Technological Development in Local Relief of Residual Stress

1. **Merchandise Name**：Technological Development in Local Relief of Residual Stress

2. **Developing Staff Members**

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3. **Development Idea**

Conventionally, in accordance with the heat source, heat treatments can be roughly divided into two kinds: burning heating method and electric heating method, wherein the electric heating method further includes a resistance heating treatment, a conduction heating treatment, an electrical heating treatment, and a laser heating treatment. The resistance heating treatment can further be categorized into a direct heating way and an indirect heating way. The said direct heating way conducts electricity directly to a workpiece to heat the workpiece via the heat induced by the resistance of the workpiece itself. The said indirect heating way puts a workpiece into a heating furnace and controls the temperature of a gas received in the heating furnace by heated pieces arranged inside the heating furnace, so as to heat the workpiece by the heated gas. Specifically, shielding gas such as argon, helium or nitrogen can be taken as the gas received in the heating furnace for avoiding high- temperature oxidation of the workpiece during heat treatment process.

However, in the condition that only a part of the workpiece has to be heated or the volume of the workpiece is small, an inner space of the heating furnace still has to be filled with the shielding gas to active the anti- oxidation function, and this will lead to a large consumption of the shielding gas and thus a great cost. Besides, the size of the workpiece is limited by the inner space of the heating furnace for the heating furnace to completely receive the workpiece and to proceed the heat treatment. Furthermore, an even thermal environment provided by the heating furnace is hard to achieve since the heat is generated by the plural heated pieces, and thus results of the heat treatment are usually not good enough.

The present finding relates to a heat treatment device and, more particularly, to a local resistance heating device with shielding gas controlthat is able to provide only a part of a workpiece with shielding gas to process resistance heating treatment. The local resistance heating device comprises two end-members and a mid-member. The two end-members are respectively members connected with an anode pole and a cathode pole, each end-member has an air channel, the air channel of one of the end-members is adapted to connect with an output terminal of a gas supplier, and the air channel of the other one of the end- members is adapted to connect with a sucking terminal of the gas supplier. The mid-member is arranged between the two end-members, wherein the two end-members and the mid-member jointly define a heating room communicating with the air channels of the two end-members.

The finding further shows that the air channel of each end-member has an inner passageway and an outer passageway, the inner passageway has a connecting hole adapted to connect with the gas supplier, the outer passageway has a plurality of nozzles communicating with the heating room, and a connecting channel links the inner and outer passageways. The finding further shows that the connecting channel and connecting hole are formed on two opposite sides of an axial center of the end-member.

4. Technological Competition and Industrial Application

The main objective of this heat treatment to provide a local resistance heating device with shielding gas control, which can provide the shielding gas to a treated portion of a workpiece only, so as to largely decrease the consumption of the shielding gas. Another objective of this finding is to provide a local resistance heating device with shielding gas control, which can merely proceed heat treatment to the treated portion of the workpiece without limitation in the size of the workpiece. Still another objective of this finding is to provide a local resistance heating device with shielding gas control, which can provide an even thermal environment for enhancing the quality of the treated portion.

5. Merchandise Statement of Achievement

Fig. 1 shows an exploded perspective view of a local resistance heating device with shielding gas control. The local resistance heating device includes two end-members 1 and a mid-member 2 between the two end-members 1.

The two end-members 1 are respectively connected with an anode pole 11a and a cathode pole 11b, while the two end-members 1 are oppositely arranged on two sides of the mid-member 2 and each end-member 1 is in the shape of a ring formed by an integral piece or assembled pieces. In this embodiment, each end-member 1 includes a first half-ring 12 and a second half-ring 13 for users to efficiently assemble or dismantle the end-members 1. The first half-ring 12 has an assembling hole 121 and the second half-ring 13 has an assembling hole 131 aligning with the assembling hole 121 when the first half-ring 12 engages with the second half-ring 13, so that a coupling member 14 can extend through the assembling holes 121, 131 to firmly couple the first and second half-rings 12, 13 together. Accordingly, by the assembled first and second half-rings 12, 13, each end-member1 has a oupling hole 15 formed at an axial center thereof.

