United States Patent

Brown, Jr.

[15] **3,669,283**

[45] **June 13, 1972**

[54] **METHOD AND APPARATUS FOR DEHACKING BRICK**

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[52] **U.S. Cl.**.....**214/8.5 C**, 214/1 Q, 214/152, 198/33 AD, 198/31, 198/32

[51] **Int. Cl.**.....**B65g 59/02**

[58] **Field of Search**.....214/6 A, 6 FS, 6 DK, 6, 6 P, 214/8.5 R, 8.5 C, 8.5 A, 152, 8.5 D; 198/31, 32, 33 AD

[56] **References Cited**

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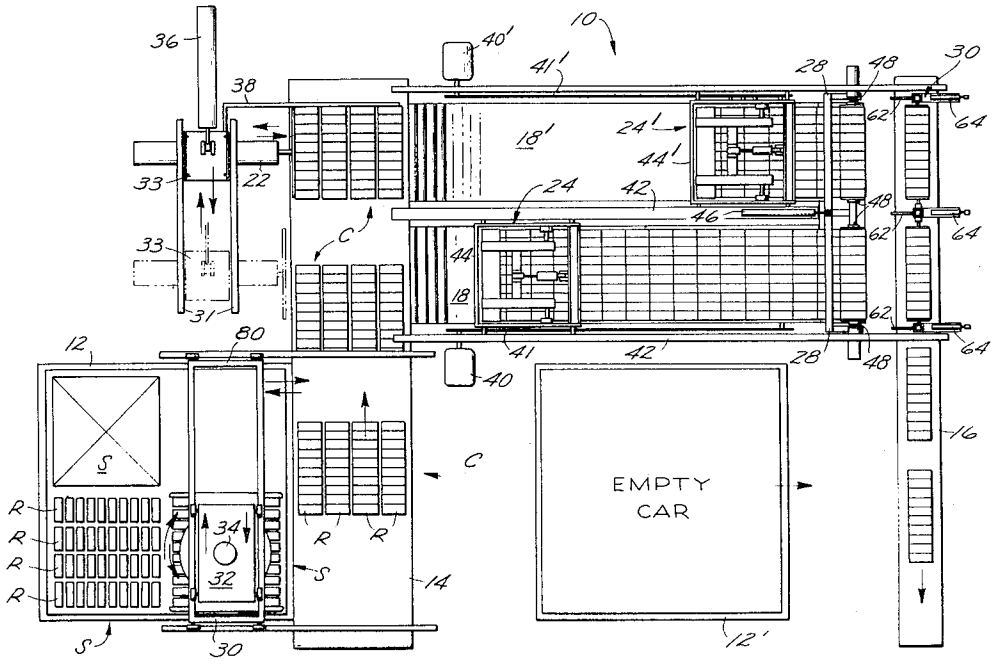
[57] **ABSTRACT**

Brick stacked in courses comprised of double-layer rows within which the face sides of the individual pairs of superposed bricks may be confronting are dehacked by sequentially removing complete successive courses from each stack, and pairing courses from the upper and lower portions of the stacks such that the respective double-layer rows thereof are in alignment. Successive double-layer rows are then removed simultaneously from each pair of courses, and the upper layer of each such unit is everted and aligned with the lower layer to form a single-layer line of bricks all having their face sides facing upwardly and alternating in row groupings between bricks from the upper portions of the stacks and bricks from the lower stack portions. The blending of the bricks eliminates marked color gradients sometimes present in the original stacks.

