

5 **Zone-based heating element**

The invention relates to a heating element for generating IR heat beams for contactlessly heating plastic profile ends, preferably for end-face welding of pipes or fittings clamped in a device, comprising a heating plate made at least partially of a
10 conductive material and having two heatable faces, a heating wire for generating the heat beams, wherein the heating wire is arranged on the faces of the heating plate.

Heating elements for welding plastic profiles, wherein the heating of the plastic profile ends takes place contactlessly, are known from the prior art and are often used in
15 chemical as well as in high-purity sectors since there is a high requirement for the cleanliness of the connection between the pipes. Such heating elements usually have heating cartridges which are arranged in bores that project over the circumference into the centre of the heating plate. The entire heating plate is then heated via these heating cartridges. On the one hand, this has the disadvantage that
20 the heating plate does not have a uniform temperature but is warmer in the region of the heating cartridges and has lower temperatures in the regions further away. On the other hand, it is not possible to control the temperature individually in specific regions. In addition, it has been found that, during the heating of a pipe end, heat accumulation occurs in the upper inner region of the pipe, which leads to non-uniform
25 heating and, as a result, a constant, uniform weld seam is not achieved. This heat accumulation is also produced, above all, by the fact that in the inner region of the pipe, where no heating of the heating plate would be necessary, there is strong heating due to the arrangement of the heating cartridges.

30 US 2007/0262075 A1 discloses a heating plate for double-walled pipes in which the respective end of a pipe is arranged in a groove, wherein the heating wire runs in the heating plate directly under the groove or in the heating plate along the contour of the pipe or of the groove, thereby ensuring that the heat source is also arranged right at the pipe wall thickness. The disadvantage here is that, for different pipe diameters, it
35 is also always necessary to use different heating plates.

5 The problem addressed by the invention is that of proposing a heating element for generating IR heat beams for contactless heating which is suitable for different pipe diameters and enables uniform heating, as well as being energy-saving.

This problem is solved according to the invention by the fact that the heating plate
10 has a plurality of heating zones spaced apart radially from one another.

The heating element according to the invention for generating IR heat beams serves for the contactless heating of plastic profile ends, preferably pipe ends or fitting ends, which are clamped in a device for end-face welding. The heating element is
15 preferably arranged in a device for end-face welding or can be retrofitted into such a device and can also replace a conventional welding plate. The heating element according to the invention comprises a heating plate made at least partially of a conductive material and having two opposite, heatable faces facing away from one another. The two heatable faces serve for the simultaneous heating of the opposite
20 pipe ends, which are joined together after heating by the heating element. The heating element comprises a heating wire for generating the IR heat beams, wherein the heating wire is arranged on the faces of the heating plate. In order to achieve optimum heat distribution, the heating plate has a plurality of heating zones spaced apart radially from one another. The heating zones can be heated selectively or
25 optionally independently of one another. This means that, for example, the innermost heating zone is heated and the outer heating zone is not, since a small pipe diameter is being welded.

There is preferably no heat conduction between the heating zones.
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Each heating zone is preferably insulated from the heating zone arranged closest to it. This reduces unwanted heat discharge to the adjacent heating zones, which are then usually not heated since only the heating zone corresponding to the pipe diameter is heated.

35 It is advantageous if the heating element has at least two heating zones. Owing to the range of pipe diameters, it has been found that three to six heating zones are to be preferred on one heating element.

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It has been found to be an advantageous embodiment if the heating plate is formed from a plurality of heating rings spaced apart radially from one another. As a result, the heating plate is of modular construction and thus the individual heating rings can be controlled individually.

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It has been found to be an advantageous embodiment if an insulation gap is arranged between the heating rings, which insulation gap reduces the heat transfer between the individual heating rings. Owing to the fact that there is a gap between the heating rings in each case and the heating rings do not rest against one another or come into contact with one another anywhere, the heat of the individual heating rings is not transferred by heat conduction to the nearest heating ring; instead, the gap is located between them and the heat is transferred exclusively by convection, which thus represents very low heat transfer.

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The heating wire on the faces of the heating rings is preferably arranged in a spiral around the centre of the heating plate. The structure of the heating plate is preferably correspondingly concentric or the heating rings are arranged concentrically with respect to one another and form the heating plate. It has been found to be an advantageous embodiment if the spirally extending heating wire on the respective heating ring forms the heating zone.

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It is advantageous if a spacer element is arranged between the heating rings for radial spacing of the heating rings. It is thereby possible to generate a spacing between the heating rings, thus ensuring that the individual heating rings, which are made of a conductive material, preferably aluminium, do not transfer the heat by heat conduction.

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It has been found to be a preferred embodiment if the spacer element consists of an insulating material, for example a ceramic material. As a result, the individual heating rings are arranged in a manner insulated from one another.

