electromagnetic interaction between the external magnetic field and the magnetic field generated by the ring heater occurs in such a case. The Lorentz force acting on the ring heater can alter the position of the ring heater, damage the ring heater or even destroy the latter.

US7,335,864 B2 describes the fact that the inherent magnetic field of a resistance heater can be reduced by a heating coil being wound in a bifilar fashion, such that the electric current flows in opposite directions through the partial turns of the heating coil.

However, despite the use of a ring heater modified in this way, the difficulties mentioned cannot be eliminated satisfactorily because the interaction between the magnetic fields remains, albeit in weakened form.

Therefore, ~~the object~~embodiments of the present invention ~~is~~seek to provide a ring-shaped resistance heater for supplying heat to a growing single crystal which has the advantages of the ring heater described in US 2004/0192015 A1 without having the disadvantages thereof during use in the presence of a strong external magnetic field.

~~The object is achieved by means of~~ According to an aspect of the present invention, there is provided a ring-shaped resistance heater for supplying heat to a growing single crystal, comprising

an upper and a lower ring, which are electrically conductively connected by means of a loop adjacent to a ring gap of the lower ring, such that the flow direction of electric current which is conducted through the respective rings is opposite ~~in the rings~~to each other;
connecting elements which hold the upper and lower rings together at a distance; and

first and second current leads for conducting electric current through the upper and lower rings, wherein the first and second current leads are mechanically connected to one another in an electrically insulated manner and secured in this way against a force which compresses them or pulls them apart and which is brought about by an external magnetic field.

The ring heater of the present invention comprises two ring-shaped partial coils arranged one above the other, said partial coils also being designated hereafter as upper and lower rings and being connected by means of a loop to form an integral component. The flow direction of electric current that flows through the partial coils reverses when passing through the loop. The ring heater thus has the structure and properties of a coil wound in bifilar fashion.

Preferably, the upper and lower rings and the current leads substantially consist of carbon, for example carbon fiber reinforced carbon (CFC) or graphite. Graphite is particularly preferred, in particular a graphite type having the lowest possible resistivity, the highest possible flexural strength and the highest possible thermal conductivity. In order that the area of the cross section of the rings can be as small as possible, the resistivity should preferably be not more than 11 $\mu\Omega$m. The flexural strength should preferably be not less than 50 MPa, and the thermal conductivity should preferably be not less than 120 W/mK. The high thermal conductivity prevents a formation of overheated locations ("hot spots") that accelerate the wear of the ring heater.

Connecting elements hold the upper and lower rings together and at a specific distance from one another. They thereby compensate for electromagnetic forces which act on the rings, and prevent, in particular, the rings from being displaced relative to one another under the influence of a magnetic field acting on the melt. The distance between the rings is preferably not less than 2 mm and not more than 150 mm. A distance smaller than 2 mm is not preferred, owing to the risk

Patent Claims

1. A ring-shaped resistance heater for supplying heat to a growing single crystal, comprising
an upper and a lower ring, which are electrically conductively connected by means of a loop adjacent to a ring gap of the lower ring, such that the flow direction of electric current which is conducted through the respective rings is opposite ~~in the rings~~to each other;
connecting elements which hold the upper and lower rings together at a distance; and
first and second current leads for conducting electric current through the upper and lower rings, wherein the first and second current leads are mechanically connected to one another in an electrically insulated manner and secured in this way against a force which compresses them or pulls them apart and which is brought about by an external magnetic field.

2. The resistance heater as claimed in claim 1, wherein the upper and lower rings and the current leads ~~substantially~~ consist of carbon.

3. The resistance heater as claimed in claim 1 or claim 2, wherein edges of the upper and lower rings are rounded.

4. The resistance heater as claimed in any of claims 1 to 3, wherein the connecting elements each comprise a ring-shaped spacer, hollow cylinders, a screw and a screw nut, wherein the ring-shaped spacer is arranged between the rings, the hollow cylinders line holes through the rings in the thickness direction, and the screw is screwed at its end to the screw nut and extends through the hollow cylinders and the spacer.

5. The resistance heater as claimed in claim 4, wherein collars of the hollow cylinders are countersunk in side areas of the upper and lower rings.

6. The resistance heater as claimed in any of claims 1 to 5, wherein the upper and lower rings are held together by connecting elements at a location