10 Claims, 6 Drawing Figures



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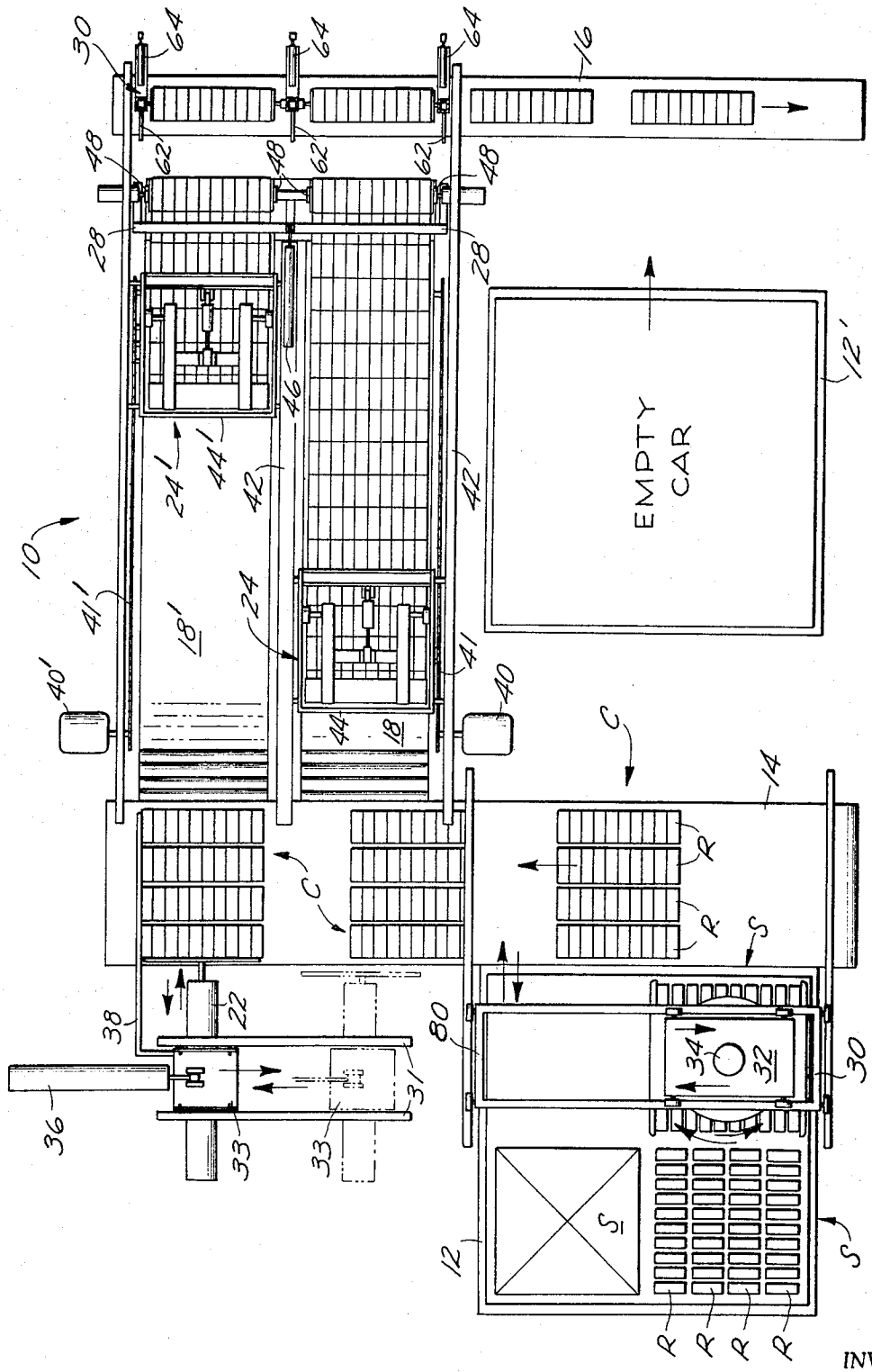

