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Vollmer

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[54] RADIATION PROTECTIVE JACKET FOR A VACUUM FURNACE

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[52] **U.S. Cl.** **13/31**

[51] **Int. Cl.** **H05b 3/02**

[58] **Field of Search** 13/20, 31, 35; 263/50

[56] **References Cited**

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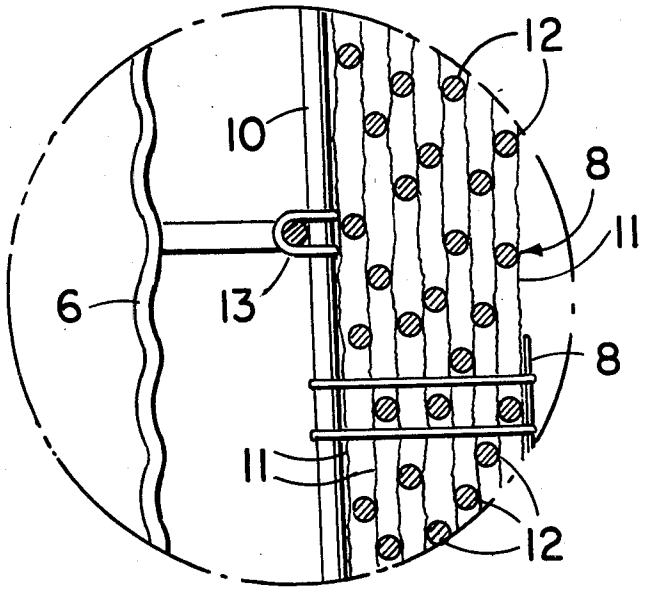
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[57] **ABSTRACT**

A radiation protective jacket comprises a multiple number of layers of metal foil which are spaced apart by metal wires such as molybdenum wires. The jacket is arranged around the goods to be treated within a vacuum furnace to enclose the workspace and it is supported in the furnace on supporting elements which are held from a holder, for example, which is mounted adjacent the top of the interior of the furnace. An electrical heating coil is stretched to extend around the materials to be treated within the center of the radiation jacket.

