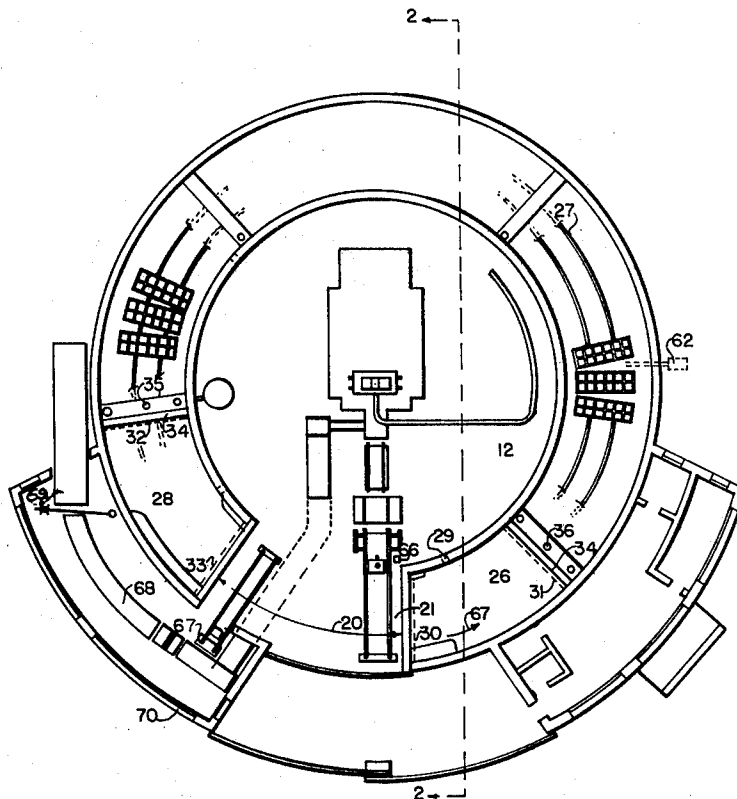


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 [22] Filed **April 21, 1969**
 Continuation-in-part of Ser. No. 662,142,
 Aug. 21, 1967, abandoned.
 [45] Patented **Dec. 8, 1970**

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Primary Examiner—John J. Camby
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[54] **KILN FOR HEAT TREATMENT OF ARTICLES ON**
A CONTINUOUS BASIS
4 Claims, 7 Drawing Figs.
 [52] U.S. Cl. 263/28;
 25/133; 263/7
 [51] Int. Cl. **F27b 9/00**
 [50] Field of Search 263/28, 7;
 25/133, 142(B), 142(C)

ABSTRACT: A circular housing defining an annular kiln tunnel and a central chamber which contains a block making machine. An endless block carrier is movable in the annular tunnel and means are provided for loading blocks from the block making machine on the carrier and for unloading blocks from the carrier to the outside of the housing, at block loading and unloading stations, respectively, in the tunnel. Air curtains separate the tunnel into a plurality of different temperature zones.



