

12

EUROPEAN PATENT APPLICATION

21 Application number: 86108077.8

51 Int. Cl.: **F 27 B 9/22, F 27 D 23/00**

22 Date of filing: 13.06.86

30 Priority: 02.07.85 IT 2139885

71 Applicant: **Società Impianti Termoelettrici Industriali s.p.A. S.I.T.I., Via Sempione 82, I-28040 Marano Ticino (IT)**

43 Date of publication of application: 21.01.87
Bulletin 87/4

72 Inventor: **Bossetti, Renato, Viale Kennedy 27, I-28100 Novara (IT)**

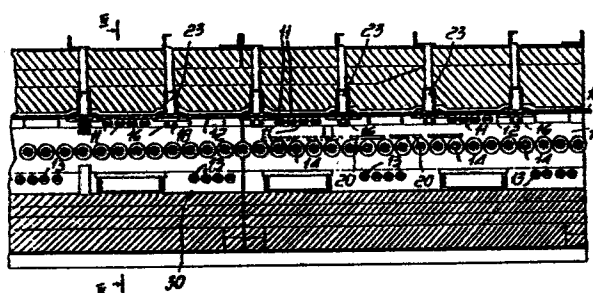
24 Designated Contracting States: **DE FR GB IT**

74 Representative: **Garrone, Fernando, Internazionale Brevetti s.r.l. Via Brentano 2, I-20121 Milano (IT)**

64 **An apparatus for firing ceramic materials particularly useful for firing glazed tiles.**

67 The apparatus comprises a roller furnace heated by a plurality of burners (14), and at least in the firing zone, a plurality of reliefs (16) arranged transversely to the direction of advance of the ceramic material.

The distance between two successive reliefs (16) is less than one meter.



"AN APPARATUS FOR FIRING CERAMIC MATERIALS PARTICULARLY USEFUL
FOR FIRING GLAZED TILES"

This invention relates to an apparatus for firing ceramic materials particularly useful for firing tiles and especially glazed tiles.

5 Glazed tiles are tiles which have been subjected to a firing treatment at a temperature higher than 1100°C.

In this case, glazed tiles are fired in roller furnaces heated by a plurality of burners. The tiles are transported through the furnace by plural independently rotating rollers.

10 This type of roller furnace, while affording high production rates, has a typical disadvantage of some importance: some of the tiles are distorted by the firing process. The distortion typically turns a square or rectangular raw tile into a fired tile of trapezoidal shape.

15 A trapezoidal tile cannot be laid even though its distortion may be relatively small, because during installation, in particular with the Italian layout method, the fault of any tile would add to the fault of a successive tile yielding an end fault which is quite showy and unattractive.

20 Thus, it has become common to provide a sorting apparatus at the furnace outlet to part tiles having an acceptable amount of distortion from those excessively distorted and, therefore, to be rejected. The practice of tile manufacturers shows that acceptable tiles must vary by less than 0.4% from the reference sample which has perfectly squared or in any case regular corners.

25 Tile manufacturers demand anyhow even smaller variations for more valuable products, so that variations lower than 0.25% are desirable.

Leaving aside the tile dimensional regularity, and considering directly the conformation of the furnace channel to treat tiles according to the present state of the art. Italian patent application No. 28352 A/77 filed by Welko Industriale S.p.A. on October 7, 1977 discloses a channel type furnace which has a plurality of muffle-chambers laid serially along the path for the ceramic material. According to said Welko application, connection between each chamber and the next is accomplished through pairs of upper and lower transverse walls which form bottle necked portions which force the hot gas stream to sweep as close as possible to the materials to be fixed. Such bottle necked portions are adjustable according to said patent application to accomodate different sizes of the ceramic material, such that the upper wall can be lowered to skim the moving ceramic material.

It has been ascertained that such transverse walls forming bottle necked portions afford improved control on the longitudinal distribution of the temperatures along the furnace. In fact the bottle necked portions practically divide the furnace into various successive chambers, enable easier control of the temperature of a single chamber with respect to the contiguous ones.

