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(54) **Diaphragm heater for heating liquids.**

(57) Diaphragm heater including distributor (3, 4) for air as a fluidizing agent is situated in a tank (2) under fluidizing bed (1) being either a fine-grained ceramic material mixed with a fine-grained solid fuel, or a fine-grained ceramic material mixed during the use of the heater with a gas or liquid fuel and with air. During operation the heat exchanger may be dipped in a metal plating bath. Air enters via a tube (5) and emerges through apertures (8) to form the fluidized bed (1).

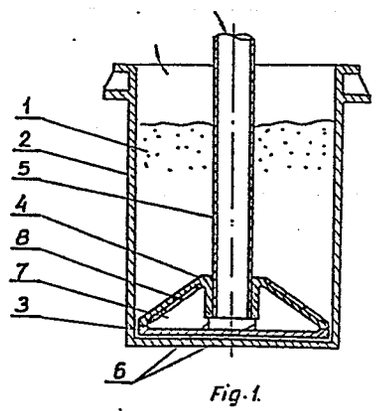

Fig. 1.

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DIAPHRAGM HEATER FOR HEATING LIQUIDS

This invention relates to a diaphragm heater applicable for heating liquids and, particularly, for heating metal baths during a metal plating process, such as galvanizing, aluminizing, etc.

A distributor of fluidizing agent known from Polish Patent Specification No. 83,343 entitled "Method of Agglomeration of Lightweight Fine-Grained Aggregate and Installation for Implementation Thereof" consists of an annular chamber connected in the bottom portion to an air supply tube and covered from above with a grid for separation of the fluidizing agent (air or air-gas mixture).

The heretofore known diaphragm heat exchanger used in the dip plating processes consists of a system of heating ducts applied to the surfaces of tank walls or crucible.

Still another known heater consists of a galvanizing pot made of Armco iron, or an intermediate tank filled with lead in which a vat with metal bath is accommodated to be used for dip plating.

A considerable drawback of these heaters when used with steel pots is the corrosion of the steel pots with

liquid lead which causes in effect a reduction of heat flux intensity to 35 kW per sq. m. which penetrates into the galvanizing bath.

Still another drawback of the known devices is the occurence of frequent failures of galvanizing plant caused by the corrosion of the pot which is hardly appreciable in the operating conditions.

On the other hand, in the case of a crucible made of carbon materials or carborundum used for an aluminium bath the bath heating rate is limited by the stresses in the crucible walls produced by the temperature gradients.

The heretofore known heater of a furnace of the Morgan type used for melting non-ferrous metals consists of a fire chamber dipped in the vat having a metal bath.

A drawback of this heater is the use of very high temperatures in the fire chamber which considerably worsens the watt-hour effeciency of the technological process and leads to excessive oxidation of metal with combustion gases.

Also known is an electric heater immersed in the metal bath.

The use of an electric heater during the dip plating process considerably worsens the efficiency of this process because utilization of heat obtained from electric energy is uneconomical as compared with heat obtained from solid, liquid, or gaseous fuel.

An object of the invention is to provide a heater for alleviating the aforementioned drawbacks.

According to the invention, there is provided a diaphragm heater comprising a housing having a region for containing a fluidized bed characterised by: a distributor within said housing adjacent said region for distributing air into said region; partition walls dividing an interior space of said distributor into chambers; apertures in a lid of said distributor; and supply means connected to supply air to the interior of said distributor.

One embodiment of the invention consists in the application of a diaphragm heater for a solid fuel including a distributor of the fluidizing agent for production of a fluidized bed situated under the fluidal bed. This distributor is accommodated in a tank, preferably having a circular cross-section the solid phase of said fluidized bed being a fine-grained ceramic material with a fine-grained solid fuel. The distributor body has the shape of a vessel, preferably of a circular cross-section, covered tightly with a lid connected with a vertical tube for supply of compressed air being a fluidizing agent the inner space of said distributor body being divided by partition walls into several chambers, said lid having through holes, preferably radial slots, for producing a fluidized bed. The lid of the body is either horizontal, or has the shape of the side surface of a cone.

