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United States Patent [19]

Jones

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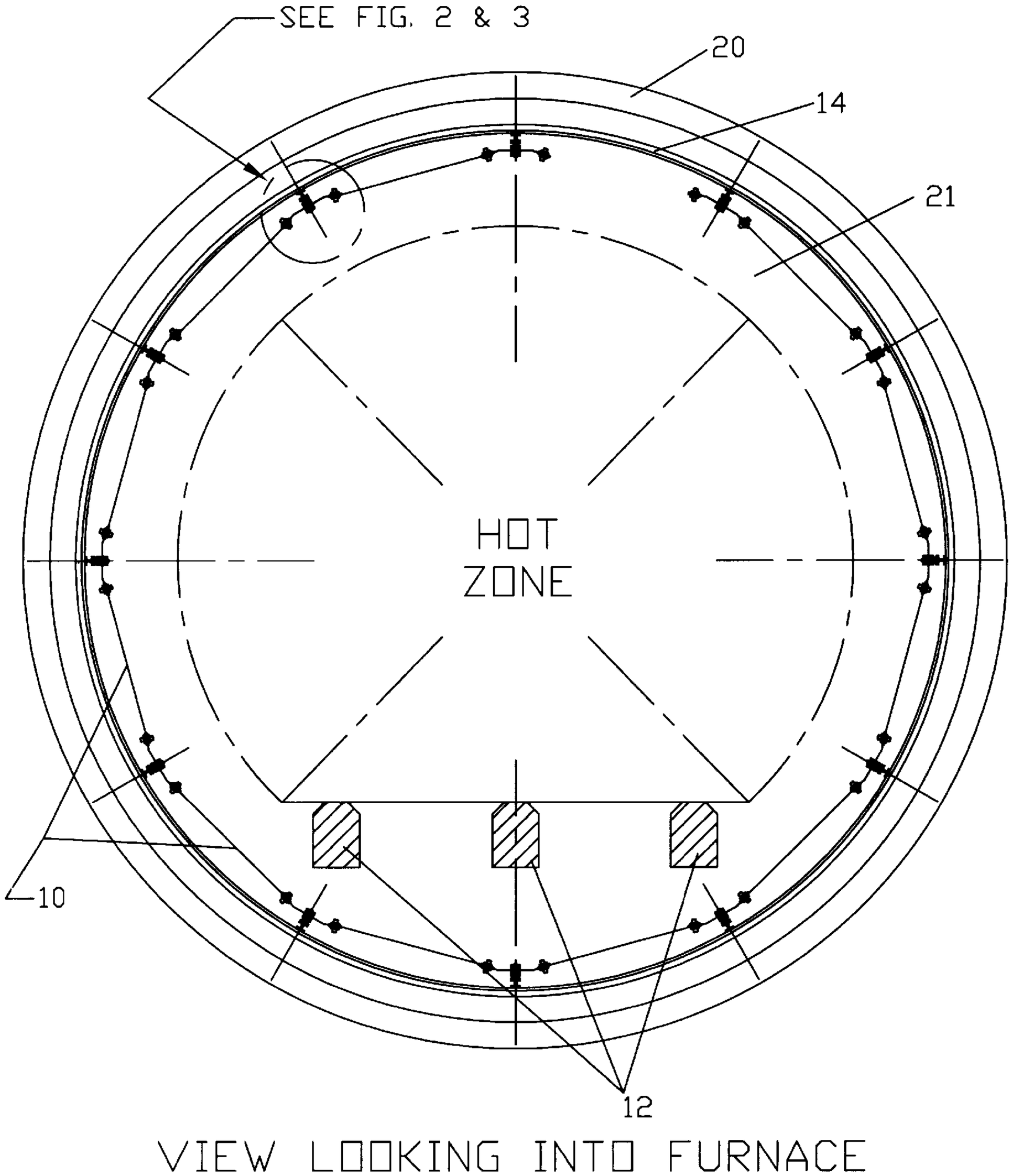
[45] **Date of Patent: Feb. 8, 2000**

[54] **PROCESS FOR REPAIRING HEAT ELEMENTS THEREFOR**

4,559,631 12/1985 Moller 373/130
4,612,651 9/1986 Moller et al. 373/130
5,497,394 3/1996 Jhawar et al. 373/130

[57] **ABSTRACT**



VIEW LOOKING INTO FURNACE

(VACUUM FURNACE 100)