However, that configuration has not overcome the above-mentioned problem of the tile distorting. Applicant has in fact ascertained that distortion during firing is not due to the longitudinal distribution of the temperatures along the furnace, but is closely related to the constancy of the temperature distribution in a cross-section. Applicant has found in fact that the variation of the temperature inside the furnace along a cross-section determines corresponding distortions in the tiles

and therefore that the dimensional regularity of the product can only be achieved if the furnace temperature is constant within acceptable limits along the cross-section in the tile passage area.

It is considered that the temperature variation along the cross-section falls within acceptable limits if it is less than 0.25% ($\Delta T = 2-3^{\circ}\text{C}$) in the central area of the furnace and less than 0.5% ($\Delta T = 5-6^{\circ}\text{C}$) in the end side portions close to the walls; the term end side portions applying to two sections of about 5-10 cm of the cross-section adjacent the walls, located in the tile sliding area.

Thus, it is an object of this invention to achieve the above-specified constancy of the cross-temperature to produce tiles having an acceptable variation with respect to standard, thereby a perfect installation is afforded. A further object of this invention is to reduce rejects and in the extreme, to avoid the need itself for the above-described sorting apparatus placed at the furnace outlet.

A not least object of this invention is to allow utilization of the whole inner space of the channel as a firing zone, thus decreasing the channel dimensions and increasing thermal output correspondingly.

Applicant has surprisingly found that the aforesaid objects are achieved by an apparatus for firing ceramic materials comprising: a channel heated by a plurality of burners; a plurality of rollers placed on a plane for transporting the ceramic material along the channel, characterized in that the crown of said channel has, at least in the high temperature firing zone, a plurality of downwardly extending reliefs arranged transversely the

- 4 -

direction of advance of the ceramic material, said reliefs being separated apart over from one another by a distance not exceeding one meter.

It has been ascertained in particular that if the aforesaid
5 reliefs are separated from one another by a distance in the 25 to 75 cm range, the tiles yielded have a particularly reduced variation from standard.

This invention will be better understood from the figures,
10 appended hereto by way of illustration and not of limitation of this invention where:

Figure 1 shows the temperature graph along a channel cross-section, at the roller plane;

Figure 2 shows a longitudinal section through the channel;

15 Figure 3 shows a part-sectional plan view of the channel of Figure 2;

Figure 4 is a cross-sectional view of the channel taken along the line IV-IV of Figure 2;

Figure 5 is a perspective view of the elevation according to
20 the invention;

Figure 6 is a cross-section through the channel according to another embodiment.

With reference to Figure 1, the curve pattern is indicative of
25 the cross-distribution of temperatures. As mentioned, that curve is optimal if in the section 2-3 the maximum temperature variation, from the set average, is less than 2-3°C and if over the sections 1-2,3-4 the maximum temperature variation, from the set average, is less than 5-6°C (0.5% of the furnace temperature). The sections
30 1-2,3-4, have a length of about 5-10 cm.

With reference to Figures 2,3,4, the ceramic material firing apparatus comprises a channel 10 heated by a plurality of burners 11 arranged in the proximity of the crown 12 and by a plurality of burners 13 arranged in the proximity of the sole 30.

5 The apparatus comprises a plurality of rollers 14 which convey the tiles 20 in a longitudinal direction along the channel.

The crown 12 has a plurality of reliefs 16 according to the invention extending transversely to the direction of advance of the tiles.

10 Each reliefs 16 extends downwards from the crown 12 of the channel to the base 18 of the reliefs 16.

Preferably, that extension, when measured vertically, exceeds 1/6 and even more preferably exceeds 1/4 the distance from the crown 12 to the bearing plane of the tiles 20 on the rollers 14.

15 Considering just the burners 11 located above the roller plane without taking into account the burners 13 located below the roller plane, according to this invention there are included at least two burners 11 between two contiguous reliefs 16. Preferably, between two contiguous reliefs 16
20 there are present three to seven burners 11 located in the proximity of the crown 12.

Making reference to the preferred embodiment of this invention, indicated in Figure 5, the reliefs 16 have coupling means consisting, for example, of the detent ribs 22, adapted to engage
25 with the supporting structures 23 of the crown of the channel 10.

