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DEVICE FOR A GASTIGHT FIXING OF CERAMIC TUBES IN HIGH TEMPERATURE FURNACES

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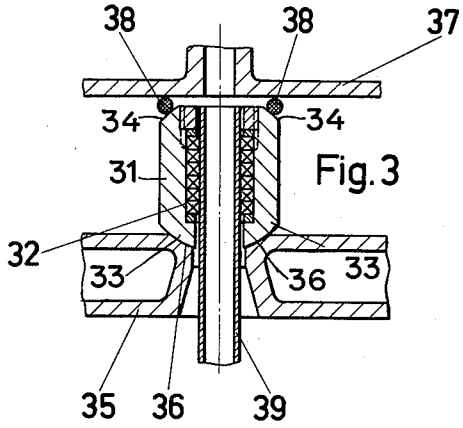
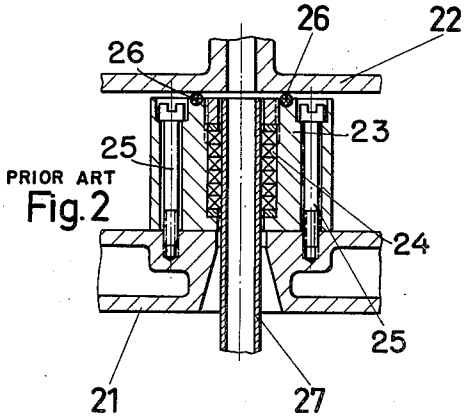


Fig. 3



PRIOR ART

Fig. 2

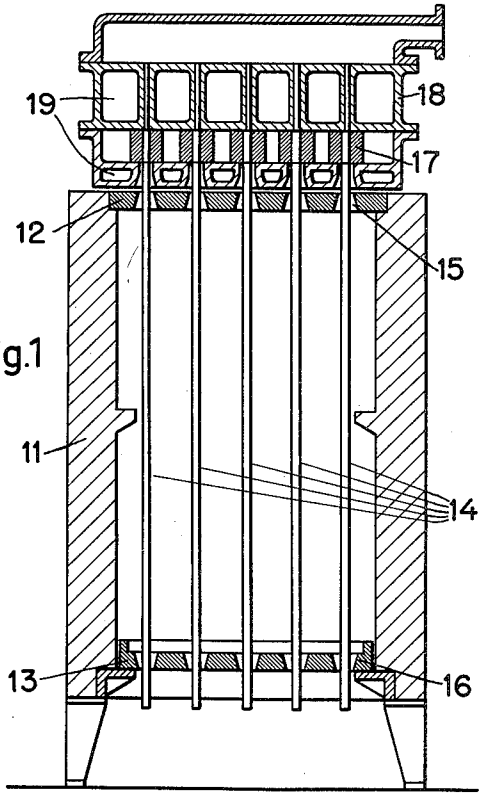


Fig. 1

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DEVICE FOR A GASTIGHT FIXING OF CERAMIC TUBES IN HIGH TEMPERATURE FURNACES

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1 Claim. (Cl. 263—37)

The present invention relates to improvements in gastight fixing of ceramic tubes in a furnace for high temperatures, particularly furnaces which are provided with vertically suspended tubes, the free ends of which project through the closure end of the furnace.

More especially, the present invention relates to the fixing of the upper end of the ceramic tubes at the head of the furnace which may be equipped with cooling elements.

In chemical reactions or heat treating processes which are carried out at relatively high temperatures, it is often necessary to employ furnaces in which the reaction space or the heating chamber is subdivided into a number of separate tubes incased in a common furnace case. If the reaction is carried out at temperatures at which metal tubes cannot be used whether it be for thermal or chemical reasons, such furnaces must be equipped with ceramic tubes, for instance, tubes of sintered alumina, sillimanite and the like, which, if desired, are associated to form bundles of tubes. Because these tubes possess a comparatively high sensivity to mechanical shock and impact and in view of their low resistance against temperature shock, special precautions are necessary in the use of such furnaces.

It has therefore proved advantageous to support the tubes only at the upper end of the furnace and to permit the lower free ends of the tubes to extend freely from the bottom of the furnace so as to prevent stress by high heat fluctuation whereby the tubes may become distorted and deviate in a lateral way.

The openings in the closure provided at the end of the furnace must on one hand, however, be rather tight in order to prevent heat losses from the furnace heating chamber, on the other hand, the lower furnace closure must not hinder the lateral play of the free lower tube ends in order to prevent stresses on the tubes which might lead to their destruction.