In another embodiment of the invention for solid or liquid fuel, the distributor is connected with a vertical system of two concentric tubes, that is an air tube and a gas tube accommodated inside the air tube. The distributor body is a vessel, preferably with a vertical cross-section, covered tightly with a lid, the inner space of said body being divided by partition walls into

several chambers, some of them used as air chambers being connected with an air through tube, and the others used as fuel gas chambers being connected with the gas through tube. The individual air chambers, or the individual groups of air chambers have been separated by fuel gas chambers. The body chamber is either horizontal, or has the shape of the side surface of a cone.

For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 illustrates a diaphragm heater suited for solid fuel in a vertical section; and

Figure 2 illustrates a diaphragm heater suited for a gaseous or liquid fuel.

The heater has a distributor of a fluidizing agent situated under a fluidizing bed 1 in a tank 2 with a circular cross-section, the solid phase of said fluidized bed 1 being a fine-grained ceramic material mixed with a fine-grained carbon (Figure 1). The distributor body 3 has the shape of a vessel with a circular cross-section covered tightly with a lid 4, having a conical surface connected with a vertical through tube 5 for supply of compressed air as a fluidizing agent. The inner space of said distributor body 3 has been divided by partition walls 6 into several chambers 7, through holes 8 being provided in said lid 4 above said chambers 7.

In Figure 2, another embodiment of the invention has a distributor of fluidizing agent situated under the fluidizing bed 1 in tank 2 connected with a vertical

system of two concentric through tubes, the air tube 5 and the gas tube 9 being accommodated inside it. The distributor body 3 is a vessel with a circular cross-section covered tightly with a lid 4 having a conical surface, the inner space of said distributor body being divided by partition walls 10 and 11 into several chambers. Some of these are used as air chambers 12 and are connected to a through air tube 5 and others, used as gas chambers 13, are connected to a gas through tube 9. The individual air chambers 12 have been separated by gas chambers 13 and holes 8 are provided in the lid 4 above the chambers 12 and 13.

During operation, the diaphragm heater according to the invention is dipped in a metal bath. After the ignition of coal in the fluidized bed 1 and after obtaining a stable combustion within the whole volume of the bed an intensive combustion of the coal contained in the fluidized bed 1 takes place and said bed is set in motion by the supplied air and thus serves for heat transfer from the coal being burned through the walls of the tank 2 to the metal bath.

Still another embodiment of the diaphragm heater according to the invention is immersed, when in operation, in the metal bath. After ignition of gas in the fluidized bed 1 and after propagation of the combustion process throughout the whole volume of the bed combustion of the gas supplied through the gas tube 9 takes place with oxygen supplied through air tube 5, the solid phase of the fluidized bed 1 being set in motion by the supplied gas. The air serves as a catalyst for combustion and transfers heat from the gas being burned to the walls of the tank 10.

An advantage of the diaphragm heater or heat exchanger according to the invention as compared with the heretofore known heaters wherein the bath of melted metal (zinc) is heated through the walls of the galvanizing pot is a reduction of heat consumption per unit weight of metal plated workpieces by 10 to 20 per cent and as compared with an electric resistance heater is a reduction by half of heat consumption as referred to the theoretical standard fuel.

The heater according to the invention enables the galvanizing efficiency to be increased by 20 to 50 per cent as compared with that obtainable in the plants heretofore used this being possible because of an increased heat load of its heating surface to as much as 233 kW per sq. m. without any danger of a negative influence of a layer of hard zinc. In consequence, the temperature of the bath can be easily maintained in conformity with technical specifications.

Claims:

1. A diaphragm heater comprising a housing (2) having a region for containing a fluidized bed (1) characterised by: a distributor (3, 4) within said housing adjacent said region for distributing air into said region; partition walls (6) dividing an interior space of said distributor into chambers (7); apertures (8) in a lid (4) of said distributor; and supply means (5, 9) connected to supply air to the interior of said distributor.