Alternatively, without departing from the scope of this invention making reference to Figure 6, the reliefs 40 form a unitary construction with the supporting beams of the crown 12 of the channel and, accordingly, they form supporting beams by

themselves.

It has been ascertained that the apparatus according to this invention affords glazed tiles which are free of distortions in excess of 0.2% with respect to the standard preset form, practically
5 without rejects, thus conclusively solving both the installation and thermal efficiency problems. This invention allows in fact the whole surface of the transport plane defined by the rollers to be utilized without leaving dead spaces, thereby reducing the volumes and increasing
10 the output.

CLAIMS

- 1 1. An apparatus for firing ceramic materials
2 comprising:
3 a channel heated by a plurality of burners;
4 a plurality of rollers arranged on a plane for
5 transporting the ceramic material along the channel,
6 characterized in that the crown of said channel has,
7 at least in the high temperature firing zone, a
8 plurality of reliefs arranged transversely of
9 extending reliefs arranged transversely to the direction
10 of advance of the ceramic material, said reliefs being
11 separated from one another by a distance not exceeding
12 one meter.
- 1 2. An apparatus according to claim 1, wherein
2 said reliefs are separated by a distance in the 25 to
3 75 cm range.
- 1 3. An apparatus according to claims 1 and 2,
2 wherein each said reliefs extends downwards from the
3 crown of said channel by a distance greater than $1/6$
4 the distance from said crown to the being plane of
5 the ceramic material onto said rollers.
- 1 4. An apparatus according to claim 3, wherein
2 each said reliefs extends downwards from the crown of
3 said channel by a distance greater than $1/4$ the
4 distance from said crown to the being plane of said
5 ceramic material onto said rollers.
- 1 5. An apparatus according to any of the
2 preceding claims wherein, in the channel section between
3 two successive reliefs, there are included at least

4 two burners arranged over the roller plane in the
5 proximity of said crown.

1 6. An apparatus according to claim 5, wherein
2 in the channel section between two successive reliefs
3 there are included 3 to 7 burners arranged over the
4 roller plane in the proximity of said crown.

1 7. An apparatus according to any of the
2 preceding claims, wherein each said reliefs has
3 coupling means adopted to engage with the supporting
4 structure of the channel crown.

1 8. An apparatus according to claim 1 to 6,
2 wherein each said reliefs forms a load-bearing beam
3 adapted to overtake the channel crown.

1 9. An apparatus as described and claimed.