7 Claims, 2 Drawing Figures



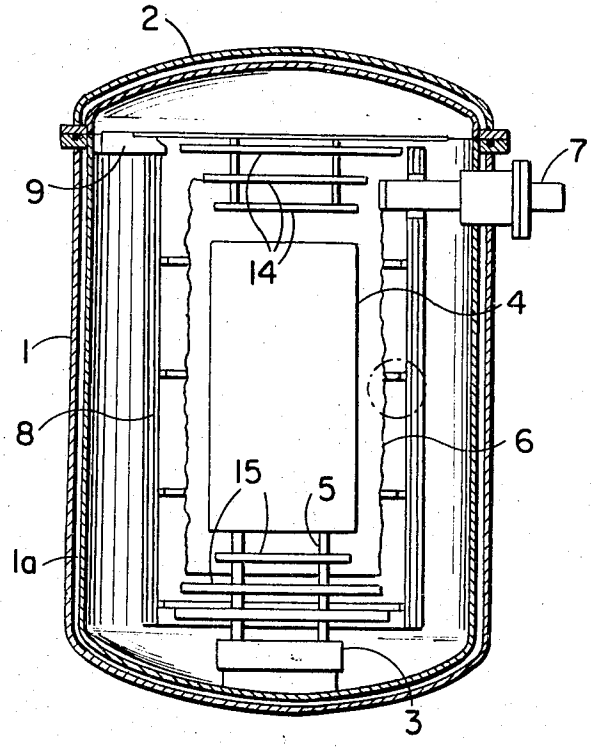


FIG. 1

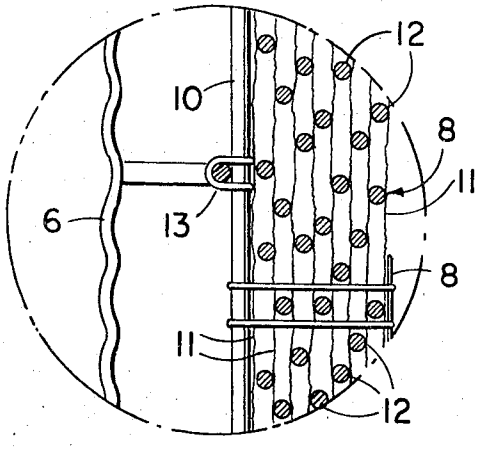


FIG. 2

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RADIATION PROTECTIVE JACKET FOR A VACUUM FURNACE

SUMMARY OF THE INVENTION

This invention relates in general to the construction of radiation protective devices and, in particular, to a new and useful radiation protective jacket formed as an arrangement of a plurality of metal foil layers spaced apart by wire spacing elements and which is arranged within a vacuum furnace to enclose the working space thereof.

Vacuum furnaces nowadays are required to have a large working space, particularly for testing, annealing, degassing or soldering in a vacuum of large workpieces, such as parts of vehicles, and particularly air and space vehicles and satellites. For economic operation, such furnaces have to be quickly heatable and coolable, which means that they should not have great heat capacity. They also have to be safe in operation in order to prevent long periods of idleness due to frequent repairs.

According to the known technology of the state of the art, the working space of a vacuum furnace is surrounded by one or several, usually cylindrical, jackets of heat reflecting sheet metal material and the front sides of the cylindrical working space are covered by radiation protective sheets. Suitable materials for the radiation protective sheets were metals maintaining their stability in the desired furnace temperature. Tungsten, tantalum or molybdenum are used for high-temperature furnaces. For large size furnaces, the radiation-protective sheets become expensive due to the high price of the metals of which they are made and because of their weight. They can only be mounted or removed from the furnace with extreme care, and by the use of lifting devices, when cleaning or repair or similar maintenance operations become necessary. Tungsten and molybdenum parts, because of their brittleness, frequently cause cracking and ruptures. Repairs are required rather frequently because the radiation protective cylinders easily warp under the high temperatures in the furnace space.

In accordance with the present invention, there is provided a radiation protective jacket of a vacuum furnace which does not have the disadvantages of the prior art. The jacket comprises an arrangement of heat reflecting surfaces enclosing the workspace of a vacuum furnace and it includes a frame of heat-resistant material to which a plurality of layers of metal foils is secured. The multiple layers of foils have proved to give a very effective radiation protection. The fact that the individual foil layers are in contact at many points surprisingly does not appear to substantially reduce its effectiveness as a radiation protection.

A radiation protective jacket comprising metal foils arranged in layers is easy to manufacture and, compared to the heavy metal cylinders which have been used up to the present time, they provide an enormous weight reduction in the protective shield formation by the factor of from three to six.

The radiation protective jacket, according to the invention, has a considerably lesser thickness than an arrangement of several sheet metal cylinders of equal effectiveness and this results in an additional advantage of a considerably enlarged furnace workspace with the same boiler dimensions. The main advantage of the invention, however, is seen in the fact that the new radiation protective jacket is not substantially distorted even with the highest occurring temperatures.

This freedom of distortion ensures low susceptibility to disturbances. In addition, routine repairs can be made easily without too much difficulty. Due to the relatively small metal mass of which the radiation protective jacket comprises, it also possesses a very minor thermal inertia so that, with a given heat production, it can be brought to the operational temperature faster and can be cooled faster than with the known arrangements. In addition, the heat supply can be reduced, thus achieving a better economy.

Accordingly, it is an object of the invention to provide an improved radiation heat shield for a vacuum furnace which

comprises a plurality of layers of metal foil which are spaced apart by the manner in which they are mounted or by intermediate metal wires arranged between adjacent layers.

