June 4, 1963 C. D. TINKER 3,091,832

KILN

Filed Aug. 5, 1960 2 Sheets-Sheet 1

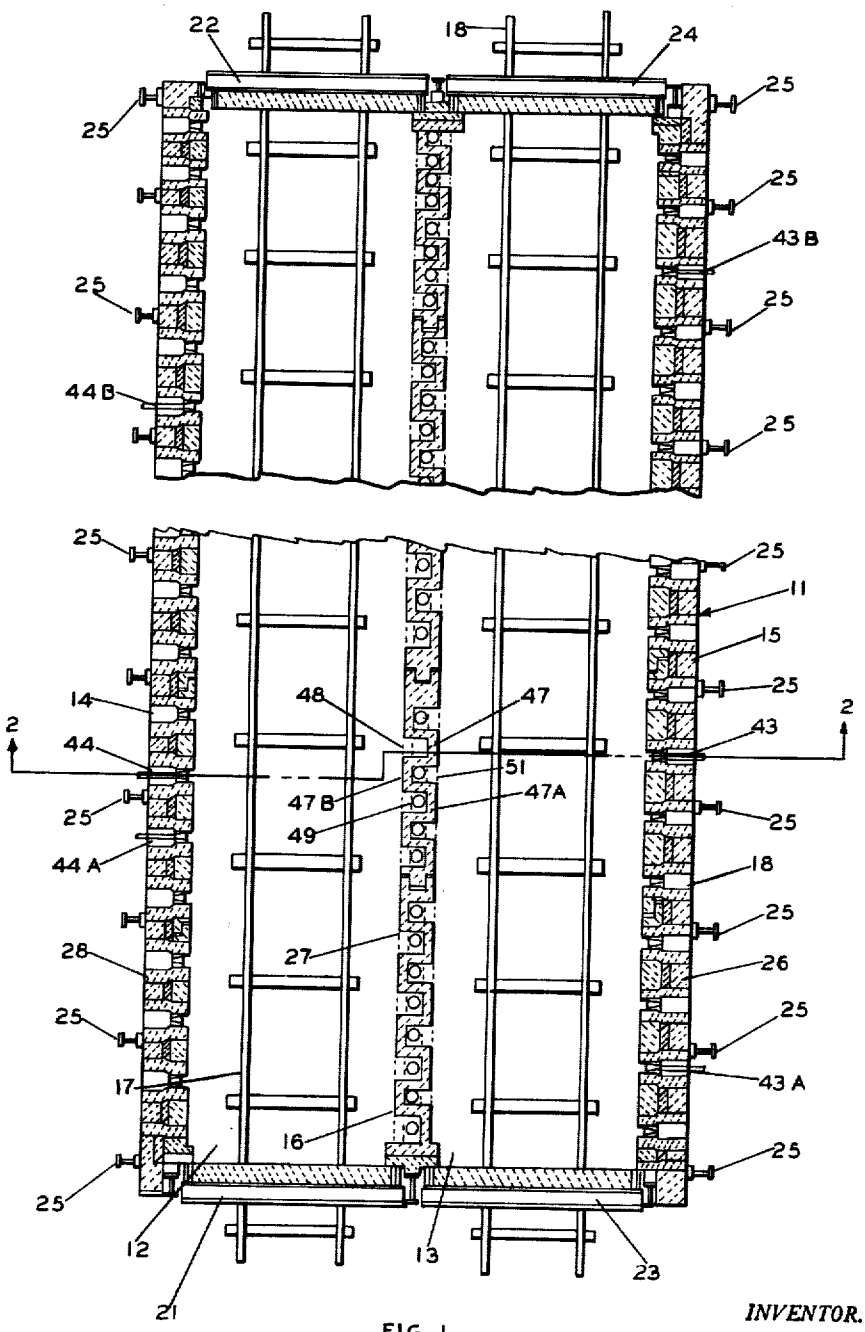


FIG. 1

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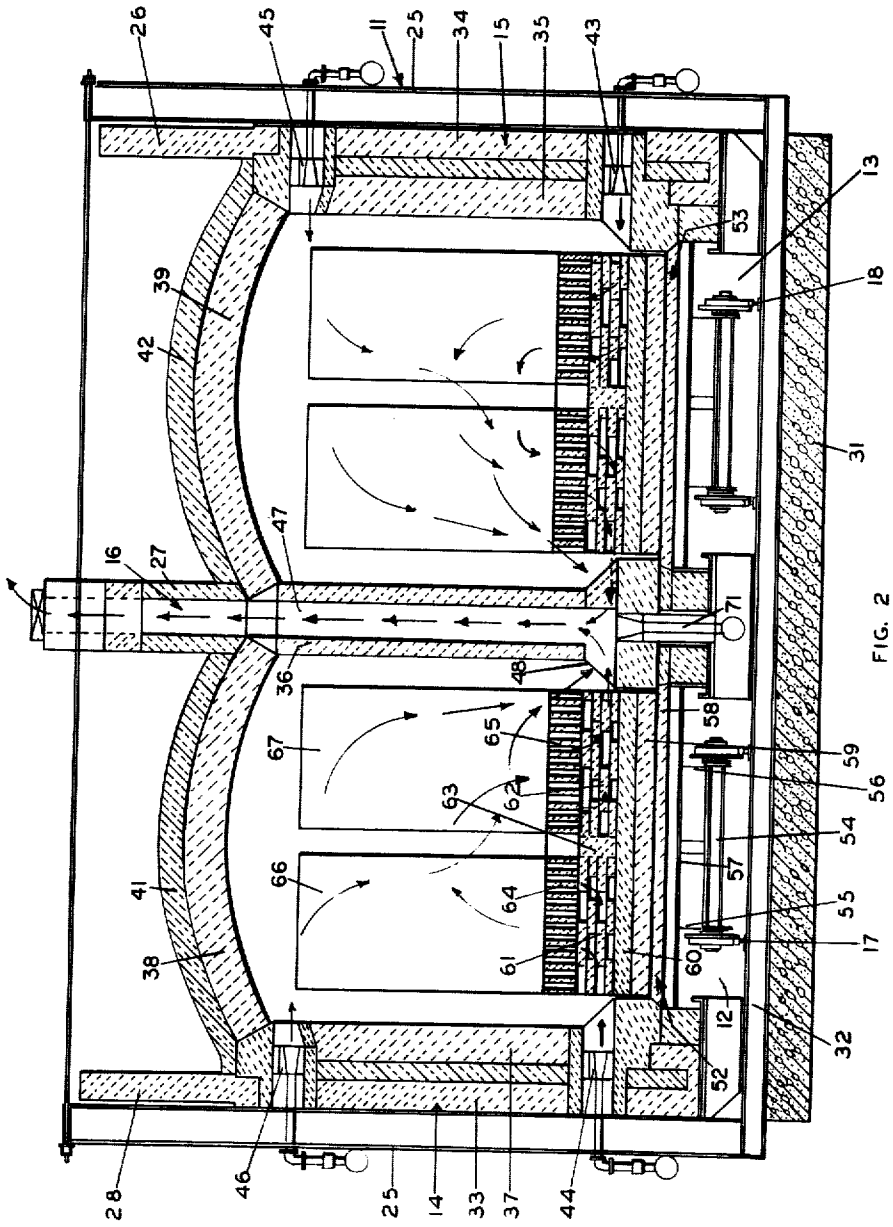


FIG. 2

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The inventions disclosed in this application relate to furnaces. The embodiment of my invention disclosed in the drawings and description hereof is that of a furnace similar to furnaces which are now used and which are designed for use in the treatment of ceramic material by heat, as for example, for the purpose of hardening such ceramic material to form ceramic ware. However, the inventions are applicable to furnaces used for the heat treatment of many types of material such as ceramic ware, refractory materials, metals, etc. My inventions are intended to improve the distribution of heat around the material treated as it passes through such kilns.

The inventions are particularly useful in furnaces such as are sometimes designated as "tunnel car bottom kilns," and the embodiment illustrated is a twin tunnel car bottom kiln.

One of the objects of my invention, therefore, is the provision of a new and improved furnace or kiln.

A further object of my invention is the provision of a new and improved twin tunnel car bottom kiln.

A further object of my invention is the provision of a new method of stacking material to be treated upon a supporting platform.

A further object of my invention is the provision of a truck or platform for conveying and holding material to be treated in a kiln so constructed and arranged as to cause the heated gases supplied thereto to circulate more efficiently around the material stacked thereon.

Further objects and features of my invention will be apparent from the subjoined specification and claims when considered in connection with the accompanying drawings illustrating an embodiment of my invention.