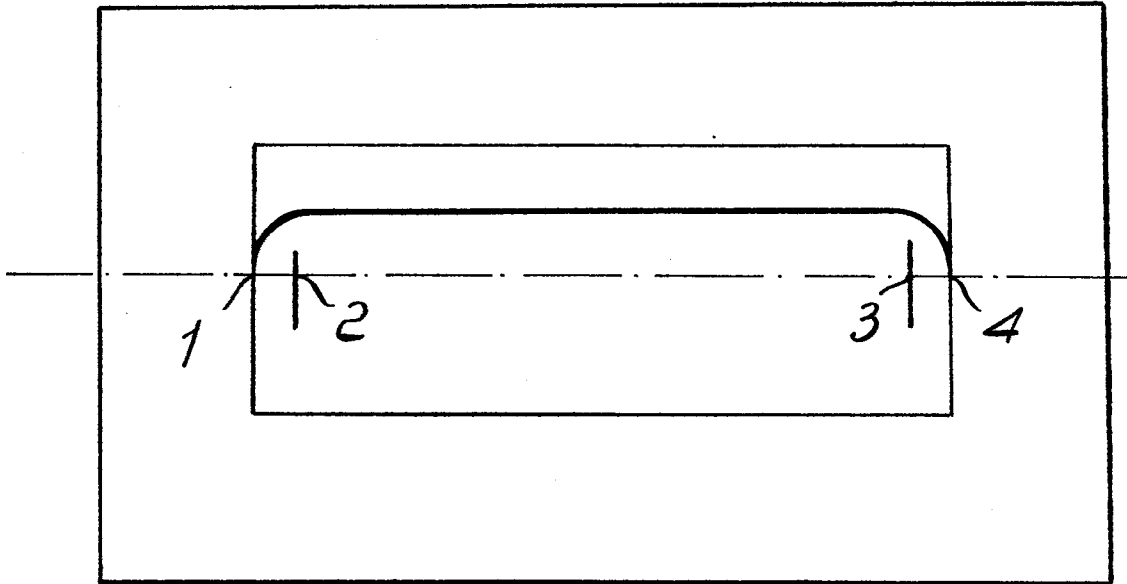


Fig. 1

