PORTABLE METAL HEAT TREATING FURNACE

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References Cited

UNITED STATES PATENTS
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ABSTRACT

A portable furnace for heat treating metals and the like has an encasement forming a housing for an insulating liner arranged within the encasement. This encasement is advantageously constructed with a flexible outer portion in the form of a hollow frustum of a cone having a cylindrical base portion and parallel base planes each provided with an opening arranged for girdling a member to be treated, and a cylindrical, hollow inner portion arranged in and fastened to the cylindrical base portion of the outer portion for rigidifying the encasement. At least one heat lamp, such as a quartz lamp, is arranged extending through an associated hole provided in the base plane adjacent the cylindrical base portion, and is mounted outside the encasement so it may be replaced while the furnace is heat treating an article. Preferably, there is a plurality of such lamps and associated openings. Further, the encasement is split perpendicular to the base planes into two or more hinged sections clampable together after the encasement is arranged girdling an article to be treated. This article may be pipe and the like. The insulating liner has a pair of layers; one layer being constructed from a rigid ceramic fiber insulation material and arranged between the encasement and the other layer, which is constructed from a blanket of ceramic fiber insulation material. These layers are replaceably fastened to the encasement as by suitable screw fasteners.

6 Claims, 4 Drawing Figures
PORTABLE METAL HEAT TREATING FURNACE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is related generally to furnaces for heat treating metals and the like. It particularly is related to a portable heat treating furnace employing quartz lamps to furnish the treating heat.

2. Description of the Prior Art

It is generally necessary to thermally, or heat treat base metals and the like in order to maintain or restore properties affected by the heat of, for example, welding. Among properties controlled or improved by such heat treatment are: (1) distortion during welding is reduced; (2) stresses that could seriously affect the service performance of a weldment are reduced; (3) weldability, which may be improved considerably by a preheat treatment; (4) improvement of dimensional stability; and (5) machinability.

Numerous proposals have been advanced for providing apparatus to perform heat treatments on metals and the like subjected to heat from, for example, welding. Among them is a furnace disclosed in U.S. Patent No. 3,353,005, which uses quartz lamps to furnish the heat. However, the lamps in this known furnace are arranged adjacent the article to be treated. This arrangement results in uneven heating of the article due to insufficient convection being permissible between the lamps and the article. Further, the furnace must be shutdown and opened to replace a lamp; a time-consuming process. In addition, a coolant must be furnished to the apparatus during operation for cooling the base or socket portion of the lamps. The provision of a coolant is often inconvenient in the field, and requires additional structure for forming cooling ducts.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a quartz lamp employing furnace which provides an even heat to an article to be heat treated.

It is another object of the present invention to provide a quartz lamp furnace in which lamps may be replaced while the furnace is in operation.

It is yet another object of the present invention to provide a quartz lamp furnace which may be operated without a coolant.

These and other objects are achieved according to the present invention by providing a heat treating furnace having an encasement forming a housing for an insulating liner arranged within the encasement.

The encasement preferably has a full, flexible outer portion in the form of a hollow frustum of a cone having a cylindrical base portion and parallel base planes, and a cylindrical, rigidifying inner portion arranged in the cylindrical base portion of the outer portion. The base planes of the outer portion are each provided with an opening arranged for surrounding an article, or member to be treated.

When the encasement is formed in a configuration as set out above, a hole is provided through the encasement and insulating liner in the outer portion base plane adjacent the cylindrical base portion. A lamp mounted outside the encasement is arranged extending through the hole and into the encasement. This outside mounting, which may be achieved by mounting brackets affixed on the outer surface of the encasement, per-

mits replacement of the lamp while the furnace is operating, and also eliminates the need for cooling the sockets of the lamps in most instances of furnace operation. Advantageously, a plurality of lamps, each arranged in an associated hole, are employed.