2. A heater according to claim 1 characterised in that said region contains fine-grained ceramic material.

3. A heater according to claim 1 or 2 characterised in that said supply means (5, 9) is arranged to supply air to at least one chamber (7) and fuel gas to at least one chamber.

4. A heater according to claim 3 characterised in that a plurality of individual air chambers (12) are separated by respective gas chambers (13).

5. A heater according to claim 3 characterised in that a plurality of individual groups of air chambers (17) are separated by gas chambers (18).

6. A heater according to any one of claims 3 to 5 characterised in that said supply means comprises two concentric tubes (5, 9).

7. A heater according to any one of claims 1 to 6 characterised in that said supply means (5, 9) passes through said region.

8. A heater according to any one of claims 1 to 7 characterised in that the lid (4) of the distributor is substantially flat.

9. A heater according to any one of claims 1 to 7 characterised in that the lid (4) of the distributor is conical.

10. A heater according to any one of the preceding claims characterised in that said apertures are slots (8).

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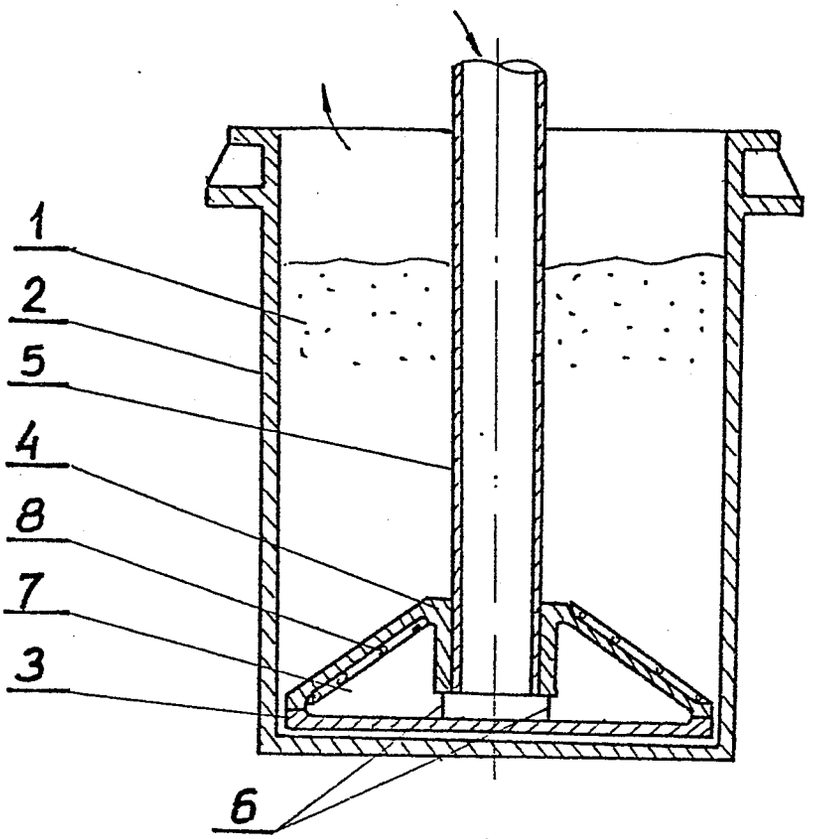

Fig. 1.