FIG. 1

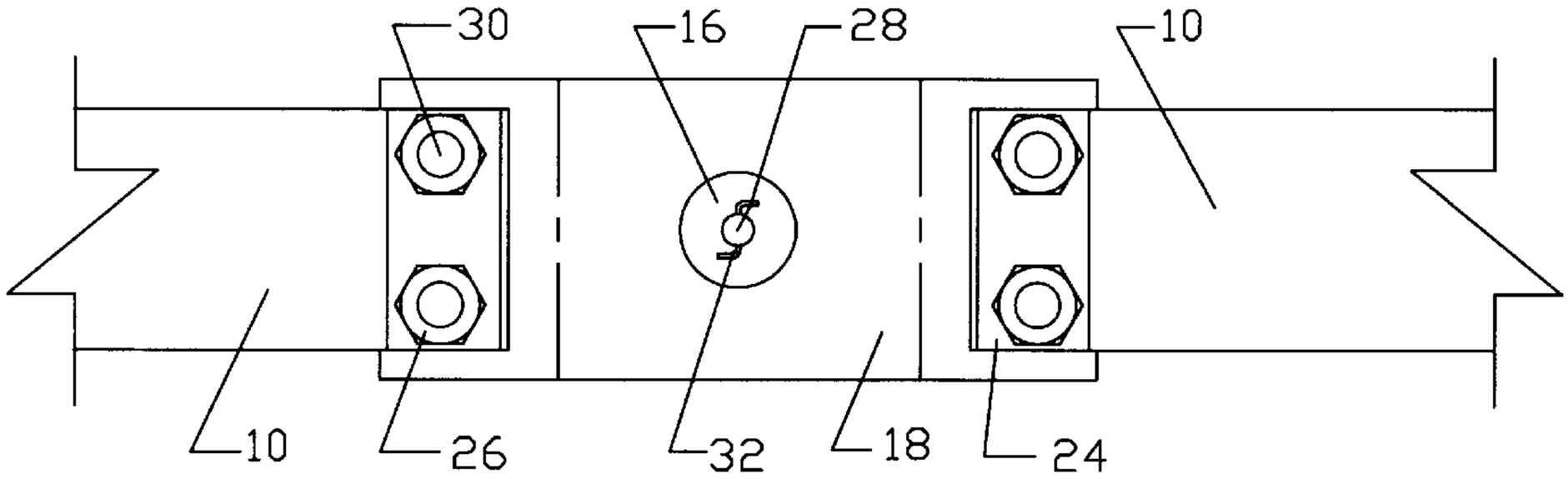
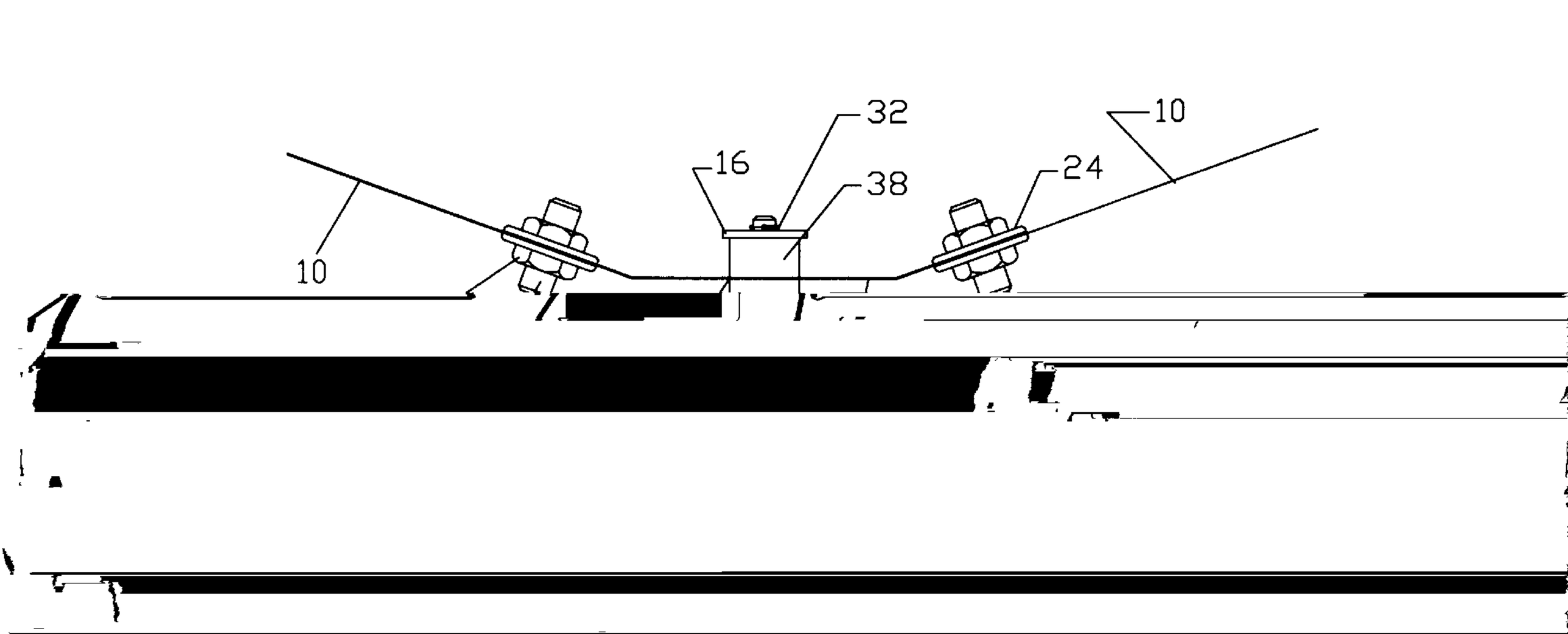