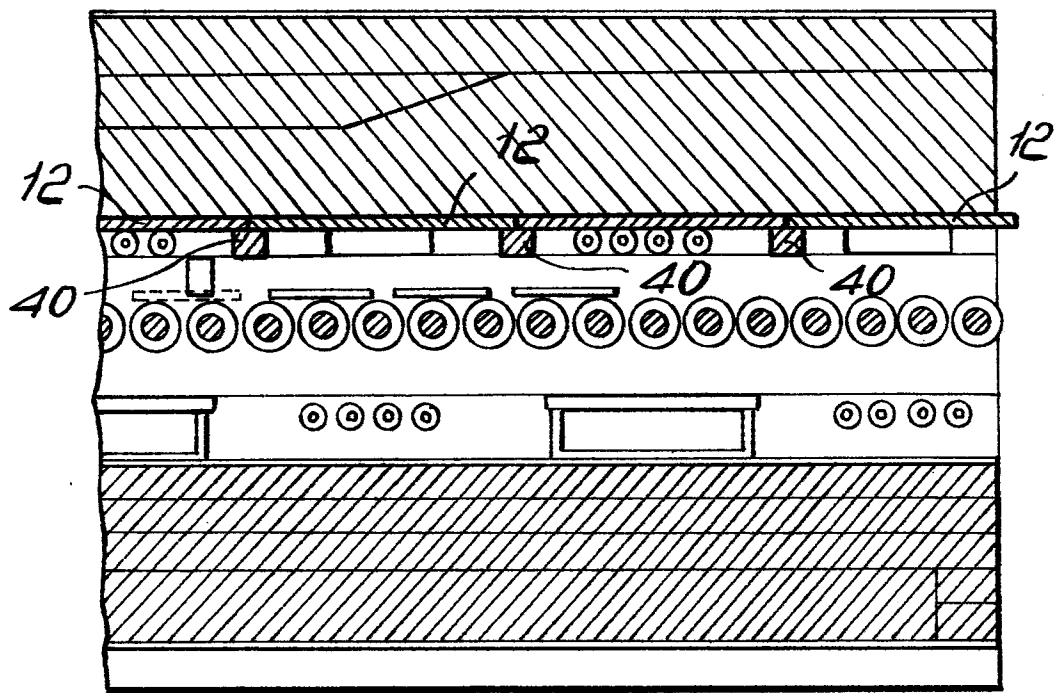


Fig. 6

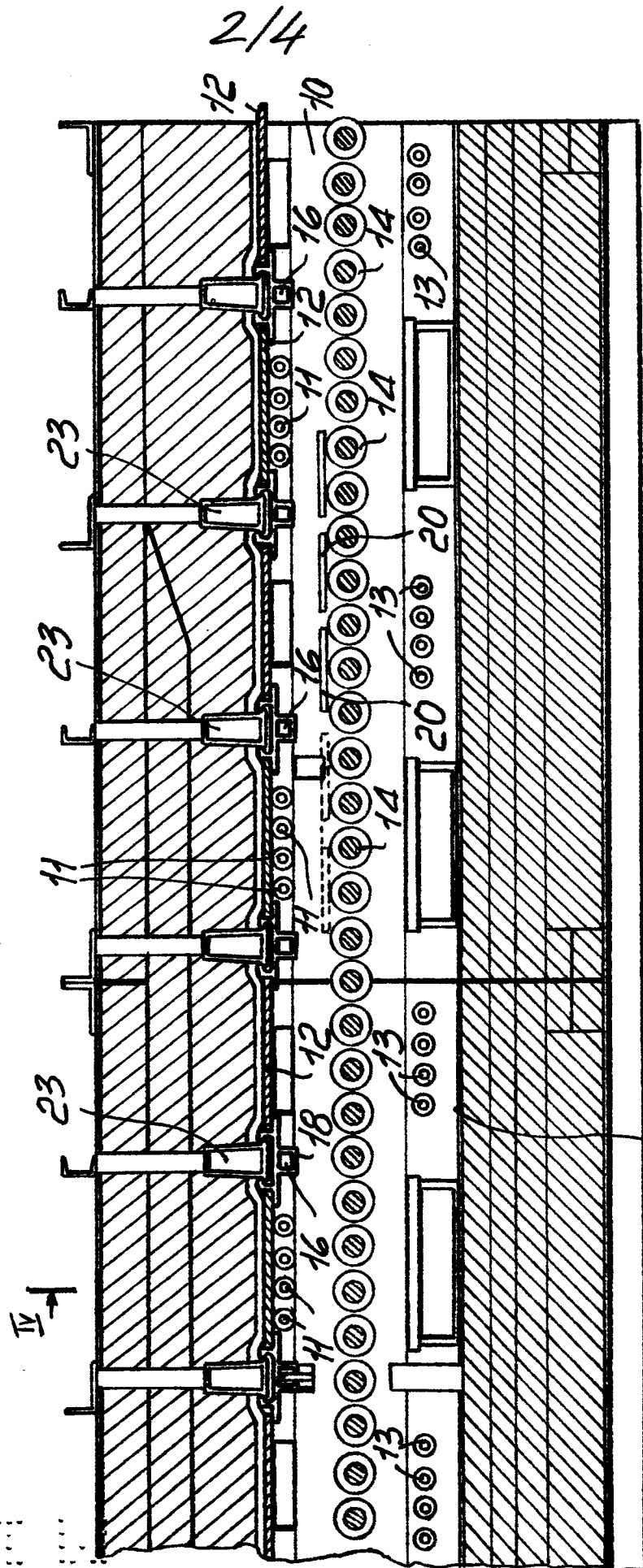