In the drawings:

FIG. 1 is a fragmentary view in horizontal section of a twin tunnel car bottom kiln constructed in accordance with my invention and constituting an embodiment illustrating my invention; and

FIG. 2 is a view in vertical section taaken substantially on the line 2—2 of FIGURE 1.

Referring in detail to the drawings, it may be seen that I have shown in FIG. 1 a kiln **11** having twin tunnels through which cars loaded with ceramic ware are adapted to be moved. Thus I have shown that the kiln **11** has tunnels **12** and **13**, has outside walls **14** and **15**, and an inner dividing wall **16** which separates the tunnels **12** and **13** from each other. In the tunnel **12** there is provided a track **17** for cars for transmitting ceramic materials through the kiln **11** (i.e. through the tunnel **12**) and holding the cars within the kiln **11** while the ceramic ware is being heated. In the tunnel **13** there is a similar track **18** for the same purpose. Doors which may be opened or closed (as for example, raised and lowered) are provided for the two tunnels. Thus the tunnel **12** has the doors **21** and **22**, and the tunnel **13** has the doors **23** and **24**. Metal beams such as **25** form a frame work for the kiln which is itself formed of refractory materials such as the brick work **26**, **27** and **28**. The kiln is supported on a masonry base **31** (see FIG. 2) and steel beams such as **32**. The outer walls **33** and **34** may be of common brick, but the inner walls such as **35**, **36** and **37** should be of firebrick. The arches **38** and **39** are also of firebrick, and above these arches **38** and **39** are arches of insulation **41** and **42** respectively. In each side of the furnace there are inserted a plurality of burners. The burners **43**, **44**, **45** and **46** may be considered illustrative,

but it is to be understood that similar burners (such as, for example, **43***a*, **43***b*, **44***a* and **44***b*) are placed throughout the length of the kiln. In the center of the kiln, dividing the two tunnels **12** and **13**, is a refractory wall housing a large number of flues or stacks of which the stack or flue **47** is illustrative. The exhaust gases are discharged through these flues or stacks.

The construction of these flues is of particular importance in my furnace, and particular attention should be paid thereto. It will be noted from a consideration of FIGURE 1 that at the level of the lower burners **43** and **44** the central wall is made up of a course of firebrick which extends from one end of the tunnel to the other, but in so extending traces a more or less sinous course so that it forms an entrance to flues alternately on each side of the wall. Above the level at which these entrances to the flue are provided from each side of the wall, the flues extend solidly upward as shown in solid lines in FIG. 2. Thus from the tunnel **12** there is the entrance **48** to the flue **47**. Spaced therefrom is the entrance **49** to the flue **47***a*. Interposed between them on the opposite side of the wall **27** is an entrance **51** from the tunnel **13** to the flue **47***b*. However, the flues **47**, **47***a* and **47***b* and entrances **48**, **49**, and **51** are not joined with each other in any way. Entrances similar to the entrances **48**, **49** and **51** extend throughout the whole length of the center wall **27**. It should be noted, moreover, that each burner is not placed exactly opposite any entrance. Thus the entrance **51** is offset from the burner **43** so that the burning gases must take a curved course in order to enter any flue through the entrance (e.g. **51**). Similarly, the burner **44** is not set opposite the entrance **48** or the entrance **49**, but rather is set between the entrances **48** and **49** so that the gases from the burner **44** must take curved courses in entering into the entrances **48** and **49**.

The loading of the ware upon the tunnel cars is also of particular importance in connection with my invention. Referring particularly to the showing of FIGURE 2, it may be seen that there are shown cars of which one is in each of the tunnels. Thus in the tunnel **12** there are a plurality of cars of which there is shown the car **52**, and in the tunnel **13** there are a plurality of cars of which there is shown the car **53**. Each car is similar, and the description of the car **52** should suffice for not only the car **52** and the car **53** but for all of the several or many cars which are positioned in line with each other on both of the tracks **17** and **18**.

