April 23, 1968 W. L. HANLEY 3,378,897

TUNNEL KILN PREHEATING SECTION

Filed Aug. 4, 1965 2 Sheets-Sheet 1

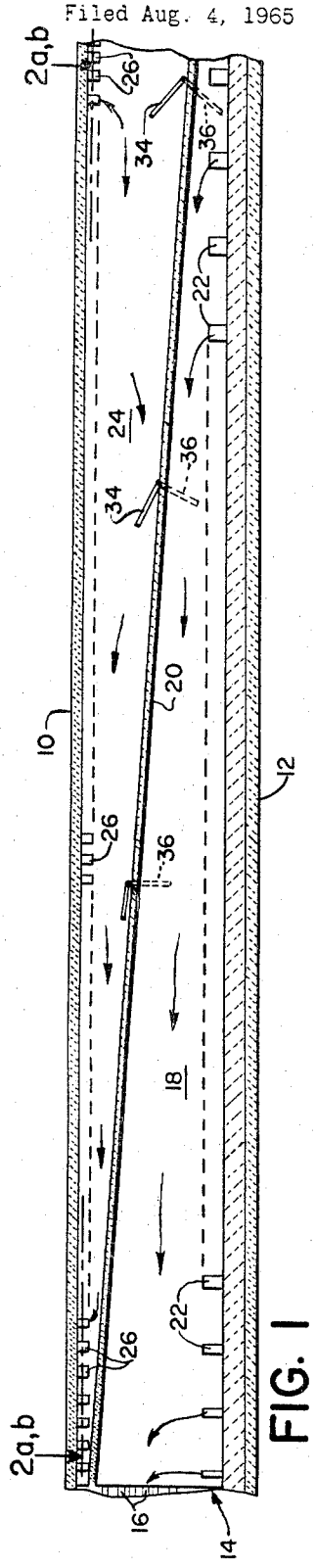
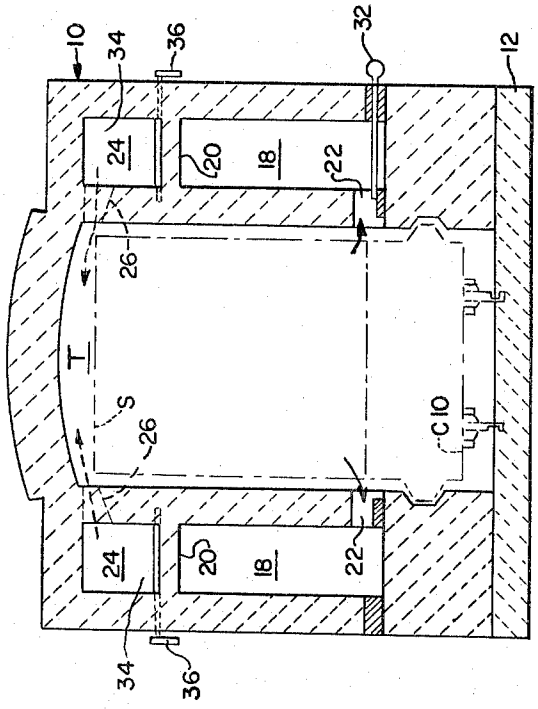


FIG. 1

FIG. 3



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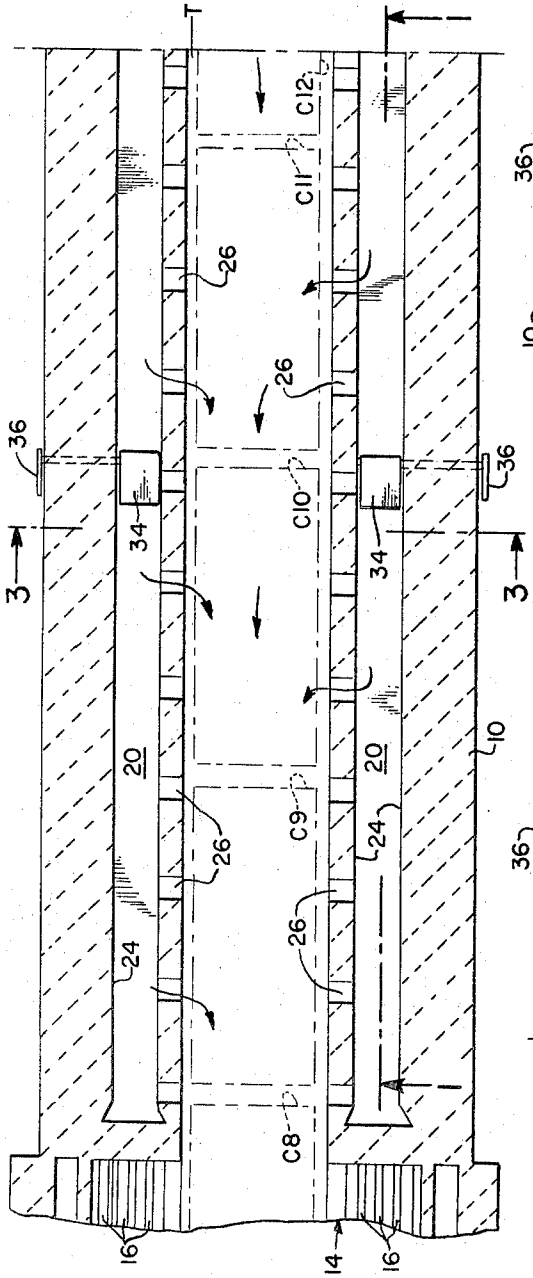
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FIG. 2a