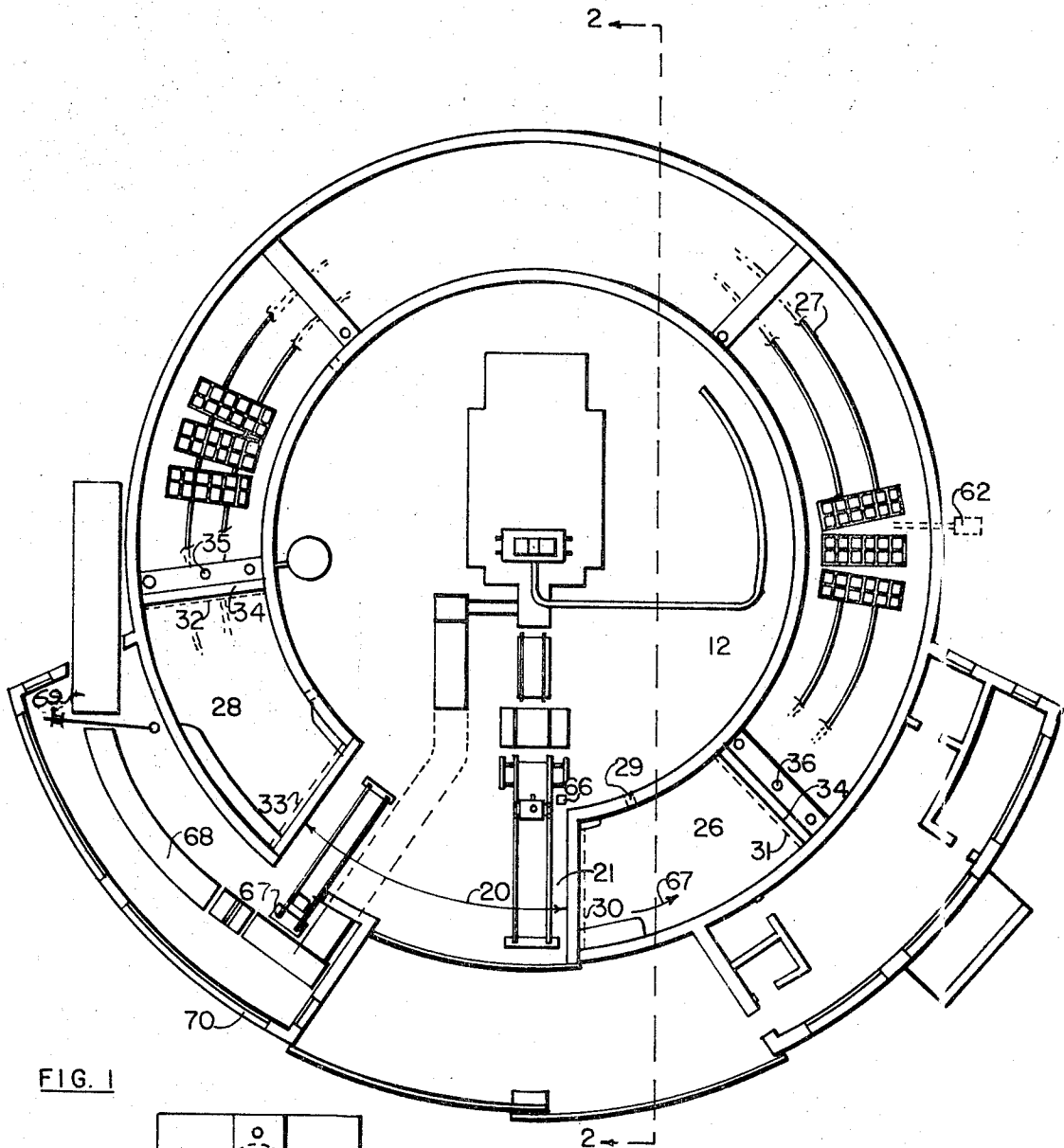


FIG. 1

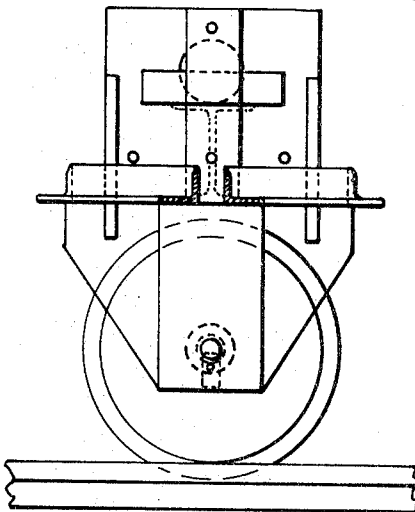


FIG. 4

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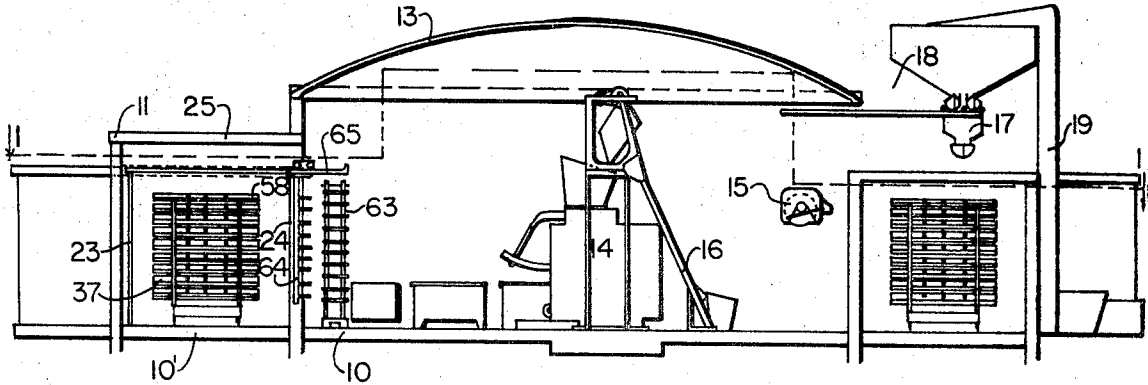