Fig. 1

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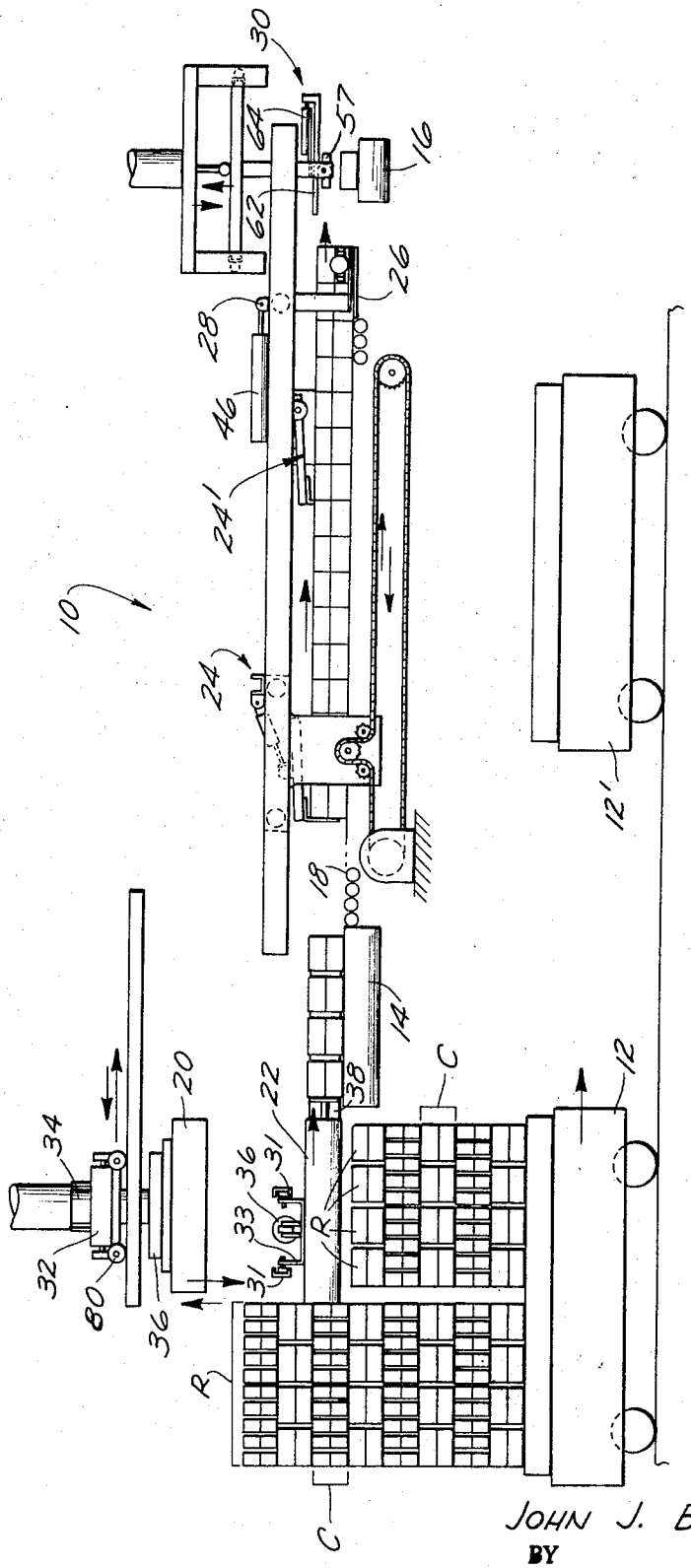

Fig. 2

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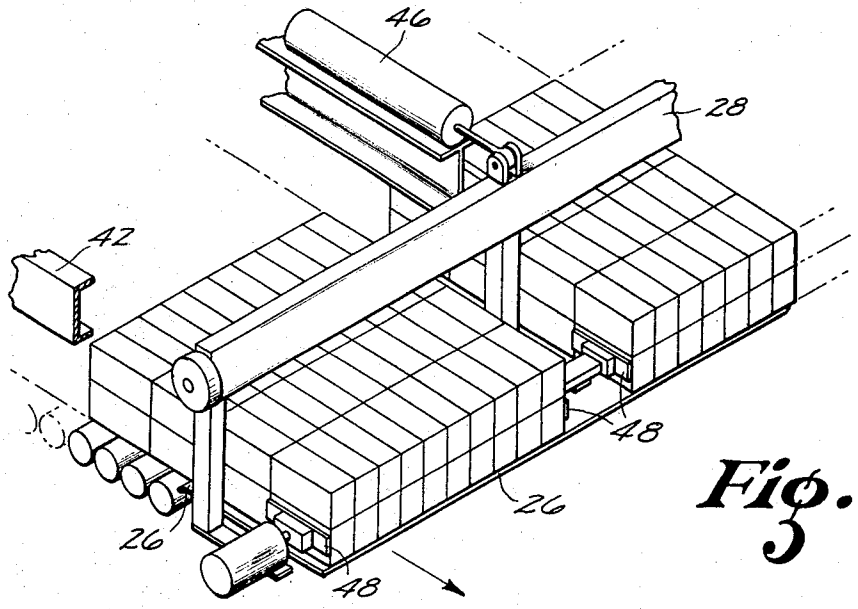