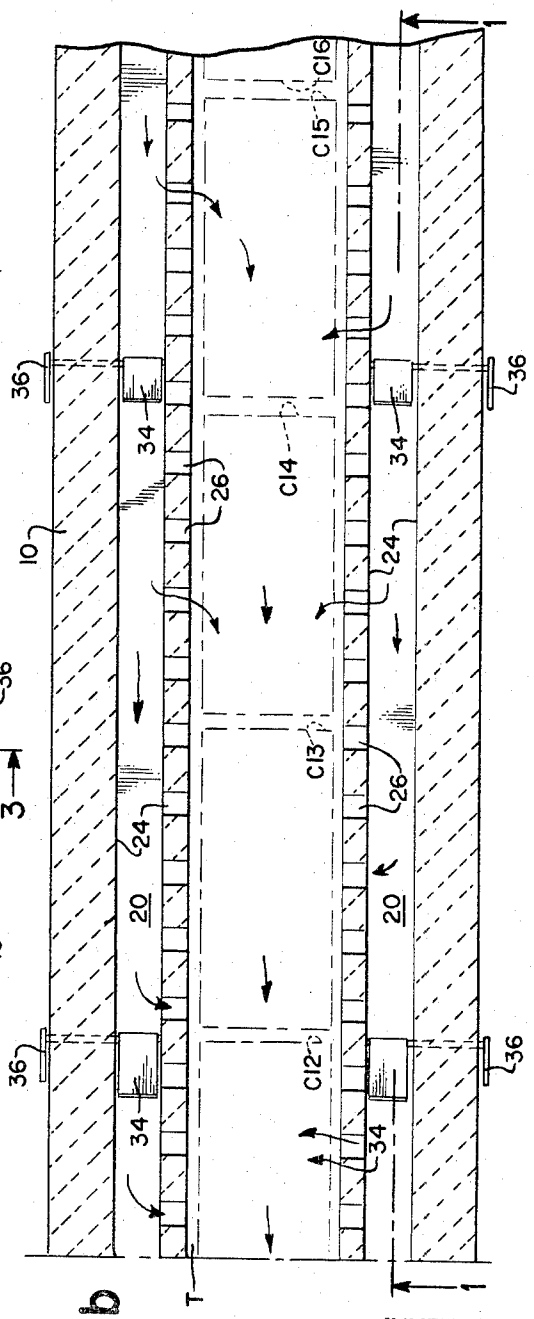


FIG. 2b

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United States Patent Office 3,378,897
Patented Apr. 23, 1968

3,378,897

TUNNEL KILN PREHEATING SECTION

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Filed Aug. 4, 1965, Ser. No. 479,047
5 Claims. (Cl. 25—142)

ABSTRACT OF THE DISCLOSURE

Disclosed herein is a pre-heating section for a tunnel kiln which is in the usual form, having a housing rectangular in cross-section and of very considerable length. Ducts are provided in the side wall of the tunnel, communicating with the interior thereof to provide for travel of hot gases through the ducts and distribution through ports into the tunnel. The ducts are arranged in pairs, each pair consisting of an upper and lower duct with a common wall between the ducts of a pair, which common wall slopes upwardly in the direction of travel of the gases. Flaps which are angularly adjustable are pivotally mounted on the upper side of the common wall and thus on the base of the upper duct to regulate the distribution of gases therefrom into the tunnel to maintain the rate of heat increase of ware passing through the tunnel, substantially uniform.

This invention comprises an improvement in the lower temperature section of the high pre-heat section of a tunnel kiln, to increase the rate of product throughput.