FIG. 2

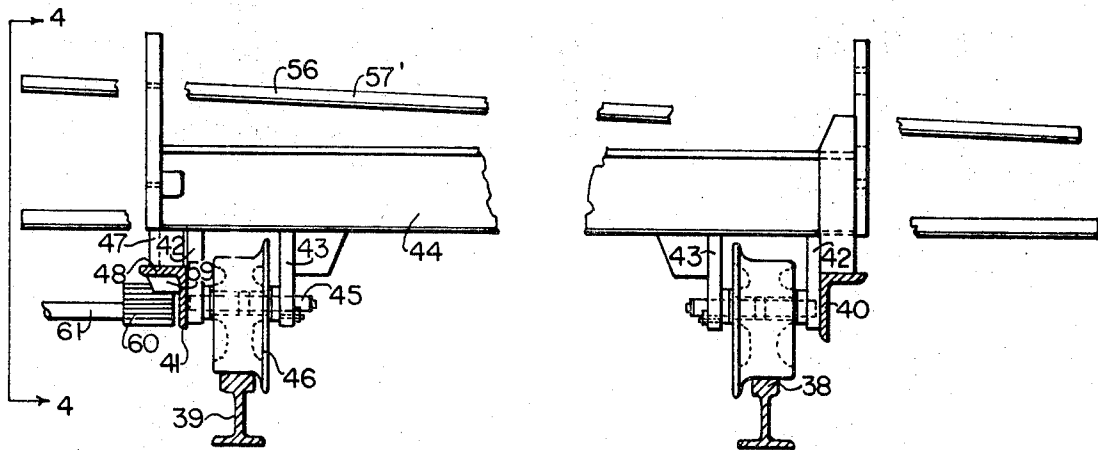


FIG. 3

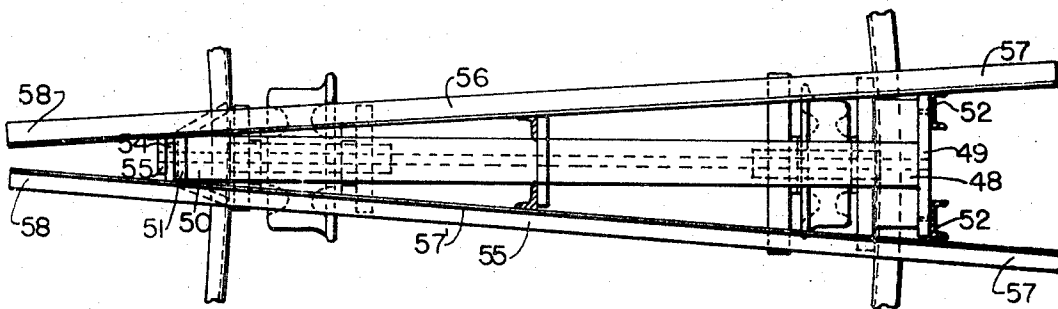


FIG. 5

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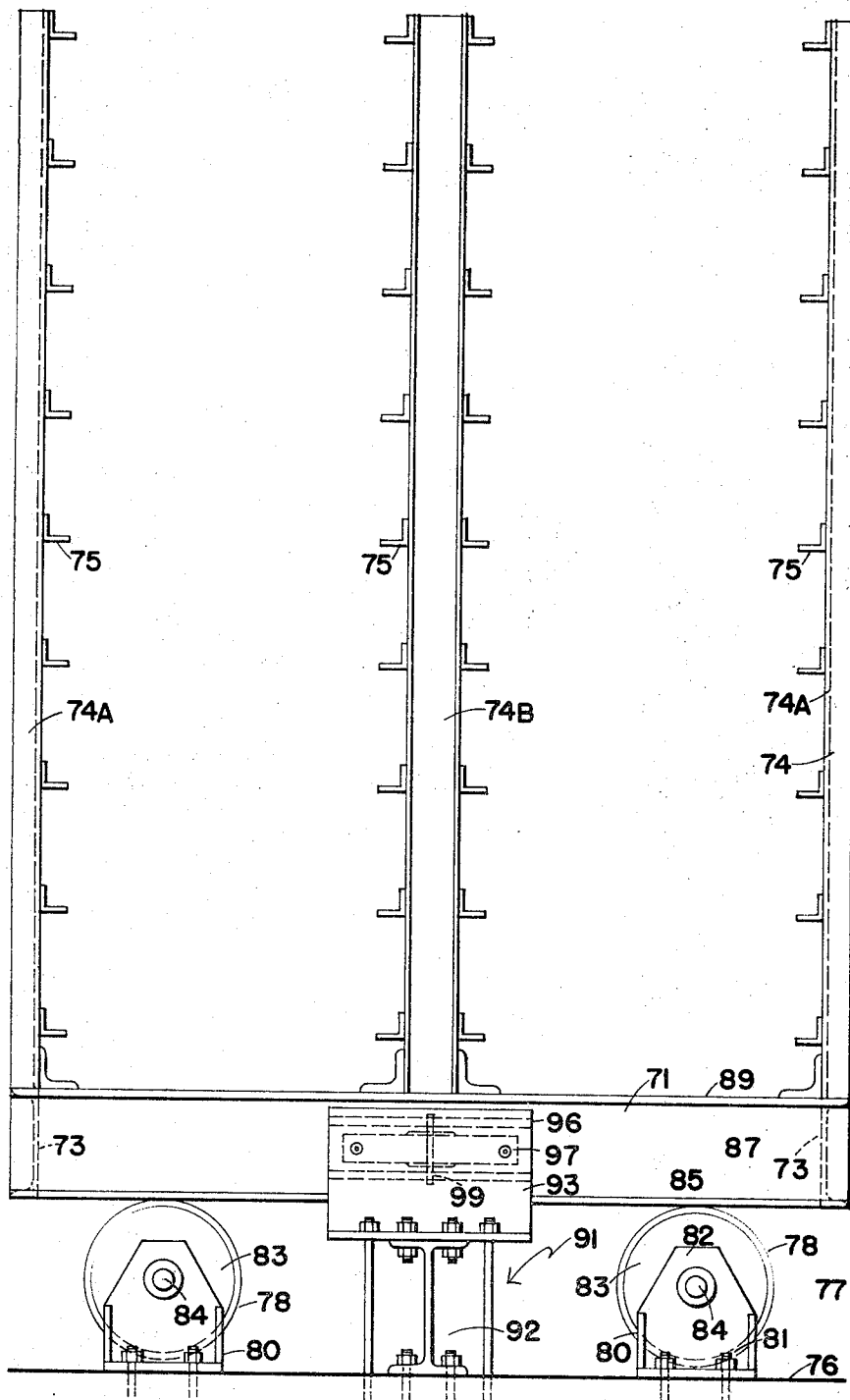