For each end-member 1, an annular air channel 16 is formed inside the end-member 1 and extends to an outer surface of the end-member 1. Besides, the air channel 16 of one of the end-member 1 communicates with an output terminal 17a of a conventional gas supplier, and the air channel 16 of the other end-member 1 communicates with a sucking terminal 17b of the conventional gas supplier. Specifically, in this embodiment, the air channel 16 includes an inner passageway 16a and an outer passageway 16b, with the inner passageway 16a and outer passageway 16b coaxially extending around the axial center of the end-member 1, with the inner passageway 16a being closer to the axial center relative to the outer passageway 16b, while a connecting channel 161 links the inner and outer passageways 16a, 16b.

In this embodiment, since the end-member 1 includes the assembled first and second half-rings 12, 13, the inner and outer passageways 16a, 16b of the air channel 16 are formed in each of the first and second half-rings 12, 13. Particularly, each of the inner passageways 16a has a connecting hole 162 used to connect with the output terminal 17a or sucking terminal 17b of the conventional gas supplier, and each of the outer passageways 16b has a plurality of nozzles 163 extending to and connecting with the outer surface of the end-member 1 facing the other end-member 1. Moreover, in order to provide the whole air channel 16 with an evenly arranged air pressure, the connecting channel 161 and connecting hole 162 are preferably formed on two opposite sides of the axial center of the end-member 1. Therefore, injected gas will not enter the outer passageway 16b until the inner passageway 16a is filled up with the injected gas.

The mid-member 2 is arranged between the two end-members 1, and the mid-member 2 and end-members 1 jointly define a heating room 21 as shown in **Fig. 2**, with the heating room 21 communicating with the two air channels 16 of the end-members 1. In this embodiment, the heating room 21 communicates with the outer passageway 16b through the nozzles 163.

The mid-member 2 includes a first bent plate 22 and a second bent plate 23, wherein the first bent plate 22 is coupled with the first half-rings 12 of the two end-members 1, and the second bent plate 23 is coupled with the second half-rings 13 thereof. Furthermore, the first bent plate 22 has at least one assembling portion 221 and the second bent plate 23 has at least one assembling portion 231 aligning with the first assembling portion 221 for coupling with the first assembling portion 221 when the first bent plate 22 engages with the second bent plate 23, so that at least one coupling member 24 can firmly couple the first and second bent plates 22, 23 together.

Fig. 3 shows a local resistance heating device with shielding gas control. The local resistance heating device with shielding gas control can automatically maintain the shielding gas in the heating room at a preferable temperature and pressure, so as to provide a suitable environment for heat treatment of weldment, and thus the structural strength of the weldment can be enhanced. Besides, since the situation of the heating room can be automatically adjusted, other kinds of heat treatment such as tempering or stress-relief annealing is also implementable.

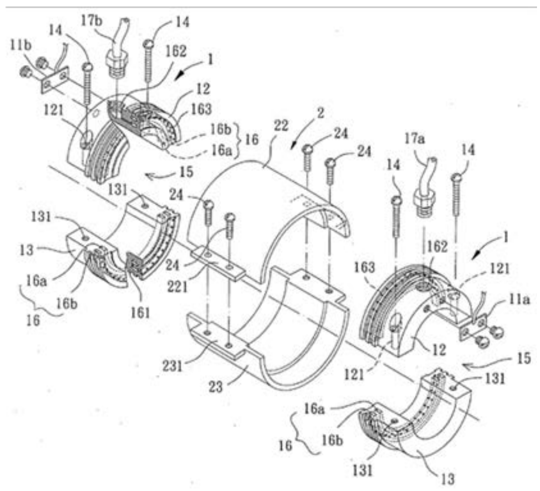

Fig. 1：An exploded perspective view of local heating device.

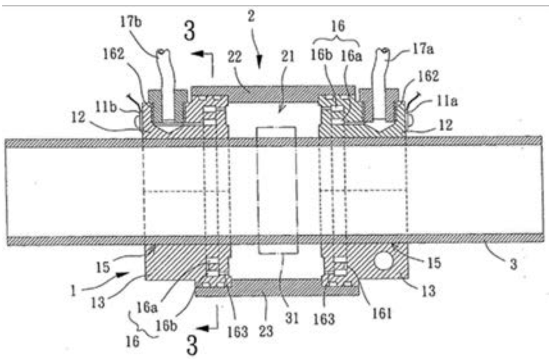

Fig. 2：A cross-sectional view of local heating device.

Fig. 3：A local resistance heating device with shielding gas control.