FIG. 2



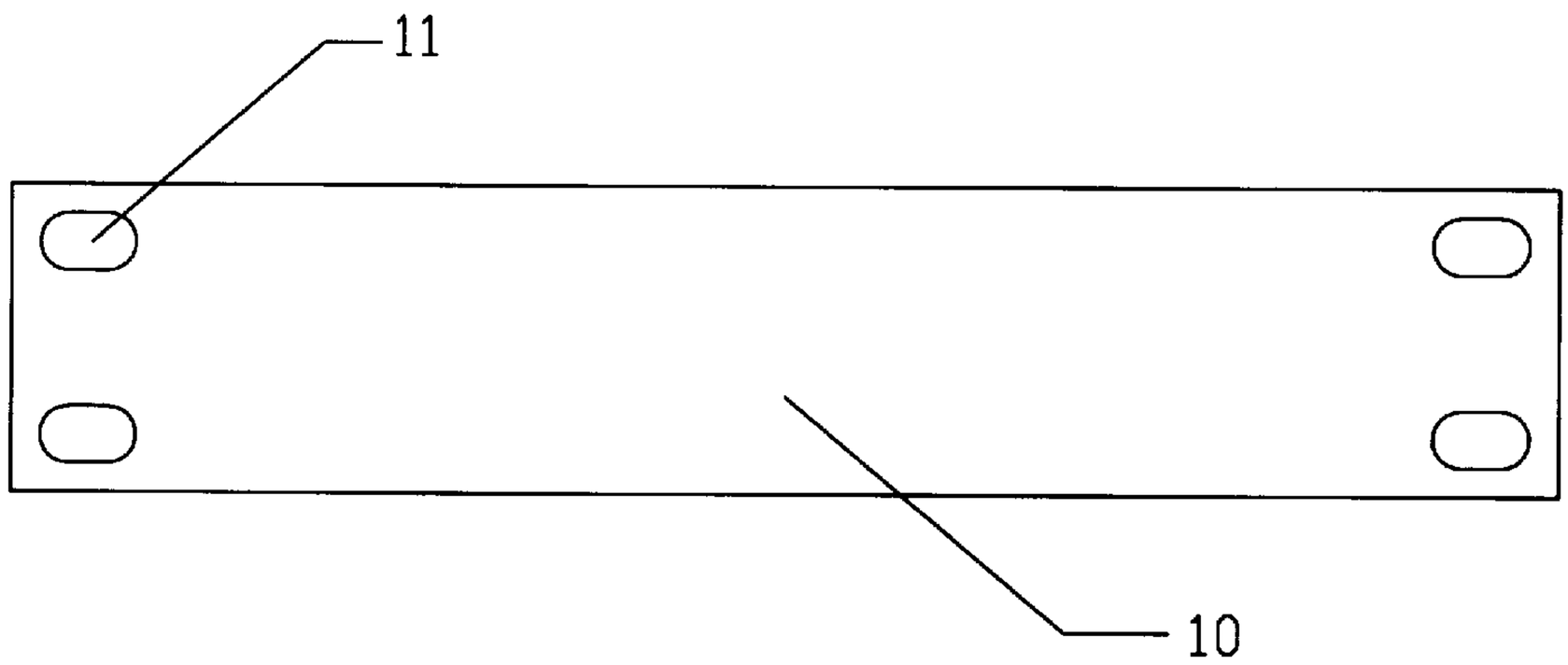


FIG. 4A

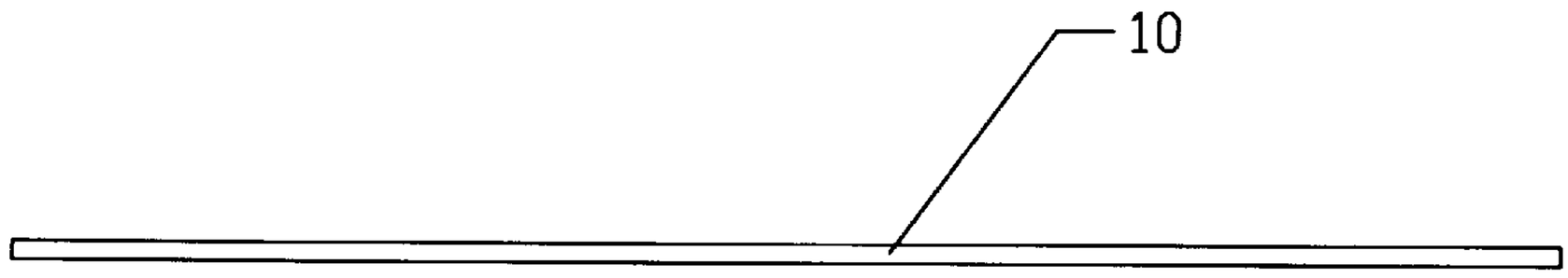


FIG. 4B

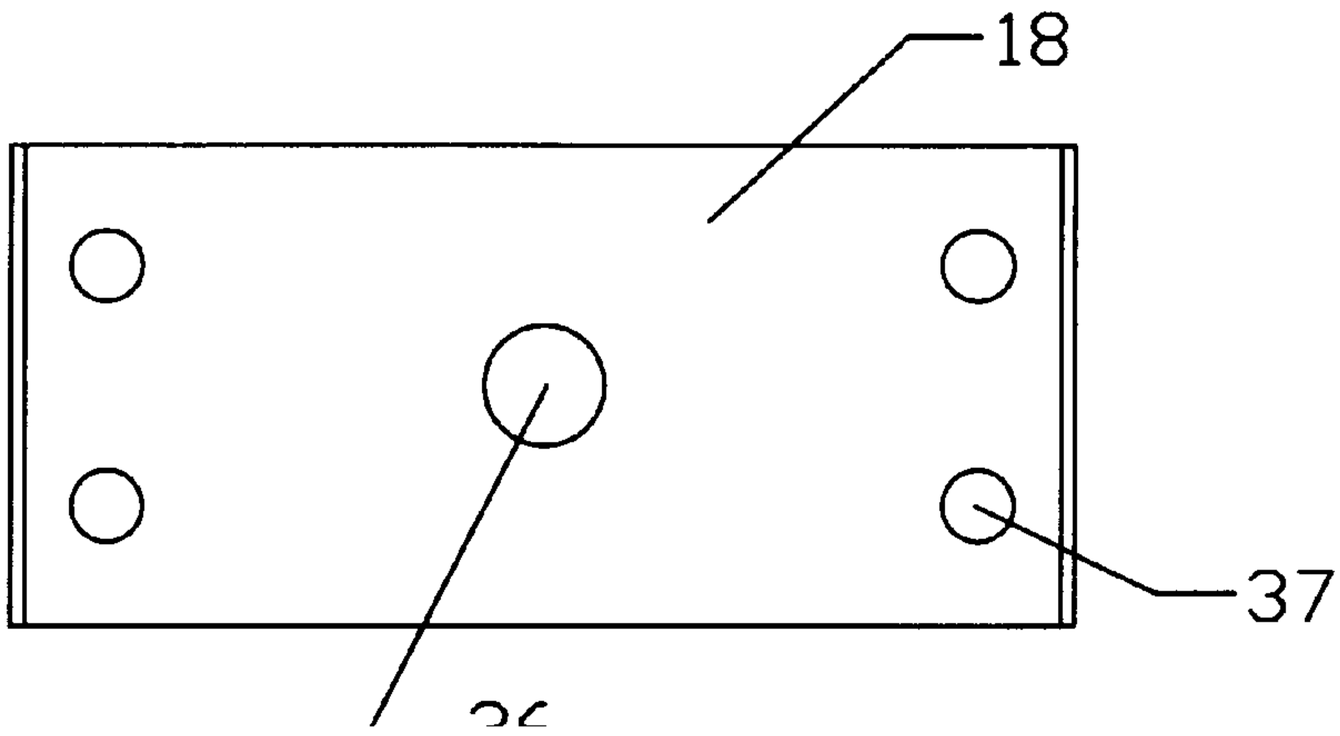


FIG. 5A

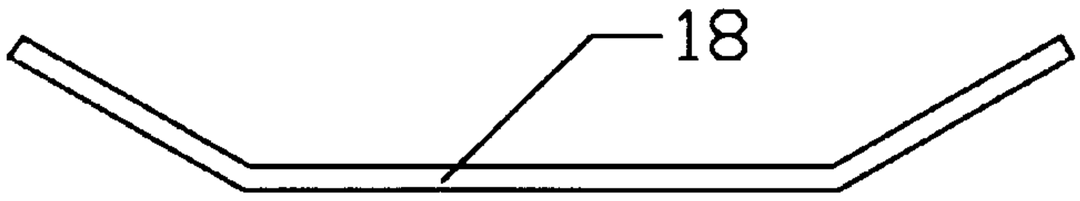
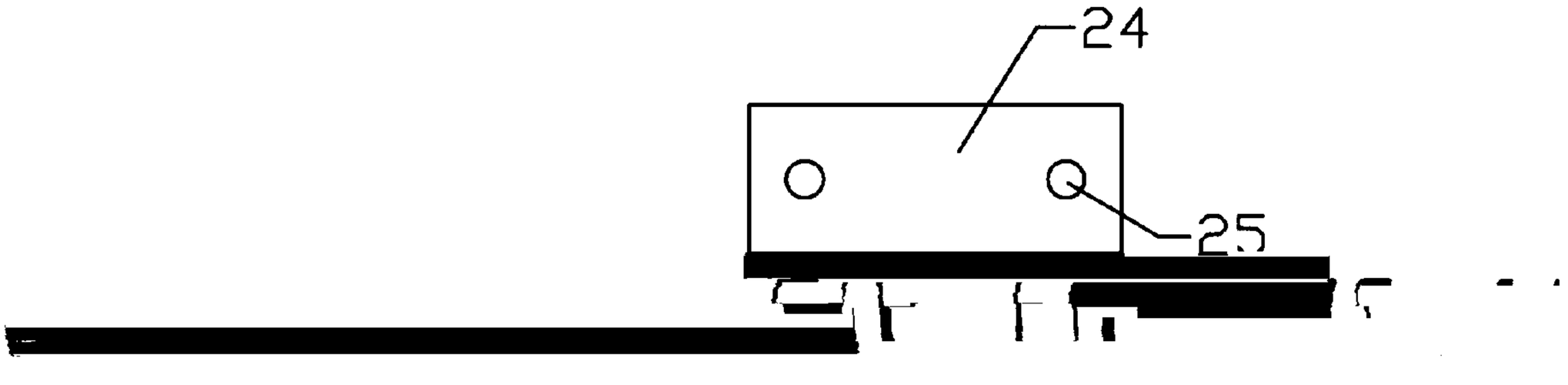


FIG. 5B



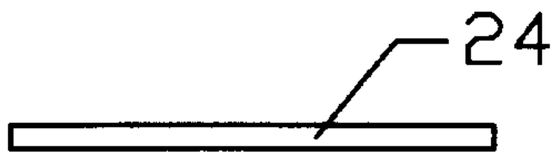


FIG. 6B

PROCESS FOR REPAIRING HEAT TREATING FURNACES AND HEATING ELEMENTS THEREFOR

This application is a continuation in part of U.S. application Ser. No. 09/027,868 filed Feb. 23, 1998.

FIELD OF THE INVENTION

This invention relates to heat treating furnaces which

comprises a plurality of heating elements sandwiched at their transverse ends between a stabilizer bar and a compensator bar. The compensator bars of this embodiment are contoured to provide a shape to the polygon, for example an octagon or pentagon. The polygons are connected to the inner wall of the hot zone chamber by a plurality of support rods which support each of the polygons a distance away from the heat shield. In a preferred embodiment, the heating elements are formed from relatively pure (commercially

In a preferred embodiment of this invention, the vacuum furnace **100** includes about six to ten longitudinally spaced banks of heating elements **10**, each bank being formed by eight separate elements **10** as shown in FIG. **4***a*. The elements **10** preferably include oblong-shaped apertures **11** located approximately near their four corners. These aper-

preferred lower width-to-thickness aspect ratio. In a typical prior art heating element using a 3.0 inch width and a 0.025 inch thickness the width-to-thickness ratio is 120. Although gravitational forces might be expected to have a higher impact on thin elements, that impact would not appear to account for the high incidence of failure in elements that are

heating elements and provide greater creep resistance and

(b) has a significantly lower width to thickness ratio.