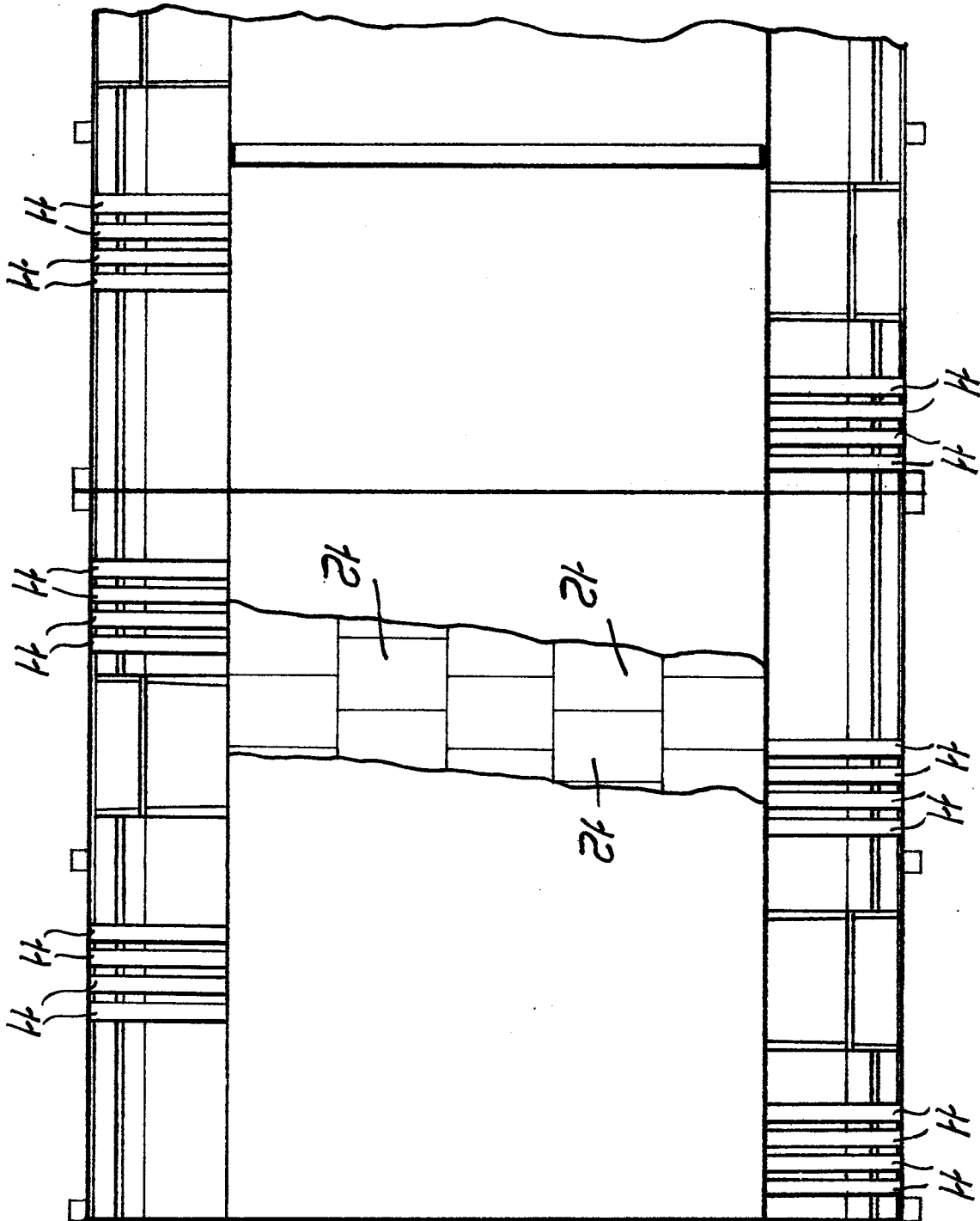