FIG. 6

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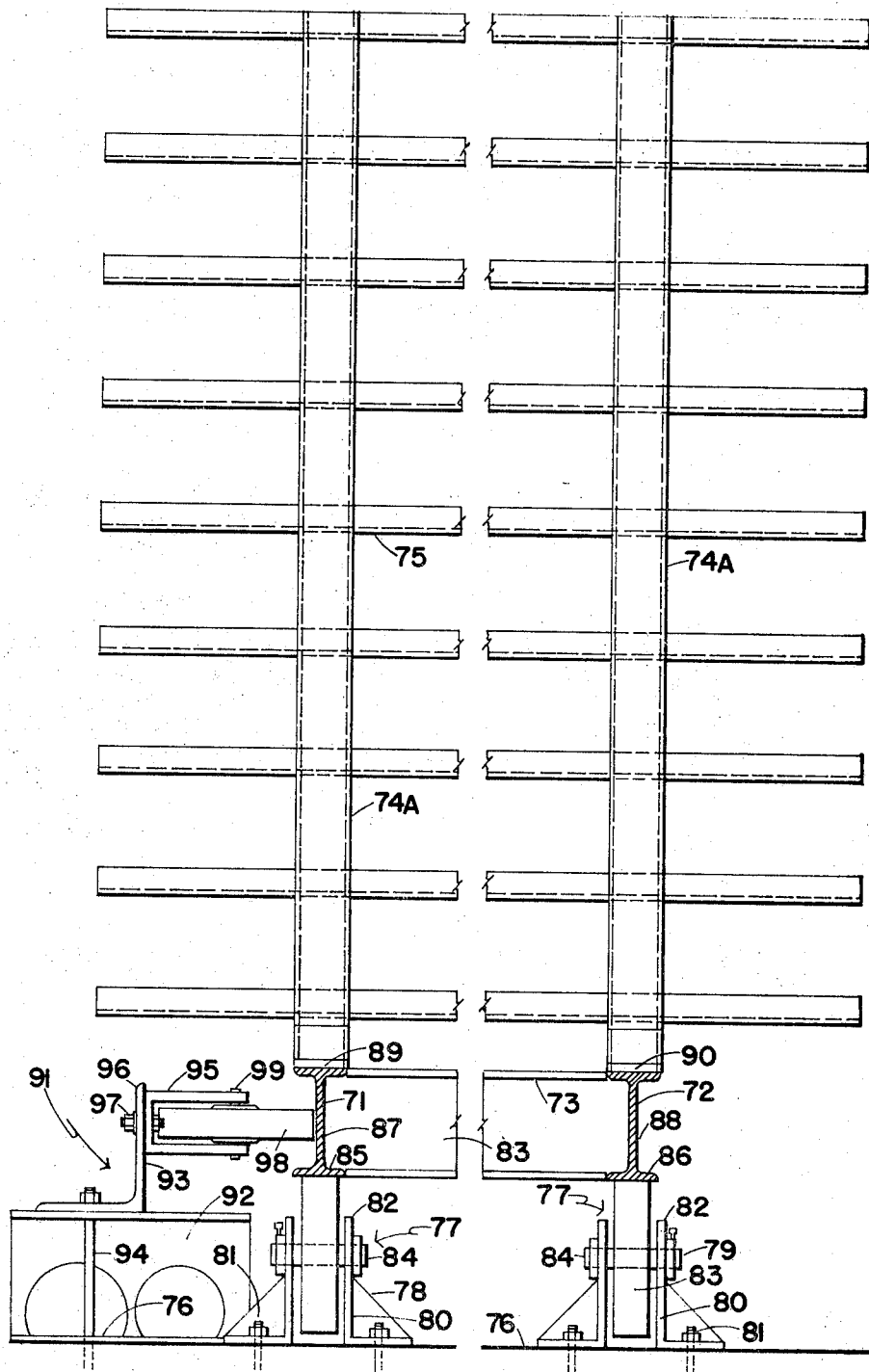