A further object of the invention is to provide a vacuum furnace which includes a holder arranged within a furnace to support a radiation protective sleeve around the exterior of a work surface which is surrounded by a heating coil and wherein the protective sleeve comprises a plurality of layers of metal foil.

A further object of the invention is to provide a radiation protective shield which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claim annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the Drawings:

FIG. 1 is a transverse sectional view of a vacuum furnace having a radiation protective sleeve constructed in accordance with the invention; and

FIG. 2 is an enlarged section of a portion of the shield indicated in FIG. 1.

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings in particular, the invention embodied therein, comprises a vacuum furnace boiler generally designated **1** of double-wall construction having an intermediate space **1***a* for circulation of a cooling medium, such as a liquid, therethrough. The cover **2** for the boiler **1** also is of double-wall construction and a cooling medium may be circulated between the walls. The vessel contains an interior support or stand surface **3** on which goods **4** to be treated in the furnace are supported by the use of supports **5**. An electric heating element or coil **6** extends around the working space and it is supplied with current by a current supply device **7**.

In accordance with the invention, a radiation protective jacket **8** is arranged in the furnace interior around the exterior of the heating element **6** and it is provided for the purpose of reflecting back to the work space the heat radiation coming from the heating element and from the heated goods **4**. The radiation protective jacket **8** is supported from a bracket or holder **9** and it is constructed of a plurality of layers of metal foil **11**.

As indicated in FIG. **2**, the protective shield **8** is supported from vertically extending rods **10** which also support the heating element **6** and the whole assembly is supported from the holder **9**. The foil protective shield **8** comprises eight separate layers of a thin tantalum foil **11** with molybdenum wires **12** inserted between the individual foils as distance pieces or spacers. The foil package which forms the jacket **8** encloses the interior space of the furnace and is secured to the supporting rods **10** at a location to be supported around the goods **4**. The easiest manner of installation is to sew the entire assembly of foils **11** with rods **12** to the rods **10** by thin wires, such as individual holding wires **13**. The individual foil layers may also be sewed to one another with the thin wires **12** so as to impart better stability to the overall construction.

The foil thickness of each foil layer **11** is less than 0.05 mm., whereby substantial savings in material is achieved with full effectiveness as a radiation reflector. The spacing between the various foils **11** may be effected other than by the use of wire spacer elements, such as the wires **12**. For example, then tubes or corrugated bands may be inserted between adjacent layers or the layers may be held such that they are spaced apart.

The front sides of the cylindrical furnace space may be constructed as radiation reflectors of known construction or foil packages may also be used for this purpose too. In the showing of FIG. 3, three different assemblies of foils 14 are arranged adjacent the top of the workpiece 4 and three separate ones 15 are arranged adjacent the bottom. Each individual assembly of these groups of assemblies 14 and 15 may be constructed as indicated in FIG. 2.

I claim:

1. A radiation protective jacket comprising a plurality of heat reflecting surfaces adapted to enclose the work space of a vacuum furnace, said surfaces being defined by a multilayer arrangement of metal foils, and frame means for supporting said metal foils, and metal wire means sewing together the individual layers of said metal foils and to the frame means.

2. A device, according to claim 1, wherein said wires are molybdenum and said foil is tantalum.

3. A protective jacket, according to claim 1, wherein said foil is of a thickness of less than 0.05 mm.

4. A protective jacket, according to claim 1, including spacer means spacing said foil layers apart.

5. A protective jacket, according to claim 4, wherein said spacer means comprises individual wire elements.

6. A protective jacket, according to claim 4, wherein said spacer means comprises metal bands inserted between individual metal foil layers.

7. A radiation protective jacket comprising a plurality of heat reflecting surfaces adapted to enclose the workspace of a vacuum furnace, said surfaces being defined by a multilayer arrangement of metal foils, frame means for supporting said metal foils, said frame means comprises at least one metal rod member, a plurality of metal wires located between adjacent layers of said foils for spacing said foils, and a holder connected to said rods for supporting said rods and said metal foils within a vacuum furnace.

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