Fig. 4

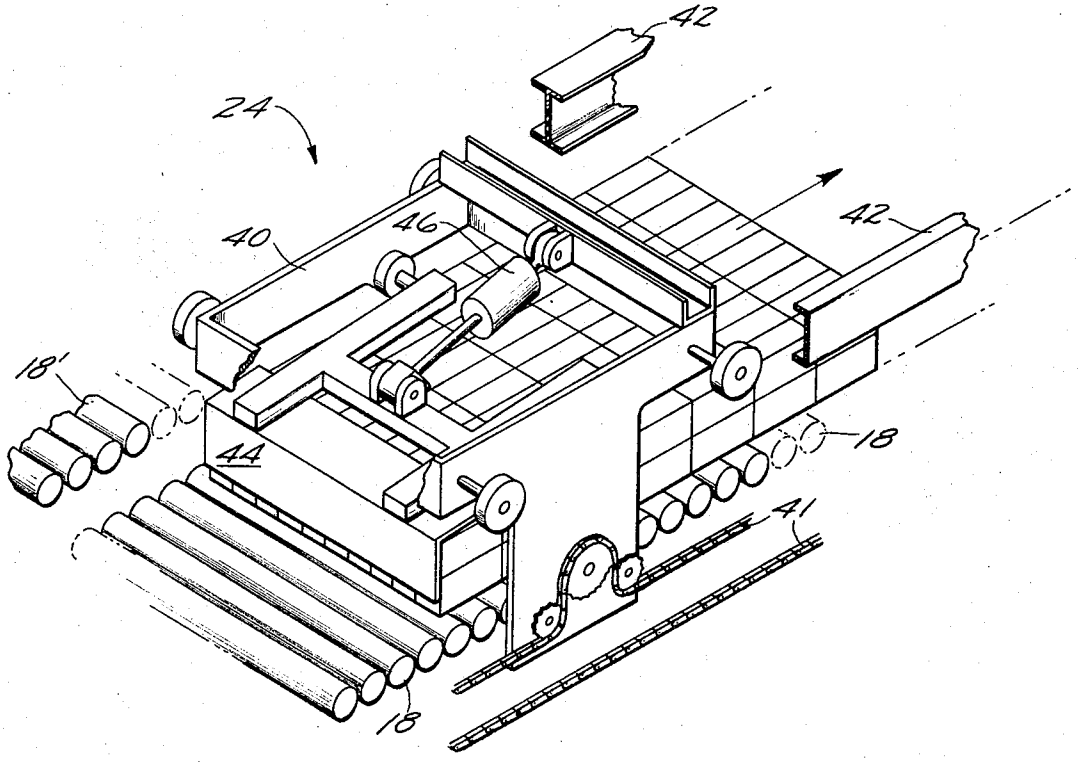

Fig. 3

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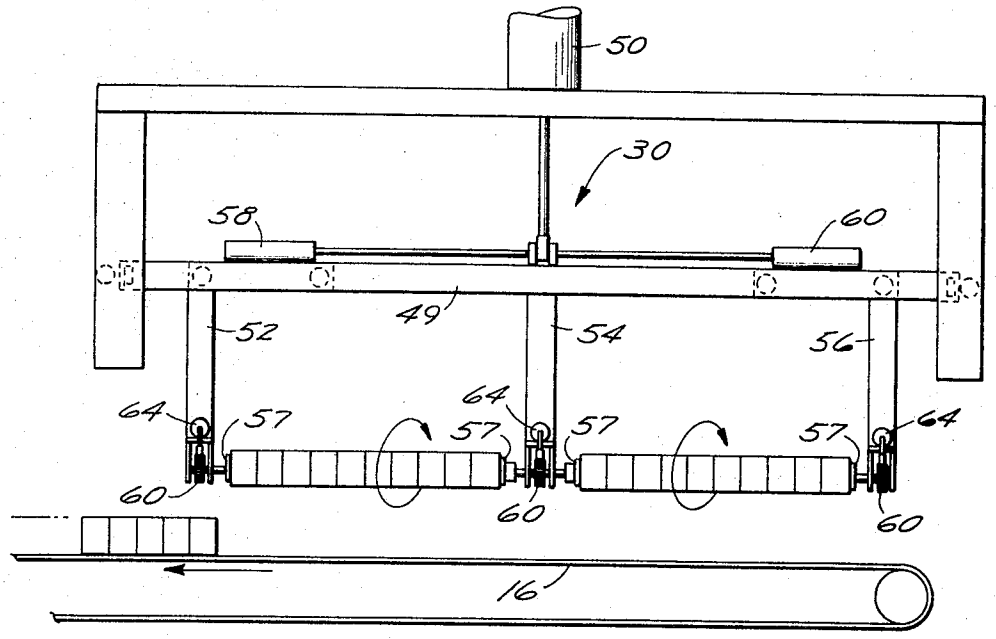