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The spacer element is preferably designed as a half-shell. This permits simple assembly of the heating plate. The heating rings are preferably of one-piece design

5 and are produced as thin-walled as possible to ensure that the energy for heating the
 pipe is not absorbed by the material of the heating ring but flows into the pipe to be
 heated. Therefore, the heating rings have a U-shaped cross section or have an all-
 round recess in the centre of the cross section, in which the spacer element is
 arranged. To enable it to be inserted there, the spacer element is designed as a half-
 10 shell.

It is advantageous if the heating plate is surrounded by a frame. The frame serves as
 a receptacle or holder for the heating plate.

15 Owing to the construction of the heating plate, the heating rings and the spacer
 elements are preferably arranged concentrically with respect to one another.
 Moreover, it is also advantageous if the axial centre of the spacer elements and
 heating rings lies in one plane.

20 Since the heating wire is arranged on the face of the heating plate and preferably
 runs in a groove, it is advantageous if a cover is arranged on the faces in order to
 cover the heating wire, and thus the heating wire is protected.
 Moreover, it is advantageous if each heating ring or the faces of the heating rings
 have a separate cover since heat transfer between the individual heating rings due to
 25 heat conduction can thereby be avoided because no contact surface is formed
 between the covers of the heating rings there either.

It has been found to be preferred if the heating rings and the spacer elements are
 fixed by being clamped together in a frame. This allows precise adjustment and
 30 centring of the individual components with respect to one another.

For fixing and centring the heating plate, centring elements which press on the outer
 circumference of the heating plate are preferably arranged in the frame.

35 All possible configurations can be freely combined with one another.

An exemplary embodiment of the invention is described with reference to the figures,
 although the invention is not limited to the exemplary embodiment. More specifically:

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Fig. 1 shows a three-dimensional view of a heating element according to the invention, without covers,

Fig. 2 shows a sectional view through a heating element according to the invention with the face covers,

10 Fig. 3 shows a longitudinal section through a heating element according to the invention, and

Fig. 4 shows a device for heating plastic pipe ends with a built-in heating element according to the invention.

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The drawing in Fig. 1 shows a three-dimensional view of a heating element 1 according to the invention. The heating element 1 is designed as an infrared heating element 1 and serves for the contactless welding of plastic profiles, preferably pipe ends as well as fitting ends. The heating element 1 is preferably arranged in a device 20 11 for welding pipe ends, in which the ends to be welded are clamped opposite one another in a clamping device 13. The heating element 1 can be slid or pivoted between the pipe ends, this arrangement in the device 11 being shown in Fig. 4. The heating element 1 according to the invention comprises a heating plate 2, wherein the heating plate 2 has two heatable, opposite faces 5 facing away from one another. 25 Arranged on the faces 5 of the heating plate 2 is a heating wire 3, which preferably runs spirally around the centre of the heating plate 2. The heating plate 2 according to the invention has a plurality of heating zones 12, which are spaced apart radially from one another, this being recognizable from the all-round insulation gap 15 between the individual heating zones 12. The heating plate 2 of the heating element 30 1, the said heating plate being illustrated in Fig. 1, has three heating zones 12, wherein the heating plate 2 preferably has at least two heating zones, particularly preferably between two and six heating zones 12. The spacing of the individual heating zones 12 with respect to one another by means of the insulation gap 15 is implemented in order to ensure that the heat is not dissipated to the other heating 35 zones 12. If, for example, welding is carried out on a pipe end having a diameter which is welded by means of the central heating zone 12, the two adjacent heating zones 12 are not activated. It is thereby possible, on the one hand, to save energy

5 and to avoid heat accumulation in the interior of the pipe since only the heating zone
12 which is assigned to the pipe diameter is heated.

Fig. 2 shows the structure of a heating plate 2 according to the invention. The heating
plate 2 preferably has heating rings 4, these being spaced apart radially from one
10 another. The heating wire 3 is arranged on the faces 6 of the individual heating rings
4 and preferably extends in a spiral, preferably in a groove provided for this purpose.
The cross section of a heating ring 4 is preferably designed as a U shape, thereby
reducing the wall thickness, and, as a result, the heat is absorbed only slightly by the
conductive material of the heating ring 4 and, as a result, as much of the heat as
15 possible is transferred to the pipe ends to be welded. A spacer element 9 is arranged
in the centre of the U-shaped cross section of the heating ring 4. The heating rings 4
are connected to one another via the spacer element 10. The spacer element 10 is
made of an insulated material, thereby avoiding or reducing heat transfer between
the individual heating rings 4. In order to fasten the spacer elements 10 as simply as
20 possible between the heating rings 4, the spacer elements 10 are designed as half-
shells, this being clearly visible in Fig. 3. Thus, the half-shell-shaped spacer rings 10
can be easily adapted around the smaller outside diameter of the heating ring 4. A
further heating ring 4 is then arranged on the outside diameter of the spacer element
10, and a spacer element is then again arranged on its smaller outside diameter. The
25 heating plate 2 is formed from so many heating rings and spacer elements that as
many diameter sizes as possible of the pipes to be welded can be covered. Of
course, some other heating plate construction is also conceivable in order to
implement the heating zones 12 spaced apart radially from one another.

