(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 083 396 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.03.2001 Bulletin 2001/11

(51) Int. Cl.[7]: **F27B 9/36**, F27B 9/30

(21) Application number: **00119175.8**

(22) Date of filing: **05.09.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **07.09.1999 IT MO990180**

(71) Applicant: **TCK S.R.L.**
41053 Maranello (Modena) (IT)

(72) Inventor: **Tagliazzucchi, Daniele**
41051 Castelnuovo Rangone (Modena) (IT)

(74) Representative: **Crugnola, Pietro**
Luppi & Crugnola S.r.l.
Viale Corassori, 54
41100 Modena (IT)

(54) Kiln for firing industrial articles

(57) Kiln (1) for firing industrial articles, particularly ceramic articles, comprising a frame (2) internally defining a firing chamber (3) inside which said articles are advanced on advancing means (9), refractory means (5, 6, 7, 8) for lining said firing chamber (3), a plurality of burners (10, 11) arranged along side walls of said firing chamber (3), said firing chamber (3) comprising anti-stratification means (13, 14, 15, 16) suitable for preventing temperature stratification zones from forming inside said firing chamber (3).

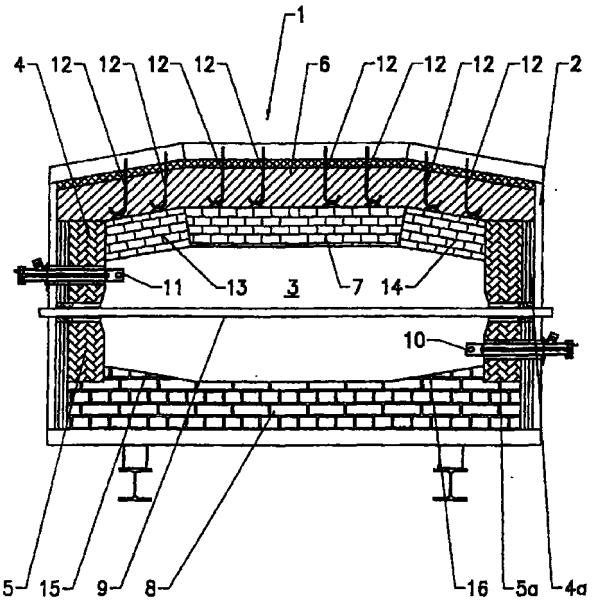

Fig.1

EP 1 083 396 A2

Description

[0001] The invention relates to a kiln for firing industrial articles, particularly a kiln for firing ceramic articles.

[0002] From prior art kilns for firing ceramic articles are known comprising art external structure defining a firing chamber lined with refractory material, through which ceramic articles, arranged in transversal rows, are advanced, for example on planes of motorized rollers. In the side walls of the kiln burners are arranged having heads projecting into the firing chamber in which the combustion of the fuel feeding the burners takes place for providing heat necessary for firing the ceramic articles. The kiln has a modular arrangement, i.e. it comprises sections substantially equal to each other, in each of which two pairs of burners for each side are arranged, said two pairs are arranged longitudinally staggered with respect to each other, one of said pairs being arranged above the advancing plane of the articles in the firing chamber, the other pair being arranged below said advancing plane. The firing chamber has a substantially rectangular cross section. This shape of the firing chamber, the arrangement and number of burners in each section of the kiln causes a non-uniform distribution of temperature in the firing chamber, so generating temperature stratification zones, which causes non-uniform firing of the products, possible damages due to different firing temperature for the product of a same row, greater consumption of fuel.

[0003] The present invention is intended to provide a kiln for firing industrial articles, particularly ceramic articles, in which the distribution of temperature within the firing chamber is as uniform as possible.

[0004] According to the present invention, there is provided a kiln for firing industrial articles, particularly ceramic articles, comprising a structure internally defining a firing chamber inside which said articles are advanced on advancing means, refractory means for lining said firing chamber, a plurality of burners arranged along side walls of said firing chamber, characterized in that said firing chamber comprises anti-stratification means suitable for preventing temperature stratification zones from forming inside said firing chamber.