FIG. 7

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KILN FOR HEAT TREATMENT OF ARTICLES ON A CONTINUOUS BASIS

This invention relates to new and useful improvements in kilns for heat treating or drying out articles on a continuous circular basis and constitutes a Continuation-in-Part of my U.S. Pat. application Ser. No. 662,142, filed Aug. 21, 1967, and now abandoned.

Although it is designed primarily for the curing of concrete products on a continuous basis, nevertheless it will be appreciated that it can be used for heat treating of articles such as concrete pipe, asbestos transite pipe, building brick, steel products, lumber and wood products, cars or the like or any article to be heat treated or dried or cured.

In the manufacture of concrete blocks and other concrete products or the like, it is conventional to palletize the blocks as formed and then transfer them to a curing kiln.

After being kiln cured, they are then transferred to storage areas all of which necessitates not only considerable handling of the blocks, but also the kilns are used for a considerable length of time. In other words, once the kiln is loaded, the blocks are heat treated for 24 to 48 hours and then the kiln has to be unloaded.

This handling and loading and unloading from the conventional kiln has other disadvantages such as the tendency for blocks to discolor, the tendency of blocks to crack due to the transit action, difficulty of stable dimension control, difficulty of efficient temperature and humidity controls and the difficulty of ensuring constant or identical curing of the blocks on the outer side of the kiln compared to blocks in the center.

My device overcomes all of these disadvantages by providing an annular rotating platform upon which concrete products are loaded directly from the block-making machine, at this point we reverse conventional methods of taking heat to the products. In this phase of the new concept we now take the products to the heat. The plate platform carries the products slowly through an annular curing chamber so that when they reach the other end, they are fully cured and ready for unloading.

The device reduces considerably the handling of blocks and enables complete stability to be obtained in the temperature and humidity ranges as required.

The circular principle involved is adapted to suit the production of concrete blocks in a central area, feed them directly to the entrance of the kiln to take the place of cured concrete products unloaded at the exit portion just immediately prior to the entry portion.

The device is also particularly suited for complete automation inasmuch as it is relatively easy to incorporate cement and aggregate storage bins, weigh batching machines, mixing machines, and conveyors of the mixed material to the automatic concrete product making machine.

With the foregoing in view, and such other or further purposes, advantages or novel features as may become apparent from consideration of this disclosure and specification, the present invention consists of, and is hereby claimed to reside in, the inventive concept which is comprised, embodied, embraced, or included in the method, process, construction, composition, arrangement or combination of parts, or new use of any of the foregoing, of which concept, one or more specific embodiments of same are herein exemplified as illustrative only of such concept, reference being had to the accompanying FIGS. in which:

FIG. 1 is a plan view of the assembly taken substantially along the section 1-1 of FIG. 2.

FIG. 2 is a vertical section of FIG. 1, substantially along the line 2-2 of FIG. 1.

FIG. 3 is an enlarged cross-sectional view of the product a carrying component.

FIG. 4 is a view at right angles to FIG. 3 substantially along the line 4-4 of FIG. 3.

FIG. 5 is a plan view of part of the component.

FIG. 6 is a side elevation of the preferred embodiment of one segment of my block carrier enlarged with reference to the remaining drawings.

FIG. 7 is an end view of FIG. 6.

In the drawings like characters of reference indicate corresponding parts in the different figures.

With conventional kiln curing of concrete products such as blocks or the like, it is not possible to obtain accurate curing control as the first set of blocks in the curing chamber is cured longer than the last set of blocks. This causes variation in color or tone of finished products and variation of tensile strength. Lack of proper humidity control often cause hairline or shrinkage cracks to the finished blocks.