A preferred embodiment of the insulating liner has a pair of layers; one of these layers is advantageously constructed from a rigid insulation material and is arranged between the other layer, which is constructed from a blanket insulation material, and the encasement. The layers are advantageously, removably connected to the encasement as by suitable fasteners.

The encasement may be formed from a plurality of mating sections, selectively cooperable to girdle a member to be treated. These sections are advantageously hinged together, and are clamped about the member to be treated as by a suitable latch.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an end elevational view showing a heat treating furnace according to the present invention arranged girdling a pipe.

FIG. 2 is a fragmentary, side elevational view showing the furnace and pipe of FIG. 1.

FIG. 3 is a fragmentary, longitudinal, sectional view showing a detail, with the pipe removed, of the furnace of FIGS. 1 and 2.

FIG. 4 is a fragmentary, exploded, perspective view showing an encasement and insulating liner for a furnace according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now more particularly to FIGS. 1 to 3 of the drawings, a heat treating furnace 10 according to the present invention is shown which has an encasement 12 forming a housing for an insulating liner 14 arranged within encasement 12.

A plurality of lamps 16 are mounted outside of encasement 12, and are arranged extending through an associated hole 17 (FIG. 3) provided in encasement 12. These lamps 16 may be, for example, conventional quartz lamps. Lamp mounting brackets 18 are affixed on the outer surface of encasement 12, and each lamp 16 is removably mounted on an associated bracket 18 as by a bent bar 20, a setscrew 22, and a wing nut fastening arrangement 24. The latter removably attaches socket 26 of a lamp 16 to bar 20 of its associated bracket 18. A, for example, high-temperature withstanding ceramic cement 28 may be applied to the base portion of lamp 16 for keeping these base portions cooler and from coming apart. The particular mounting for lamp 16 shown in FIGS. 1 to 3 of the drawings permits replacement of one or more lamps 16 while encasement 12 is arranged girdling a, for example, pipe 30 to be heat treated. The distance of lamp 16 from the outer surface of pipe 30 should be sufficient to ensure uniform, no hot spot heating of pipe 30 by a convective heat transfer between lamp 16 and the pipe or other article being heat treated. The particular configuration of encasement 12 shown in the drawings has been found
particularly suited for achieving this uniform heating. The frusto-conical configuration allows for a wide length of pipe 30 or other piece of metal to be heated while lamps 16 are protected in a smaller area from the heat of the metal being treated. Further, since the bases and sockets of lamps 16 are arranged outside of encasement 12, a coolant such as air is normally not needed to cool the base portions and sockets. However, the structure may be cooled if desirable from an outside source such as a length of tubing (not shown) without affecting the heated zone within encasement 12, because furnace 10 is so well insulated in a manner to be discussed below that the outside atmosphere cannot get inside encasement 12. Ceramic cement 28 helps ensure this heat seal.

As mentioned above, encasement 12 is advantageously in the form of a hollow frustum of a cone having a cylindrical base portion 32 and parallel base planes. Each base plane is provided with an opening 34, 36, respectively, arranged for girdling pipe 30. Holes 17 for lamps 16 are arranged in the base plane adjacent the cylindrical base portion 32, while brackets 18 are arranged on this portion 32.

Encasement 12 is preferably formed from a plurality of mating sections, two sections 38 and 40 being shown in the drawings, selectively cooperable to girdle pipe 30 and pivotally connected together as by a conventional hinge 41. A latch arrangement 42 of any suitable, known type selectively clamps sections 38 and 40 in girdling arrangement about pipe 30. It is to be understood that different combinations of sections may make furnaces according to the present invention that are large or small, flat or curved, wide or narrow, or whatever size and/or shape required.