[0005] Owing to the invention, a distribution of temperature as uniform as possible may be obtained in the firing chamber, which allows a better and more regular firing of the articles and smaller consumption of fuel to be obtained.

[0006] The invention will be shown in greater detail here below, for exemplifying and non-limiting purpose, with reference to the attached drawings, in which:

Figure 1 is a cross section of a kiln according to the invention;

Figure 2 is a longitudinal section of a modular element of a kiln according to the invention;

Figure 3 is a longitudinal section of a row of consecutive modular element like that of Figure 2.

[0007] The kiln 1 according to the invention comprises a structure 2 in which a chamber 3 for firing industrial articles, for example ceramic articles, is defined. The chamber 3 is defined laterally by side walls 4, 4a, each provided with refractory lining 5, 5a, at the top by a vault also provided with a refractory lining 7, and at the bottom by a floor 8 made of refractory material. The refractory lining 7 is fixed to the vault of the kiln by hook means 12, for example brackets. A plurality of transversal motorized rollers 9 are arranged in the chamber 3, said rollers defining an advancing plane for the articles to be fired in the chamber 3.

[0008] Two rows of burners 10, 11 are arranged on the side walls 4 of the chamber 3, a first row being arranged on the wall 4a, below the plane of the roller 9 and a second row of burners 11 being arranged on the wall 4, opposite to the wall 4a, above the plane of the roller 9. The side end portions 13 and 14 of the refractory lining 7 of the vault 6 of the kiln are tilted downward, toward the side walls 4 and the side end portions 15 and 16 of the floor 8 of the kiln are tilted upward toward the side walls 4.

[0009] Thereafter, the section of the firing chamber 3 comprises a central part having substantially even height and two side parts having height progressively decreasing toward the side walls 4. This shape promotes a circulation of air and combustion fumes produced by the burners 10 and 11, preventing air and fumes stagnation zones from being created and so ensuring a remarkably better temperature uniformity, with respect to the kilns of the state of art.

[0010] The temperature uniformity is further improved since the height of the firing chamber 3 progressively decreases along the advancing direction of the articles to be fired, so promoting a flow of the air and of the fumes in said direction, which contributes to a further improvement of the temperature distribution. The height decrease of the firing chamber 3 may be, for example, equal to 1%, i.e. about 1 centimetre per linear metre. Said height decrease may be obtained shaping the vault 6 tilted downward along the advancing direction of the articles to be fired. In addition to the tilt of the vault 6 also the floor 8 of the chamber 3 may be tilted upward along the advancing direction of the articles to be fired.

[0011] The kiln 1 comprises a row of modular units 17, 17a, 17b, 17c, having substantially equal length, one of which is shown in Figure 2, while Figure 3 shows three modular units arranged in a sequence. The modular units 17, 17a, 17b, 17c are coordinated so as to obtain the height decrease of the firing chamber 3 along the whole length of the kiln 1. In Figures 2 and 3 the tilt of the vault 6 and of the floor 8 are shown more greater than they are in reality, only for emphasizing purpose.

[0012] Each modular unit 17, 17a, 17b, 17c is provided, at each side, with two groups each comprising

three burners, a first group of three burners 10 being arranged below the plane of the rollers 9and a second group of three burners 11 being arranged above the plane of the rollers 9. With respect to the kilns known from prior art, each modular unit having the same length of a modular unit of prior art kilns comprises a further burner for each group, that is, on the whole, four further burners for each modular unit 17, 17a, 17b, 17c. Thus, a better heat distribution and smaller fuel consumption are obtained inside the firing chamber 3. Therefore, having a greater number of burners for each modular unit 17, 17a, 17b, 17c, the burners may be operated at a lower combustion temperature, i.e. a temperature closer to the requested firing temperature of the articles, which allows the fuel consumption of each burner to be reduced, the temperature obtained in the firing chamber 3 being the same. Furthermore, the reduction of the combustion temperature of the burners reduces the thermal shocks of the lining of the kiln 1 so increasing the service life of the kiln.