With the present device, each set of blocks remains in the curing chamber for exactly the same length of time and under exactly the same conditions of temperature and humidity, so that a fairly standardized product is obtained. When the blocks leave the kiln, they can be preshrunk and can be handled easily and are ready for use in construction.

Proceeding therefore to describe the invention in detail, reference should first be made to FIGS. 1 to 5. The device consists of a substantially circular building having a base or floor 10 and a circular or annular kiln enclosure collectively designated 11 situated upon the floor 10.

This annular kiln enclosure 11 defines a central area 12 which is covered by a roof 13.

Within the central area may be situated a conventional automatic block machine 14, a mixer 15 and a skip conveyor 16 extending therebetween. The mixer can be fed from a travelling weigh batcher 17 fed from aggregate and cement bins 18 which in turn are kept supplied by elevators 19 from the exterior of the building.

The annular kiln enclosure extends around the major part of a circle, the minor part or portion of the circle 20 defining kiln entrance facilities 21 and kiln exit facilities 22.

The kiln enclosure 11 comprises a floor or base 10, an outer annular wall 23 and inner annular wall 24, and a roof or cover portion 25, thus forming what might be termed a circular tunnel. The walls 23 and 24 and the roof 25 are preferably insulated in order to facilitate the maintaining of the necessary temperature and humidity within the various zones of the kiln tunnel.

The kiln tunnel 11 is divided into two or more zones mainly a preset area or zone 26, a low temperature control humidity zone 27, and a high temperature control humidity finishing zone 28. The preset zone 26 commences with the entrance to the tunnel 21 and extends approximately 45° into the tunnel. It may contain a CO₂ input 29 which is used in some methods of curing.

An air curtain identified by the dotted line 30 extends across the entrance 21 and a further air curtain identified by the dotted line 31 defines the end of the preset zone.

Inasmuch as the air curtain phenomena are well known, it has not been thought necessary to describe the operation of same. However, it will be appreciated that mechanical doors, which are also well known, could be used in these locations.

There is a further air curtain indicated by the dotted line 32 at the beginning of the high temperature zone 28 and a final air curtain adjacent the exit 22 of the kiln tunnel and identified by the dotted line 33, all of which are shown in FIG. 1.

The zone 28 extends from the air curtain 32 through approximately 45° to the exit air curtain 33 so that the main low temperature zone 27 extends from air curtain 31 to air curtain 32.

The main zone 27 also is provided with a transverse dam 34 across the floor between walls 23 and 24 adjacent air curtain 31 and also adjacent air curtain 32, said dams being approximately 4 inches high. The floor 10' between the dams and extending through the zone 27 therefore becomes a water pan and water may be flooded through this pan by water input pipes shown schematically at 35 adjacent air curtain 32 and may be drained through drains 36 shown schematically adjacent air curtain 31.

The water in the pan 35 may be defined insofar as temperature is concerned either prior to entering through the water input 35 or, alternatively, by embedded heat inducing means

either electrical or fluid. However, as these are conventional it has not been deemed necessary to show details thereof.

The temperature in the zones 26, 27 and 28 may also be controlled by well known radiant heat or other means. It is desirable that the temperature in the preset zone 26 be in the neighborhood of 70° F.

In zone 27, a temperature of approximately 160° F is sufficient, but in the finishing or high temperature heat zone 28, the temperature may be raised to approximately 360° F and this would necessitate some form of radiant heat panel.

However, the above temperatures are purely for explanatory purposes and the necessary temperatures and humidity factors would be decided upon depending upon the articles being treated by the kiln.

An annular product carrying component collectively designated 37 extends through the tunnel and is rotated by a source of power, hydraulic or pneumatic friction or gear, on a continuous basis.

The construction of this component is shown in detail in FIGS. 3, 4 and 5.

Upon the floor 10' of the kiln tunnel are secured a pair of spaced and parallel rails 38 and 39, said rails forming a continuous circle.

A circular or annular flange member 40 of angle iron configuration is provided adjacent the outer rail 38 and an inner flange member 41 is provided adjacent the inner rail 39. Plates 42 are welded to the vertical surface of the flange members 40 and 41 and extend upwardly therefrom and these together with spaced and parallel plates 43 support radially extending beams 44, the beams being welded to the upper edges of plates 42 and 43. Wheel axles 45 are also carried by plates 42 and 43 and rail wheels 46 are journaled for rotation upon axles 45 and engage the rails 38 and 39 as clearly shown.

Filler plates 47 extend between beams 44 and the horizontal component 48 of the flanged members 41 and 40. It will thus be seen that an annular turntable device has been provided which is continuous in a complete circle and which rides upon the annular rails 38 and 39, through the kiln tunnel 11.