According to the present invention it was found that some of the aforementioned special precautions can be overcome in a simple manner by an improved device for the holders at the upper end of the tube. Instead of firmly connecting the holders with the furnace casing or with a solid furnace head, the holders consist of a movable head provided with a borehole within which to rest the end of the tube whereby the lower bearing surface and its counterpart surface are sphere-shaped and the lower supporting element rests on a corresponding sphere-shaped bearing surface of the furnace case or the furnace head.

The accompanying drawings serve to illustrate the device according to the invention.

In such drawings:

FIG. 1 is a longitudinal section through a furnace provided with ceramic reaction tubes which according to FIG. 2 are fixed in a known manner at the upper end of the furnace closure.

FIG. 3 shows the device according to the invention, i.e. the fixing of the tubes in a movable head with sphere-shaped supports (bearing surfaces).

In FIG. 1, numeral 11 designates the furnace case, numerals 12 and 13 the upper and lower closures provided with conical openings 15 and 16 to permit passage

for the tubes 14. By means of the heads 17—see FIG. 2 in detail—the tubes are firmly clamped and at the same time firmly connected with the furnace head 18. The figure also shows several cooling chambers (devices) and gas collecting chambers 19 which are, however, not essential for the new invention.

In FIG. 2 the holding of the upper ends of the tubes is shown in detail. Numerals 21 and 22 are parts which are firmly connected with the furnace head 18 (FIG. 1). Numeral 23 is a head for the tubes provided with a borehole and sealing elements 24; the head is firmly connected with the part 21 and therefore with the furnace head 18 by means of the screws 25. As a consequence the upper end of the tube 27 is not movable towards the furnace head 18 or towards the furnace itself. Numeral 26 is a sealing element against permeability of gas and seals off the holder 23 towards the upper part 22 of the furnace head. In the embodiment according to the known form as shown in FIG. 2, the upper end of the tube is fixed against the furnace head and also against the furnace itself. In case the tube with its free lower end vertically deviates to its longitudinal axis, a stress is formed on the tube as soon as the lower end of the tube touches the rim of the boreholes 16 (FIG. 1). If the movement is strong the stress may surpass the strength of the ceramic tubes (especially dangerous in the heating or cooling period) and the tube may be destroyed. If, however, the diameter of the boreholes 16 is so large that even an extremely distorted tube cannot touch the walls of the furnace, the lower closure of the furnace cannot give protection against losses of heat escaping from the furnace room.

FIG. 3 shows the device of the holder according to the invention. The holder consists of a head 31 provided with a borehole; the borehole contains a sealing element 32 for the closure of the end of the tube. The lower and upper supports (bearing surfaces) 33 and 34 of the holding head are sphere-shaped. Part 35 of the furnace or the furnace head 18 (FIG. 1) on which the holding head 31 is set up has also sphere-shaped bearing surfaces 36 corresponding to the bearing surfaces 33; as a consequence the bearing surfaces may interdependently move like a support. The holding device is sealed off against the upper part 37 of the furnace head by means of the flexible sealing element 38, thereby inhibiting the lateral escape of the gases passing through the tube 39.

In a furnace as shown in FIG. 1 which is supplied with a holding head according to the invention as shown in FIG. 3 (in comparison with the device as shown in FIG. 2), even a strong deviation of the tube which may cause a contact of the lower end of the tube with the wall of the boreholes at the lower closure of the furnace cannot result in a destruction of the tube because the upper end of the tube may turn freely with the holder on the sphere-shaped surfaces 33 and 36, thereby compensating the distortion of the tube without the occurrence of tensions. The tubes are therefore not subject to an additional mechanical stress. This fact causes a remarkable increase in the longevity of the tubes even with frequent temperature shocks. A furnace equipped with holding devices and tubes according to the invention is almost foolproof against a breakdown.

I claim:

In combination with a furnace having a fixed furnace head at its top end and a closure provided with apertures at its lower end and having ceramic tubes vertically suspended at their upper ends from the fixed furnace head and their lower ends projecting freely from the lower end of the furnace through the apertures in the closure at such lower end, an individual holding device for the upper end of each tube comprising an annular head provided with a bore adapted to receive the tube associated

therewith, means for supporting the tube in said bore and for providing a gastight seal between the exterior of the tube and the annular head, said annular head being provided with a lower sphere shaped bearing surface and also with an opposed upper sphere shaped surface, the lower sphere shaped surface being movably supported upon a complementary sphere shaped surface in the lower portion of the fixed furnace head, and a flexible annular sealing element sealing the upper opposed sphere shaped surface of the annular head against the upper portion of the furnace head.

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