high temperature properties of the ductile iron were not desired, the ductile iron would permit a heater of one-third greater capacity within the same physical envelope.

The aluminum strip or band heaters cannot be used at all at the high temperatures of which the ductile iron heaters are capable. The only heaters meeting the high temperature capability of the ductile iron heaters are heaters with the elements cast into the bodies. These cast-in heaters are from three to four times as heavy as the ductile iron heaters and are incapable of being repaired. When a heating element of a cast-in heater burns out, the entire casting must be thrown away. A burnt out element in the ductile iron heater can be easily replaced.

By way of example, and not of limitation:

	Ductile Iron Heater 3" wide × 6¾" long × 7/16" thick	Extruded Aluminum heater 3" wide × 6¾" long × 7/16" thick
Operating Temperature	1000°F	600°F
Watts/sq. in. Input	55	40

Ductile iron is described in extensive patent literature starting with U. S. Pat. No. 2,485,760.

If the operating temperature is kept below the temperature at which changes in the grain structure take place, the ductile iron retains its ductility and after use to heat a surface of one curvature can be bent or formed to heat a surface of different curvature.

What is claimed is:

1. A heater having an arcuate plate like body of ductile iron with external arcuate surfaces spaced from each other in the thickness direction, an inner surface being a heat transfer surface and the outer surface having grooves and tubular electric heating elements having external tubular metal sheaths in said grooves, a structure of heat conductive metal having an arcuate surface to be heated mating with said inner arcuate surface of said body, and means for clamping said body against said structure and for clamping said heating elements against the bottoms of said grooves, said heater being capable of operation at temperatures of 1,000°F without perceptible disintegration or creep.

2. The heater of claim 1 in which the body of the heater is clamped against the arcuate surface of the structure to be heated by an external tension band.

3. The heater of claim 1 in which the body of the heater is initially tightened against and bent into intimate contact with the arcuate surface of the structure to be heated while the heater is brought up to the temperature at which the grain structure of the body changes and ductility is lost.

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