Secured to the outer ends 48 of each of the beams 44 is an upwardly extending plate 49 and secured to the inner ends 50 of each of the beams 44 is a further upwardly extending plate 51.

Secured to the outer plate 49 and extending upwardly therefrom is a pair of spaced and parallel channel members 52.

A plurality of pairs of angle irons 55 and 56 are welded to the outer flanges of the channels 52 and to the outer edges of the plates 53 and 54, said angle irons being horizontally disposed and in spaced and parallel relationship one above the other.

The angle irons 55 and 56 secured above one specific beam 44 incline inwardly from the outer ends 57 thereof towards the inner ends 58 and the angle irons 55 of one set together with the angle irons 56 of the next adjacent set are parallel one with the other thus defining bays situated around the component 37. The horizontal flanges 57 of the angle irons 55 and 57 of one bay face inwardly towards one another thus acting as ledgers to receive conventional pallets carrying concrete blocks or similar products 58.

In the present embodiment, some 50 bays are provided extending around the full perimeter of the component 37, each bay holding nine sets of pallets one above the other in spaced and parallel relationship as shown in FIG. 2.

Means to rotate the component 37 around the rails 38 and 39 preferably take the form of a circular tooth rack 59 secured as by welding or other means to the underside of the horizontal flange 48 of the outer flanged member 41. Alternatively, the rack can be attached to the inner flange member.

A gear 60 mounted on shaft 61 engages the rack 59 and shaft 51 is connected to a source of power 62 shown schematically in FIG. 1. This source of power may be either an electric or hydraulic motor or pneumatic means can be used.

In the present embodiment, the speed of rotation of shaft 61 together with the gear ratio between gear 60 and rack 59 is such that the component 37 rotates once in approximately 24 hours thus giving a complete curing cycle to blocks entering at 21 and leaving at 22.

In operation, blocks are manufactured by the block making machine 14 and are accumulated in the accumulator 63. A multifork component 64 which is conventional, is mounted upon an overhead rail 65 and transfers the blocks from the accumulator 63 to an empty bay on component 37 which is opposite to the multiforks 64 at that time. It is, of course, necessary to stop and start the components 37 each time blocks are loaded or unloaded and in this connection, conventional microswitches shown schematically at 66 may be used. The use of microswitches for stopping and starting devices is well known and it is therefore not believed necessary to describe same in detail.

Once a bay is completely loaded, the component 37 moves in the direction of arrow 67, each empty bay receiving a load of blocks as it passes the multiforks 64. Each bay full of blocks passes through the air curtain 30 into the preset area 26 and proceeds from there through the air curtain 31 into the main low temperature curing zone 27. As they pass around this zone, they pass through air curtain 32 into the high temperature zone 28 and thence through air curtain 33 to the exit facility 22. There a conventional multifork device similar to device 64, unloads each bay and deposits the palletized blocks to a standard pallet deblocking device 67 situated externally of the kiln and from there conventional conveying equipment illustrated schematically at 68 may convey the blocks to standard cubing devices 69. An annular wall 70 extends partway around the kiln and may contain this equipment together with other facilities normally associated with manufacturing processes. However, this does not form part of the invention.

It will therefore be seen that blocks may be loaded continuously into the bays, may pass continuously around the circular kiln and may be unloaded on a continuous basis externally thus enabling full control of temperature and humidity to be maintained.

FIGS. 6 and 7 show details of the preferred embodiment of the block carrier, one segment being shown.

In this embodiment, two arcuately curved tracks or rails are used as a base, reference character 10 illustrating the outer arcuately curved rail and reference character 11, the inner one. These rails 10 and 11 are maintained in spaced and parallel relationship by means of the cross members 12 extending therebetween at each end thereof.

Extending upwardly from these rails 10 and 11 are the vertical members 74, it being understood that there are outer members 74A extending from adjacent the ends of the rails 71 and 72 and double central members 74B extending upwardly from adjacent the center of the rails 71 and 72.

Opposing angle members 75 are secured to these uprights facing one another as clearly shown in FIG. 6 and these angle members are adapted to support conventional pallets as hereinbefore described in the previous embodiment.

Situated around the floor 76 of the tunnel, is a plurality of wheel supports collectively designated 77, there being an outer ring 78 and an inner ring 79 situated immediately below the rails 71 and 72 respectively.

These wheel supports include pairs of reinforced angle members 80 secured to the floor 76 by means of bolt assemblies 81 so that the vertical flanges 82 of these members 80 extend upwardly in spaced and parallel relationship as clearly shown in FIG. 7.

Wheels 83 are journaled upon axles or spindles 84 extending between these vertical flanges 82 and these wheels engage the lowermost horizontal flanges 85 and 86 of the rails 71 and 72 respectively. These rails also include vertically extending flanges 87 and 88 respectively and upper horizontal flanges 89 and 90 respectively.