Encasement 12 has a full, flexible outer portion 44 and a partial, rigidifying inner portion 46. Portion 46 may be cylindrical and arranged in cylindrical base portion 32 so as to function as a heat reflector and shield as well as a rigidifying element. These portions 44, 46 may be broken up to form sections forming encasement 12 as discussed above. The portions 44, 46 in any section are connected together as by rivets 48 (FIG. 3) passing through bores 50, 52. By constructing outer portion 44 from a flexible material, such as a light gauge aluminum, enclosure 12 is permitted to conform to the size and configuration of liner 14. The principal function of enclosure 12 is to protect liner 14 and make furnace 10 more durable. Further, encasement 12 can be constructed of a light weight material such as aluminum, because liner 14 keeps the outside of furnace 10 below that material's melting point.

FIG. 4 of the drawings best shows that insulating liner 14 has, for example, a pair of layers 54 and 56. Layer 54 is constructed from a rigid thermal insulation material capable of withstanding temperatures of at least, for example, 2,000° F., and layer 56 is constructed from a blanket thermal insulation material also capable of withstanding, for example, 2,000° F. temperatures. Layer 54 is arranged adjacent to and between layer 56 and encasement 12 for giving form to liner 14. Suitable devices such as screw fasteners 58 (FIGS. 1 to 3) may be arranged in bores 60, 62, 64, and 66 for removable attaching layers 54, 56 to encasement 12 so that damaged liners 14 may be replaced. Layers 54, 56 may be broken into parts associated with the sections forming encasement 12, and attached to a respective section to form a unit therewith. Liner 14 forms such an efficient enclosure that heat and light from lamps 16 is effectively kept inside enclosure 12.

Rigid layer 54 may be formed by wetting a, for example, suitable ceramic fiber material made in a conventional manner from, for example, kaolin, kyanite, or fused silica, casting the wetted material, and drying the cast material. Such procedures are well known in the ceramic art. The drying rate is dependent on such parameters as temperature, humidity, and rate of movement of the drying medium, usually air, over the surface of the casting. Layer 56 may be, for example, micro-quartz fibers, or other suitable ceramic fiber insulating material formed in a known manner into a blanket.

Handles (not shown) may be mounted on encasement 12, specifically on outer portion 44, for facilitating manipulation of furnace 10. Further, bracket holders (not shown) may also be mounted on enclosure 12 for mounting a, for example, air tube if a coolant is required for cooling the base portions and sockets of lamps 16.

As can be appreciated from the above description, a furnace 10 according to the present invention is economical to manufacture, flexible in use, and light in weight. For example, encasement 12 does not require expensive machine shop work, and liner 14 can be designed with a sufficiently low thermal conductivity to hold heat inside the furnace and reduce the number of lamps 16 required to obtain a predetermined heat. The ability to employ light weight materials permits a furnace 10 according to the present invention to be used for preheating, stress relieving, and post-weld treatments at job sites out in the field as well as in oil refineries, nuclear plants, and the like. Installation of a furnace 10 according to the present invention at a job site is simple, and can be accomplished in a relatively short period of time.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A heat treating furnace comprising, in combination:
   a. an encasement forming a housing;
   b. an insulating liner arranged within the encasement and housed thereby, the liner having a pair of layers; one layer being constructed from a rigid insulation material, and the other layer being constructed from a blanket insulation material, the layer of rigid insulation material being arranged adjacent to and between the layer of blanket insulation material and the encasement, each layer capable of withstand temperature of at least 2,000°F; and
   c. means for removably and replaceably attaching the layers of insulation material to the encasement.

2. A structure as defined in claim 1, wherein the encasement includes a full outer portion and a partial inner portion.

3. A structure as defined in claim 2, wherein the encasement outer portion is constructed from a flexible sheet material permitting the enclosure to conform to
5. A structure as defined in claim 4, further including means for selectively connecting the sections together about a member to be treated.

6. A structure as defined in claim 1, wherein the encasement is in the form of a hollow frustum of a cone having a cylindrical base portion and parallel base planes, each base plane provided with an opening arranged for girdling a member to be treated, with the inner portion partially forming the cylindrical base portion.