It has also been found to be advantageous if the heating rings 4 and spacer elements
30 10 are axially centred 14 with respect to one another. This is achieved in Fig. 2 by
means of a shoulder on the heating ring 4 and a recess in the spacer element 10, but
there are also many other solutions here, such as with spacer bushings or other
stops, in order to achieve this. To ensure that the width of the heating plate 2 is as far
as possible the same everywhere and that no offset occurs between the heating
35 rings 4 and that flat faces 5 of the heating plate 2 are obtained, the axial centre of the
heating rings and spacer elements 10 is located in the same plane in all cases.

Fig. 2 shows the covers 8 of the faces 6 of the heating rings 4. These serve to protect
the heating wire 3 and prevent unwanted protrusion of the heating wire 3. It is

5 advantageous if each heating ring 4 has a separate cover 8 in order to reduce the
heat transfer to the other heating rings 4 as much as possible there as well.
Accordingly, there is an insulation gap 15 between the individual heating rings 4,
thereby ensuring that no heating ring 4 makes direct contact with another heating
ring 4.

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It has been found to be a preferred embodiment if the heating plate 2 is arranged in a
frame 7, this being clearly apparent in Fig. 3. The concentric arrangement of the
heating rings 4 and the spacer elements 10 makes it possible for the components to
be braced relative to one another in the frame 7. The heating rings 4 preferably have
15 an aperture for the wire leadthrough 16. By means of centring elements 9, the
heating plate 2 is centred in the frame 7 and the heating rings 4 and spacer elements
10 are simultaneously clamped together. It is advantageous if the centring elements
9 are arranged and connected to the frame 7 at three points on the outside diameter
of the heating plate. The centring elements 9 are preferably designed as pins which
20 also have a spring element that ensures the central arrangement of the heating plate
2 in the frame 7.

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List of reference signs

	1	Heating element
	2	Heating plate
10	3	Heating wire
	4	Heating ring
	5	Face of heating plate
	6	Face of heating ring
	7	Frame
15	8	Cover
	9	Centring element
	10	Spacer element
	11	Device
	12	Heating zone
20	13	Clamping device
	14	Axial centring
	15	Insulation gap
	16	Wire leadthrough

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5 Patent claims

1. Heating element (1) for generating IR heat beams for contactlessly heating plastic profile ends, preferably for end-face welding of pipes or fittings clamped in a device, comprising a heating plate (2) made at least partially of a conductive material and having two heatable faces (5), a heating wire (3) for generating the heat beams, wherein the heating wire (3) is arranged on the faces (5) of the heating plate (2), characterized in that the heating plate (2) has a plurality of heating zones (12) spaced apart radially from one another.
2. Heating element (1) according to Claim 1, characterized in that the heating zones (12) can be heated selectively.
3. Heating element (1) according to either of Claims 1 or 2, characterized in that each heating zone (12) is insulated from the heating zone (12) arranged closest to it.
4. Heating element (1) according to one of Claims 1 to 3, characterized in that the heating element (1) has at least two heating zones (12).
5. Heating element (1) according to one of Claims 1 to 4, characterized in that the heating plate (2) is formed by a plurality of heating rings (4) spaced apart radially from one another.
6. Heating element (1) according to Claim 5, characterized in that an insulation gap (15) is arranged between the heating rings (4), which insulation gap reduces the heat transfer between the individual heating rings (4).
7. Heating element (1) according to Claim 6, characterized in that the heating wire (3) on the faces (6) of the heating rings (4) is arranged in a spiral around the centre of the heating plate (2).
8. Heating element (1) according to either of Claims 6 or 7, characterized in that a spacer element (10) is arranged between the heating rings (4) for radial spacing.

- 5 9. Heating element (1) according to Claim 8, characterized in that the spacer element (10) consists of an insulating material.
- 10.Heating element (1) according to either of Claims 8 or 9, characterized in that the spacer element (10) is designed as a half-shell.
- 10 11.Heating element (1) according to one of Claims 1 to 10, characterized in that the heating plate (2) is surrounded by a frame (7).
- 12.Heating element (1) according to one of Claims 8 to 11, characterized in that heating rings (4) and the spacer elements (10) are arranged concentrically with respect to one another.
- 15 13.Heating element (1) according to one of Claims 6 to 12, characterized in that covers (8) are arranged on the faces (6) of the heating rings.
- 14.Heating element (1) according to one of Claims 8 to 13, characterized in that the heating rings (4) and the spacer elements (10) are fixed by being clamped together in a frame (7).
- 20 15.Heating element (1) according to one of Claims 1 to 15, characterized in that the heating plate (2) is fixed and centred in a frame (7) by means of centring elements (9).