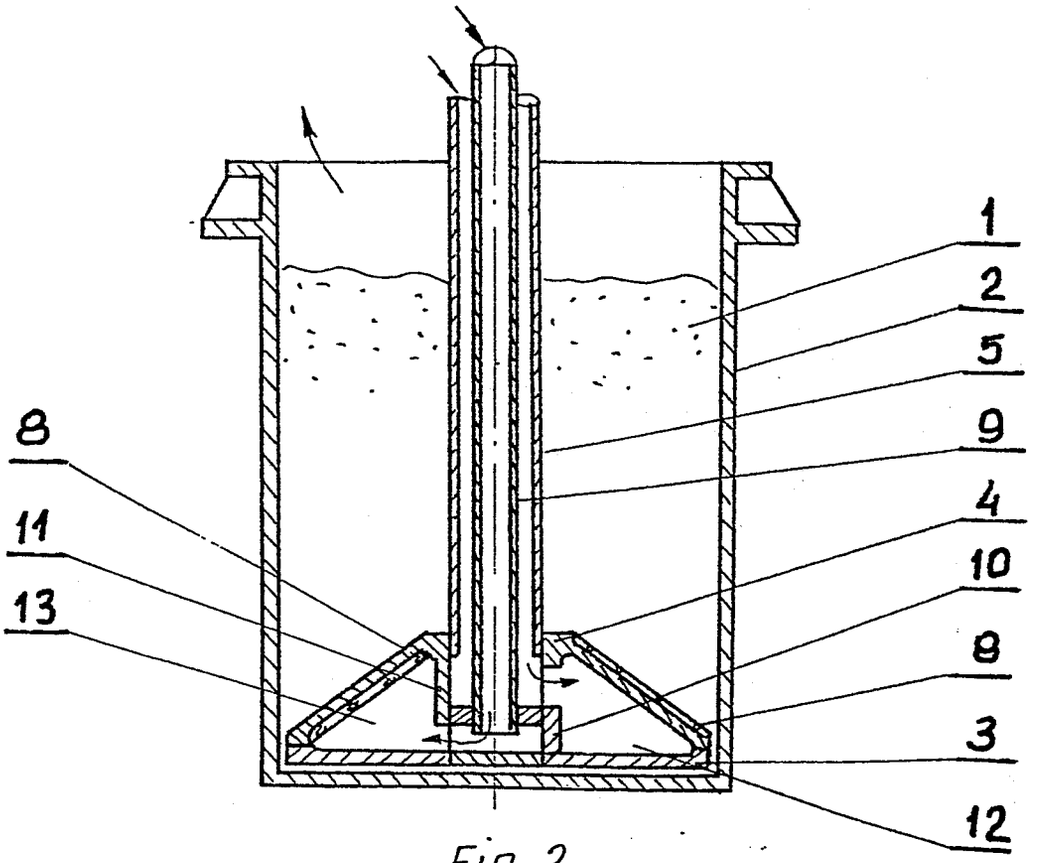

Fig. 2.

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EUROPEAN SEARCH REPORT

0116920
Application number

EP 84101385.7

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	US - A - 4 340 000 (HEIN) * Totality * --	1,8,10	F 27 B 15/10 F 23 C 11/02 C 23 C 1/14
X	DE - A - 2 408 649 (COAL INDUSTRY) * Page 6 - page 9, paragraph 1; fig. 1 * --	1,8,10	
X	DE - A1 - 2 618 291 (COAL INDUSTRY) * Page 4, paragraph 4 - page 6, paragraph 2 * --	1,8,10	
A	GB - A - 1 425 704 (BRITISH PETROLEUM) * Totality * --	1,8,10	
A	DE - A - 2 352 412 (SPROCKET) * Page 3, last paragraph - page 8, first paragraph; fig. 1-4 * --	1,2,8, 10	TECHNICAL FIELDS SEARCHED (Int. Cl. ³) F 27 B 15/00 F 27 D 11/00 F 23 C 11/00 F 23 G 7/00 C 23 C 1/00 C 04 B 31/00 H 05 B 3/00
A	US - A - 3 737 283 (NIKLES) * Totality * --	1-3,8, 10	
D,A	PL - A - 83 343 (AKADEMIA GORNICZO-HUTNICZA) ----	1,2	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	27-04-1984	TSILIDIS

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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E : earlier patent document, but published on, or after the filing date
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