The invention relates to improvements in the apparatus and therefore the operation of a portion of the high preheat section of a tunnel kiln designed for firing products such as brick, fire brick, tile, and the like, either of the glazed or unglazed kind. This type of kiln is operated by moving the ware to be processed progressively either continuously or intermittently through the kiln from its entrance end to its exit end at a controlled speed to effect the required heat treatment thereof. The ware is placed upon cars or trucks which are positioned in end to end contact to form a continuous line entirely filling the tunnel formed by the kiln throughout its length. These trucks either intermittently or continuously move through the kiln easily by pushing freshly loaded trucks through the entrance end and removing them from its other end so that the entire line of trucks progress through the kiln. Broadly speaking each truck progresses from the entrance end through a low pre-heat section, a high pre-heat section, a firing section, and a cooling section. The subject matter of this invention is concerned with an improvement in the cooler end of the high pre-heat section.

As an example of the type of kiln in which the improvement of this invention finds advantageous use, reference is made to applicant's Patent No. 2,961,732, granted Nov. 29, 1960, for Tunnel Kiln.

Specifically it is an object of this invention to control the movement of the preheating gases in the cooler end of the high preheat section of the tunnel under the control of pressure regulators so that the ware on the trucks in that end of the section may be gradually heated at predetermined uniform rates.

More detailed objects of the invention will be apparent from the following description of the embodiments thereof selected for illustration herein.

In the drawings,

FIGURE 1 is a vertical section through the low temperature portion of the high preheat section of the tunnel kiln showing the heated gas supply and exit ducts for one side of the kiln in which the regulators of this invention have been mounted;

FIGURES 2*a* and 2*b* together constitute a horizontal cross-section taken on the line 2*a*, *b*—2*a*, *b* of FIG. 1; and

FIGURE 3 is a cross-sectional view taken on the line 3—3 of FIG. 2*a*.

The lower temperature end of the high preheat section of the tunnel kiln illustrated in the drawings herein corresponds to the left end of the high preheat section of the tunnel kiln of the above mentioned patent. To better illustrate its relationship to the entire kiln structure a fragmentary part of the low preheat section of the kiln is shown at the extreme left or entrance end of the lower temperature end of the high preheat section. The exit or right hand end of this section connects directly to the higher temperature end of the high preheat section which in turn communicates with the entrance end of the firing section of the kiln.

In accordance with acceptable practice in this art, the housing of the tunnel kiln is suitably constructed of refractory brick and cement. As shown in FIG. 3, the lower temperature end **10** of the high preheat section (not shown) is of generally rectangular cross-sectional shape and is mounted upon a suitable foundation **12**. The adjacent or exit end of the initial preheat section is diagrammatically illustrated at **14** and includes a series of tubular flues **16** horizontally arranged and connecting directly with the duct **18** in the side walls of the section **10**. At this point it may be noted that the construction and arrangement of the apparatus on each side of the tunnel T formed by the housing **10** is the same and for this reason the same reference numerals are used in designating the parts on each side of the housing. The housing forms the tunnel T which runs from end to end of the kiln and is provided usually with tracks on its floor along which the cars C8 to C16 are guided in end to end relation. The ware is arranged in any suitable manner in stacks S on the cars. This is the usual practice in this art.

As is clear from the several figures, the side walls of the tunnel housing **10** are dimensioned so that pairs of vertically arranged ducts **18** and **24** are formed therein. These ducts are of gradually changing cross-sectional area which results from the provision of a longitudinally inclined horizontal division wall **20**, see FIG. 1, which forms the top of the lower duct **18** and the bottom of the upper duct **24**. As will appear later, the preheating gases travel through the duct **24** from the righthand end to the lefthand end and from there into the tunnel T and are withdrawn from that tunnel through the lower duct **18**, passing from the right to the left. As indicated in FIG. 1, the horizontal flues **16** of the initial preheat section **14** directly communicate with the lefthand end of the duct **18**. The lower duct **18** is connected at a lower level with the tunnel T by a plurality of longitudinally spaced ports **22**. Similarly the upper duct **24** is connected with the tunnel T near its top by means of a series of longitudinally spaced ports **26**.

The preheating gases of lower temperature introduced into the ducts **24** at their righthand ends can be obtained from any suitable source. They are preferably the gases coming from the lefthand end of the high preheat section having in turn been supplied under pressure from the exit end of the firing section (see the above-mentioned patent).