The spacing of the wheel supports 77 is such that all of the segments of the block carrier is supported at all times during

its movement around the tunnel by means hereinbefore described.

However, with this particular type of construction, with the lower horizontal flanges 85 and 86 engaging the surfaces of the wheels 83, it is obviously necessary that some method of side support be provided adjacent the outer rail 71.

This takes the form of a plurality of side roller guide assemblies collectively designated 91 which are mounted upon concrete blocks 92 for positioning purposes outboard of the outer ring 78 of wheel supports and engageable by the outer rail or track 87.

An angle iron support 93 is bolted through the concrete block 92 into the floor 76 of the tunnel by means of bolt assemblies 94 and a wheel fork 95 is secured to these vertical flanges 96 of the angle bracket 93 by means of bolt assembly 97 so that the wheel fork 95 extends inwardly at right angles from the vertical flange 96. A wheel 98 is journaled for rotation between fork 95 and upon bearing spindle 99 so that the wheel is journaled for rotation in a horizontal plane. This horizontally mounted wheel engages the vertical flange 87 of the outermost rail or track 71 as clearly shown in FIG. 7 thus centering the entire endless block carrier within the tunnel as it rotates therein.

The operation of this modified block carrier is the same as that described for the previous embodiment.

Various modifications can be made within the scope of the invention concept which is herein disclosed and/or claimed.

I claim:

1. In a continuous kiln for cement blocks and the like, the combination of a substantially circular housing including radially spaced inner and outer walls and a floor defining therebetween an annular kiln tunnel and a central chamber within said inner wall, an endless block carrier movable along said floor of said tunnel, means cooperating between said block carrier and said floor mounting said block carrier for said movement along said floor, means for propelling said carrier along said floor, said tunnel having a block loading station and a block unloading station juxtaposed to each other, said inner wall being provided with a block loading opening communicating said loading station with said central chamber, a block making machine positioned in said central chamber, block loading means for transferring blocks from said block making machine through said loading opening to said block carrier at said loading station, said outer wall being provided with a block unloading opening communicating said unloading station with the outside of said housing, block unloading means for transferring blocks from said block carrier at said unloading station through said unloading opening to the outside of the housing, and air curtain means separating said loading and unloading stations from the remainder of said tunnel and also separating the remainder of the tunnel into a plurality of different temperature zones.

2. In a continuous kiln for cement blocks and the like, the combination of a substantially circular housing including radially spaced inner and outer walls defining therebetween an an-

nular kiln tunnel and a central chamber within the inner wall, an endless track provided within said tunnel, means for propelling said carrier along the track, said tunnel having a block loading station and a block unloading station juxtaposed to each other, said inner wall being provided with a block loading opening communicating said loading station with said central chamber, a block making machine positioned in said central chamber, block loading means for transferring blocks from said block making machine through said loading opening to said block carrier at said loading station, said outer wall being provided with a block unloading opening communicating said unloading station with the outside of said housing, block unloading means for transferring blocks from said block carrier at said unloading station through said unloading opening to the outside of the housing, and air curtain means separating said loading and unloading stations from the remainder of said tunnel and also separating the remainder of the tunnel into a plurality of different temperature zones.

3. In a continuous kiln for cement blocks and the like, the combination of a substantially circular housing including radially spaced inner and outer walls and a floor defining therebetween an annular kiln tunnel and a central chamber within said inner wall, an endless block carrier movable along said floor of said tunnel, means cooperating between said block carrier and said floor mounting said block carrier for said movement along said floor, said last means including an inner and an outer track on the underside of said block carrier, a plurality of inner and outer ring wheel supports secured to said floor around said tunnel, a wheel journaled for rotation in each of said wheel supports, each ring being under each track for engagement by said track, a plurality of side roller guides mounted outboard of said outer ring and engaging said outer track on the side thereof, means for propelling said carrier along said floor, said tunnel having a block loading station and a block unloading station juxtaposed to each other, said inner wall being provided with a block loading opening communicating said loading station with said central chamber, a block making machine positioned in said central chamber, block loading means for transferring blocks from said block making machine through said loading opening to said block carrier at said loading station, said outer wall being provided with a block unloading opening communicating said unloading station with the outside of said housing, block unloading means for transferring blocks from said block carrier at said unloading station through said unloading opening to the outside of the housing, and air curtain means separating said loading and unloading stations from the remainder of said tunnel and also separating the remainder of the tunnel into a plurality of different temperature zones.

4. The device according to claim 3 in which said track is provided with a base flange and a vertical web, said side roller guides including a support bracket secured to said floor, a fork extending horizontally from said bracket and a roller journaled for rotation in a horizontal plane in said fork, said roller engaging said web.

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