[0013] The groups of burners 10, 11 may also comprise a different number of burners, for example the group of burners 10 may comprise three burners, while the group of burners 11 may comprise two burners, or vice versa.

[0014] The average distance between the burners 10, 11 of each group of burners is within about 400 mm and about 850 mm depending on the length of each modular unit 17, 17a, 17b, 17c and is chosen so as to optimize the heat distribution inside each of said modular unities 17, 17a, 17b, 17c.

[0015] In practice, materials, dimensions and constructive details, may be different from, but technically equivalent to those described without departing from the scope of the present invention.

Claims

1. Kiln (1) for firing industrial articles, particularly ceramic articles, comprising a structure (2) internally defining a firing chamber (3) inside which said articles are advanced on advancing means (9), refractory means (5, 6, 7, 8) for lining said firing chamber (3), a plurality of burners (10, 11) arranged along side walls (4, 4a) of said firing chamber (3), characterized in that said firing chamber (3) comprises anti-stratification means (13, 14, 15, 16) suitable for preventing temperature stratification zones from forming inside said firing chamber (3).

2. Kiln according to claim 1, wherein said anti-stratification means (13, 14, 15, 16) comprises side end portions (13, 14) of the refractory lining (7) of the vault (6) of the kiln (1), each of said side end portions (13, 14) being tilted downward toward the corresponding side wall (4, 4a) of said firing chamber (3).

3. Kiln according to claim 1, or 2, wherein said anti-stratification means (13, 14, 15, 16) comprises side end portions (15, 16) of the floor (8) of the kiln (1), each of said side end portions (15, 16) being tilted upward toward the corresponding side wall (4, 4a) of said firing chamber (3).

4. Kiln according to any one of the preceding claims, wherein said firing chamber (3) has height progressively decreasing along the advancing direction of said articles.

5. Kiln according to claim 4, wherein said height of the firing chamber (3) decreases of about 1 cm per linear metre along said advancing direction.

6. Kiln according to claim 4, or 5, wherein said vault (6) is tilted downward along said advancing direction.

7. Kiln according to any one of claims 4 to 6, wherein said floor (8) is tilted upward along said advancing direction.

8. Kiln according to any one of the preceding claims, comprising a plurality of modular units (17, 17a, 17b, 17c), each of said modular units (17, 17a, 17b, 17c) having substantially the same length.

9. Kiln according to claim 8, wherein said modular units (17, 17a, 17b, 17c) are so co-ordinated as to obtain said progressively decreasing height.

10. Kiln according to claim 8, or 9, wherein each of said modular units (17, 17a, 17b, 17c) comprises a first group (10) of said burners (10, 11) arranged on a side wall (4a) of said firing chamber (3), said first group (10) of burners (10, 11) comprising more than four burners.

11. Kiln according to claim 10, wherein the burners (10, 11) of said first group (10) of burners are aligned in two rows staggered with respect to each other along said side wall (4a) of said firing chamber (3), said two rows comprising a first row arranged below said advancing means (9) and a second row arranged above said advancing means (9), one of said two rows comprising at least three burners (10, 11).

12. Kiln according to claim 21, wherein said first row and said second row comprise the same number of burners (10, 11).

13. Kiln according to claim 11, wherein the number of burners (10, 11) of said first row is different from the number of burners (10, 11) of said second row.

14. Kiln according to any one of claims 10 to 13, wherein each of said modular unities (17, 17a, 17b, 17c) comprises a second group (11) of said burners (10, 11) arranged on a wall (4) opposite to said wall (4a) of said firing chamber (3), said second group (11) of burners (10, 11) comprising more than four burners (10, 11.

15. Kiln according to claim 14, wherein the burners (10, 11) of said second group (11) of burners (10, 11) are aligned in two further rows staggered with respect to each other along said Side wall (4) of said firing chamber (3), said two further rows comprising a further first row arranged below said advancing means (9) and a further second row arranged above said advancing means (9), one of said two further rows comprising at least three burners (10, 11).