It is well understood in this art that in the firing section carbonaceous fuels such as gas or oil are burned and the hot products of combustion are forced directly into the tunnel into contact with the ware to effect firing thereof. After performing their firing function these hot gases are withdrawn from the firing tunnel into the intake end of the hot end of the preheat section. The gases then circulate in the high preheat end of this tunnel section over the ware, gradually raising its temperature as it

moves toward the entrance end of the firing section. After performing this preheating function these gases pass into the righthand end of the ducts 24, FIG. 1, from which they move through the ports 26 into the tunnel T and are withdrawn at longitudinally spaced points from a lower level in the tunnel T through the ports 22 into the lower duct 18.

At this point it may be noted that the members 32 comprise controllable dampers for adjusting the volume of flow of the gases at the ports 22. The lefthand end of the duct 24 is sealed off, as shown in FIG. 1, while the lefthand end of duct 18 connects with the flues 16 so that the gases travel from that duct into and through the flues 16. As disclosed in the above patent, a second blower could be provided at the other end of the low preheat section of which the tubes 16 are a part to further control the rate of gas flow.

Experience with the apparatus as thus far disclosed and as disclosed in the above patent has indicated that the hot products of combustion travel towards the left along the ducts 24 from right to left are distributed at different rates into the tunnel T through the ports 26. The ducts 24 being closed at the lefthand end create a condition of gradually increased pressure towards its lefthand end, so that the preheating gases are delivered into the tunnel T in this region in greater volume than in other regions to the right of the closed off end.

For example, with the apparatus of the above mentioned patent, experience has demonstrated that whereas the temperature of the ware at the positions of trucks C9, C10 and C11 increase from truck to truck at the rate of about 40° per unit of time, the temperature of the ware on the trucks C12, C13 and C14 increases at the rate of 15° per car. In other words, the rate of temperature increase of the ware as it progresses from left to right is not uniform, whereas uniform temperature increase is desired.

In accordance with this invention a series of pivoted pressure regulators or flaps are mounted on the division wall 20 in the duct 24 and arranged so that their angular position can be adjusted. As shown in the drawings these deflectors are at 34 and are pivotally mounted on shafts which are provided with handles 36 by means of which their positions can be adjusted externally of the housing. The adjustment of the angular positions of the regulators 34 is diagrammatically illustrated in FIG. 1. These positions are determined for each run of the kiln, so as to get a uniform temperature increase from car to car. The heating gases flowing down the duct 24 towards its closed end are regulated by the regulators 34 towards ports 26. Thus the pressure and hence the volume of hot gases at various spaced points along the duct passing through the ports 26 can be proportioned to get the required heating

gradient in the successive ware stacks. The hot gases striking the regulators 34 are given components of transverse movement which tend to direct more or less of the desired portions of the hot gases through the adjacent ports 26 and thence into the tunnel T and onto the ware of the adjacent trucks.

From the above description it will be apparent to those skilled in the art that the subject matter of this invention is capable of some variation in its detail. It is proposed, therefore, that the subject matter of the invention be more accurately determined by the scope of the appended claims rather than by the illustrative embodiment herein disclosed.

What is claimed is:

1. In a tunnel kiln preheater, the combination comprising an elongated refractory housing forming a tunnel through which stacks of ware to be heat treated may move, pairs of upper and lower ducts in the side walls of said housing, said upper and lower duct of each pair being separated by an inclined common wall forming the bottom of the upper duct and the top of the lower duct, a plurality of longitudinally spaced exit ports connecting said upper ducts with the tunnel near its top, a plurality of longitudinally spaced exit ports connecting said lower ducts with the tunnel at a level below said first ports, means for delivering hot gases to said upper ducts, and spaced positionable means on the bottoms of said upper ducts for regulating the pressure of the hot gases adjacent thereto to regulate the pressure of the gases flowing into the tunnel through adjacent exit ports.

2. In the combination of claim 1, said pair of upper ducts being closed off at their far ends.

3. In the combination of claim 1, said means comprising longitudinally spaced positionable flaps.

4. In the combination of claim 1, said last means comprising a plurality of longitudinally spaced flaps and means for adjusting the angular position of said flaps.

5. In the combination of claim 1, said last means including a plurality of flaps lying in different angular positions with respect to the axis of said tunnel.

References Cited

UNITED STATES PATENTS

1,333,099	3/1920	Booth	25—142
1,418,669	6/1922	Ogden	25—142
1,701,223	2/1929	Bergman	25—142
2,961,732	10/1960	Handley	25—142

FOREIGN PATENTS

110,918	11/1917	Great Britain.

WILLIAM J. STEPHENSON, *Primary Examiner.*