The car **52** includes the truck **54**, supporting standards **55** and **56**, steel beams such as **57**, and layers of refractory material such as **58**, **59** and **60**. Positioned above the layer **60** is a perforate chain wall consisting of two laterally perforate portions **61** and **62**, and an imperforate portion or partition **63** which separates the two portions **61** and **62**. The perforate portion **61** allows the passage of burning gases inward from the burner **44** as far as the partition **63**. Above the portions **61** and **62** are vertically perforate decks **64** and **65** respectively. Heated gases may pass upward through the deck **64**. Stacked upon the decks **64** and **65** are layers of ceramic ware **66** and **67** which are to be cured or hardened or burned within the furnace. The heated gases coming up through the deck **64** pass through and around the ware **66** and **67** and downward through the deck **65**. Then it passes inward through the portion **62** to the flue **47**. The path of the gases is thus from the burner **44** through the laterally perforate chain wall **61**, then up through the deck **64** (because it cannot pass through the imperforate wall **63**), in and around the ware **66** and **67**, then down through the deck **65**, then inward through the laterally perforate chain wall **62**, to the entrance **48** and into the flue **47**. Also, heated gases coming in through the burner **46** pass through and around the ware **66** and **67**

down through the deck **65**, then inward through the chain wall **62** to an entrance **48** and into the flue **47**.

In order to start a draft of heating gases in the furnace I provide a starting burner at the lower end of each of the flues. Thus at the bottom of the flue **47** there is shown the stack burner **71**. Each of the flues is provided with a stack burner for starting a draft of heating gases upward through such flue. A damper tile is provided for the top of each flue.

In the operation of my furnace, the stack or draft starting burners (such as the stack burner **71**, for example) are lighted to start a draft of air upward through the stacks or flues. Then the burners (such as burners **43**, **44**, **45** and **46**) are ignited to heat the furnace. The chain walls **61**, **62**, **63**, **64** and **65** are constructed on the cars, and ware is stacked thereon. The doors are opened and the cars are positioned within the furnace. The doors are then closed. The heated gases follow the courses indicated in the last paragraph from the burners (e.g. the burners **43**, **44**, **45** and **46**) to the flues. For example, the course of said gases from the burners **44** and **46** to the entrance **48** of the flue **47** is indicated by arrows in FIG. 2. Similar arrows indicate the passage of similar heated gases from the burners **43** and **45**. In the stacks or flues the draft created by the stack burner of each flue draws these heated gases strongly through the furnace so that the ware is efficiently heated. The flues being in the center of the furnace do not lose heat to a cooler surrounding atmosphere.

It is to be understood that the above described embodiment is for the purpose of illustration only, and various changes may be made without departing from the spirit and scope of my invention.

I claim:

1. A kiln comprising

a pair of side by side twin kiln tunnels having an imperforate common wall between them formed of refractory material; and

each of said tunnels also having a floor, a roof and an outside side wall;

said common wall having an inlet level adjacent to its lower end and being formed at said inlet level as a serpentine refractory barrier between said tunnels thus providing a plurality of alternate stack inlets from each of said twin tunnels alternately interposed and being imperforate above said inlet level so that heated gases may not pass from one tunnel to the other; and

a plurality of separated stacks each connected to one of said inlets and extending upward through and enclosed by said common wall;

each said outside wall of each of said tunnels having a plurality of burners so positioned that they are spaced apart but that the burning gases issuing from all of said burners extend for substantially the entire length of said side walls.

2. The structure of claim 1 in which each of said stacks has an outlet opening above said kiln for the escape of gases entering said stack from the tunnel through the inlet for the stack and each of said stacks has a starter burner provided at the base of said stack for creating an up-draft therein.

3. The structure of claim 1 in which each of said stacks has an outlet opening above said kiln for the escape of gases entering said stack from the tunnel through the inlet for the stack; and

in which the side wall of each tunnel has said plurality of burners positioned therein at approximately the same vertical level as the level of said inlet openings and provided for projecting heated gases into said tunnel.

4. The structure of claim 1 in which there is provided in combination with each of the kiln tunnels a movable platform positioned in the tunnel and adapted to be loaded with ceramic ware to be treated.

5. The structure of claim 1 in which the inlet openings to the adjacent stacks are arranged alternately on opposite sides of said common wall and receive gases alternately from said pair of tunnels.

6. The structure of claim 1 in which the side wall of each of said tunnel kilns has said plurality of burners positioned therein at approximately the same vertical level as the level of said inlet openings; and

has a plurality of additional burners also positioned in each said side wall but positioned well above the level of said inlet opening;

all of said side wall burners being provided for the purpose of projecting heated gases into said tunnel.

7. The structure of claim 1 in which the plurality of burners of each of said kiln tunnels for projecting heated gases into said tunnel are positioned laterally opposite to a stack which has an inlet opening into the tunnel on the opposite side of the common wall from said burner.

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