16. Kiln according to claim 15, wherein said further first row and said further second row comprise the same number of burners (10, 11).

17. Kiln according to claim 15, wherein the number of burners (10, 11) of said further first row is different from the number of burners (10, 11) of said further second row.

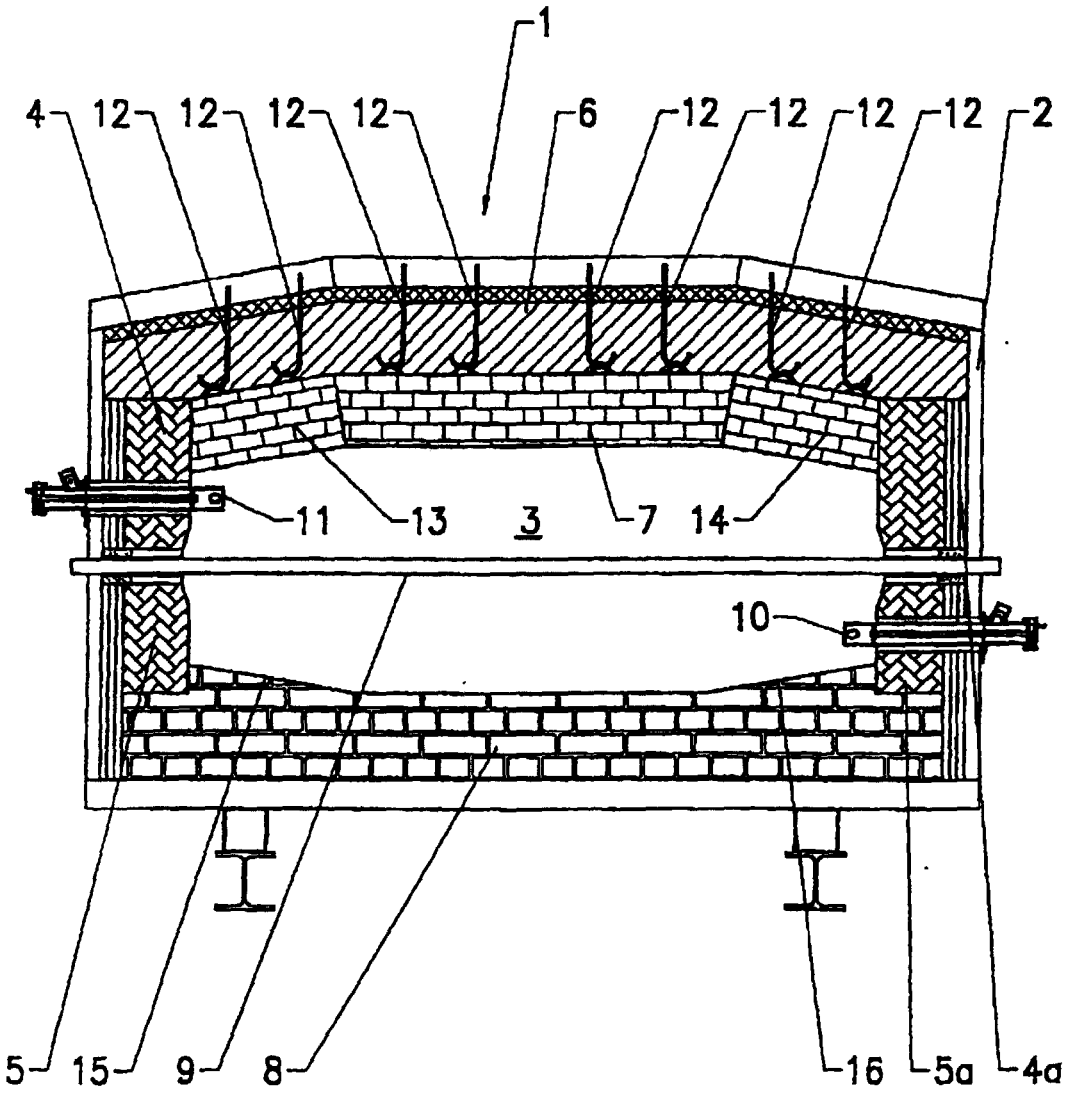

Fig.1

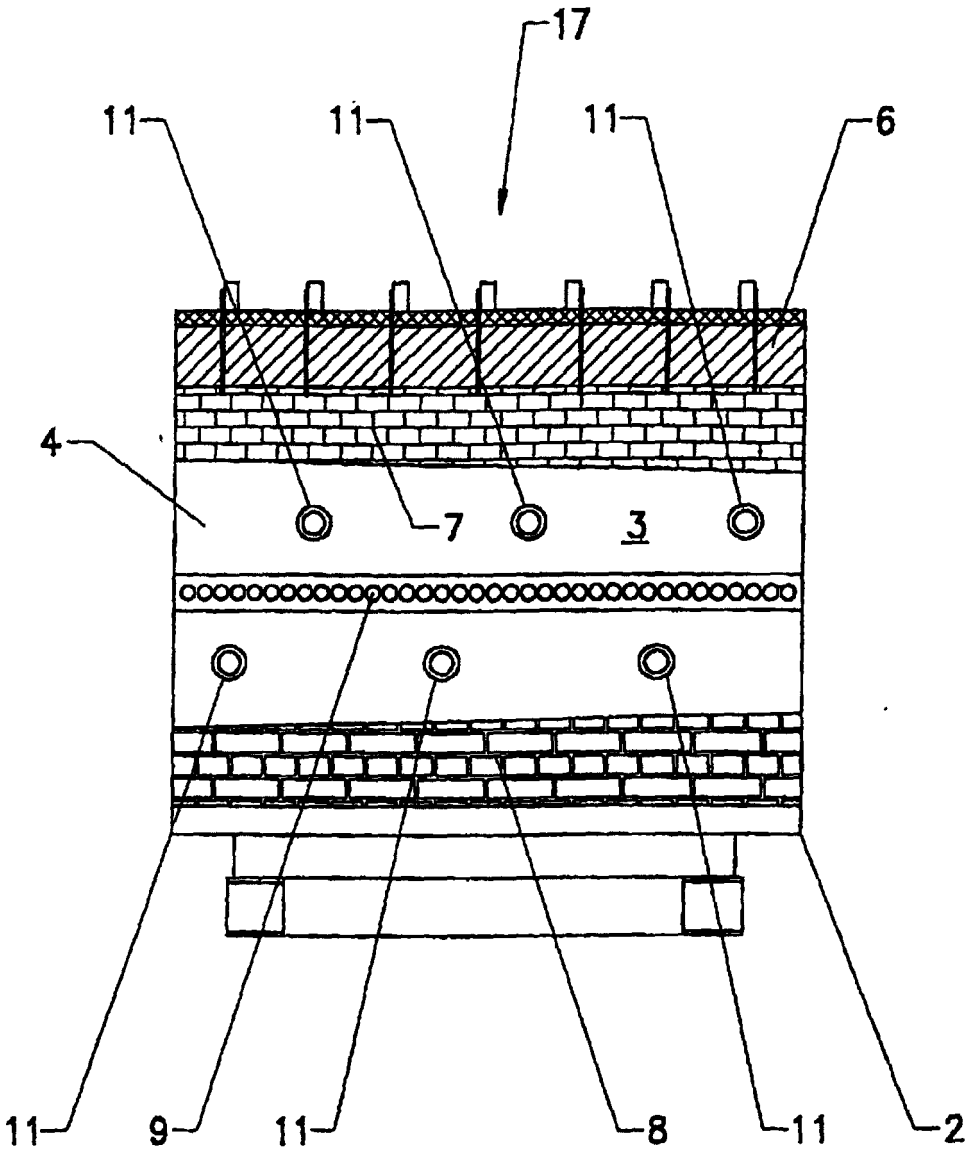

Fig.2

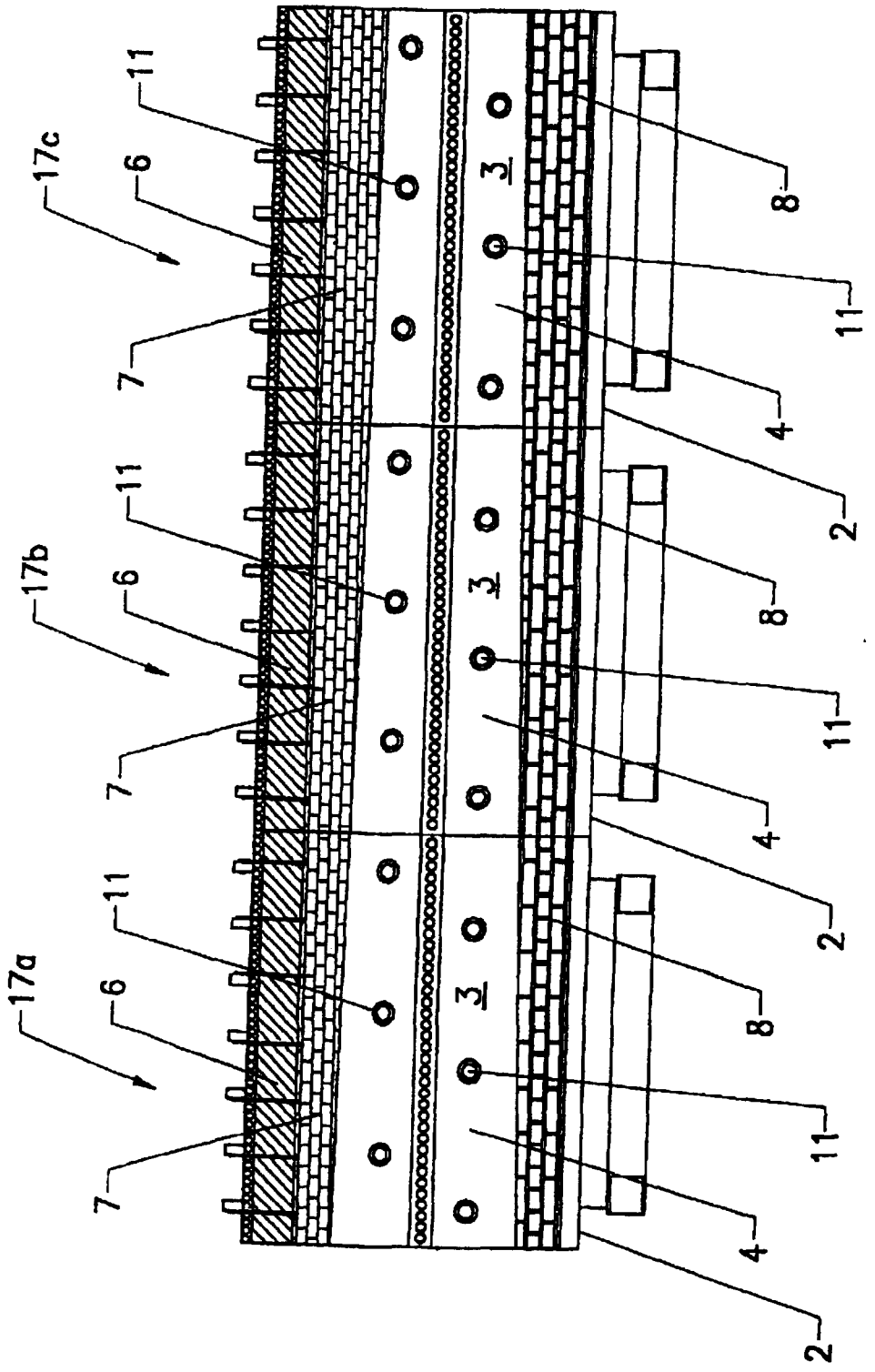

Fig.3