Fig. 2

Fig. 3



4/4

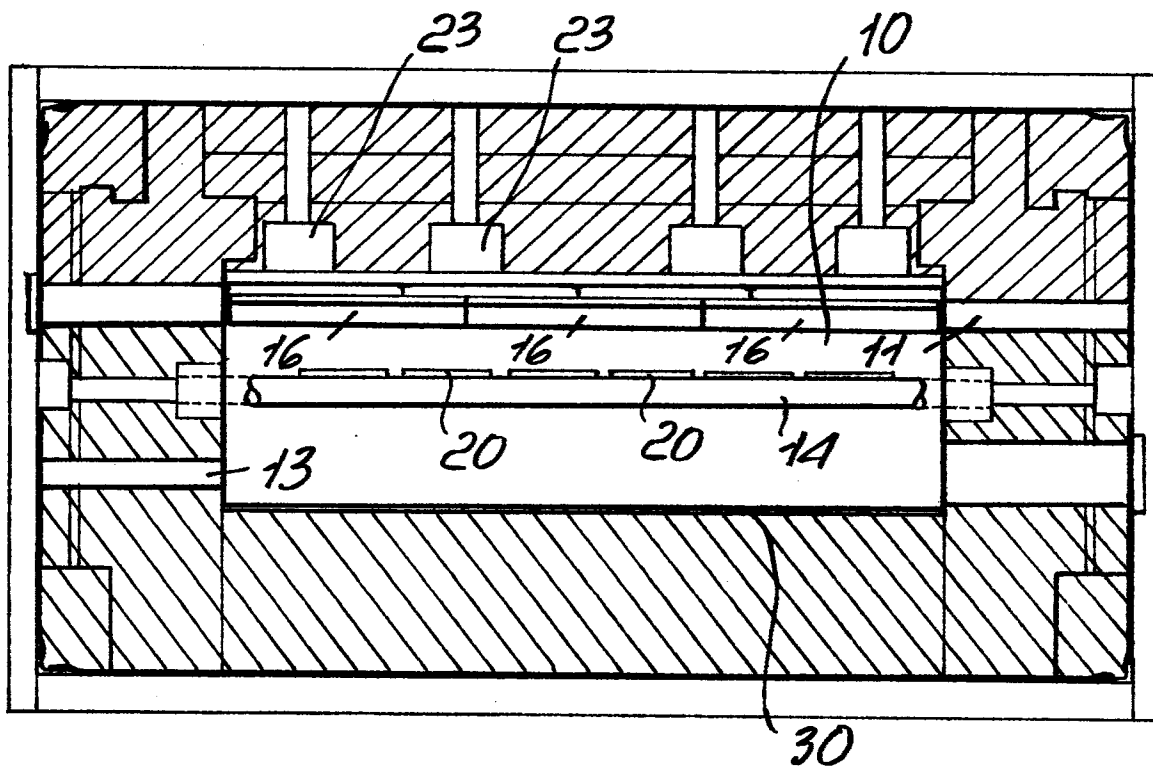


Fig. 4

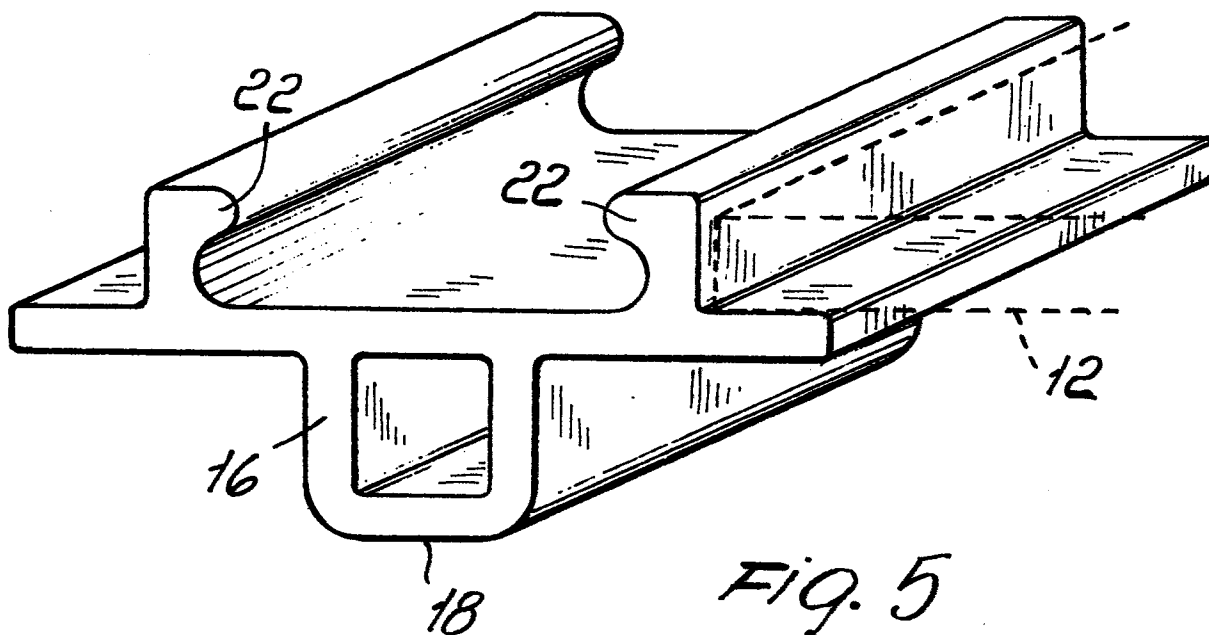


Fig. 5



European Patent
Office

EUROPEAN SEARCH REPORT

0208920

Application number

EP 86 10 8077

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.4)
Y	US-A-3 328 861 (P. D'H. DRESSLER) * Figure 1; lines 49-51; claims *	1,4,5, 7,8	F 27 B 9/22 F 27 D 23/00
Y	FR-A- 596 680 (SPARK PLUG CO.) * Page 4, lines 40-48; figure 1 *	1,4	
A	DE-C-3 338 078 (W. WEISSBRODT) * Claims; figures *	7,8	
A	EP-A-0 046 993 (BUCHTAL GmbH)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			F 27 B F 27 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24-10-1986	Examiner COULOMB J.C.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	