Fig. 6

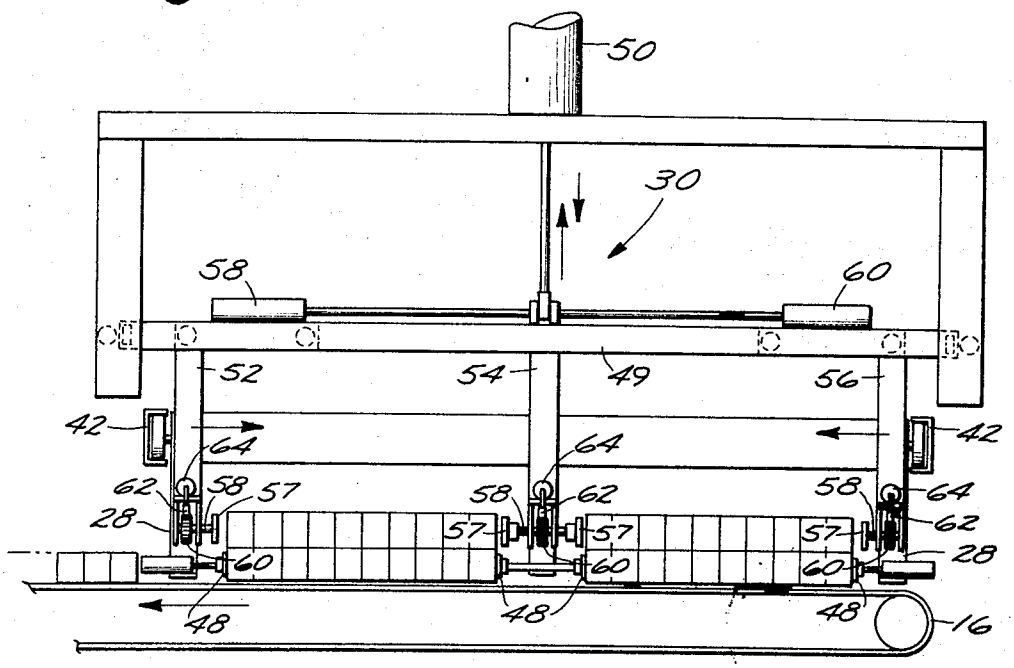

Fig. 5

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METHOD AND APPARATUS FOR DEHACKING BRICK

BACKGROUND OF THE INVENTION

This invention relates to the dehacking or unstacking of bricks, which art is typified by U.S. Pat. No. 3,487,959, and more particularly relates to an improved method and apparatus for efficiently dehacking fired brick to form a single-layer line within which bricks from the upper and lower stack portions are blended and all have their face sides facing in the same direction.

In the process of their manufacture, bricks are customarily arranged for firing purposes in open stacks upon kiln cars which are conducted through a furnace or kiln. Each stack is frequently formed of alternating header-oriented and stretcher-oriented courses having a plurality of double-layer rows therein. The bricks in the upper layer of each such row have their downward sides supported by and contiguous with the upward sides of the bricks in the bottom layer. The confronting sides protect and shield each other during the firing operation, and form the so-called "face sides" of the completed bricks. Although desirably all possessing uniform characteristics, such completed bricks will usually vary significantly in color depending upon their vertical locations in the stack during firing and flashing.

Following the firing operation, the bricks stacked as aforesaid upon the kiln cars must be dehacked preparatory to shipment and eventual use. Manual dehacking is laborious and time-consuming work, and it has therefore previously been proposed to instead employ automated methods and apparatus for such purpose. However, the suggested techniques have in most instances been inefficient or have involved the use of unduly cumbersome and/or expensive apparatus. In some instances the suggested apparatus has additionally been incapable of arranging the dehacked bricks in a single line or row wherein bricks from the upper and lower portions of the stacks are intermingled and all have their face sides extending in the same direction. Such an arrangement is highly desirable since it eliminates the need for subsequent reorientation and "blending" of the bricks preparatory to or during use.

SUMMARY OF THE INVENTION

With the foregoing in mind, the present invention provides an improved method and apparatus for efficiently and economically dehacking bricks, arranged in stacks as aforesaid, to form a single-layer row or line within which bricks from the upper and lower stack portions are blended and all have their face sides facing in the same direction. In a preferred form of the invention, each course removed from one upper or lower stack portion is paired with a course removed from the other stack portion, after being compacted in each case in the row direction, such that the double-layer rows of the paired courses are in alignment. Successive double-layer rows are then transferred simultaneously from the paired and compacted courses to a delivery conveyor. The lower layer of each such unit is deposited upon the conveyor and moved longitudinally by it, while the upper layer is everted and then deposited upon the same conveyor in longitudinal alignment with the lower layer. The bricks in the resulting single-layer line upon the conveyor alternate between row groupings of those which during firing were in the upper portion of the stacks and row groupings of those which then were in the lower portion of the stacks, and all have their face sides extending upwardly. Subsequent color-blending and/or other reorienting of the bricks is therefore not required.

Eversion of the upper layer of each double-layer row of bricks is accomplished by rotating the same about its own longitudinal axis while maintaining such axis in the same vertical plane as that containing the longitudinal axis of the lower layer of the row. This permits the operation to be rapidly performed in a small amount of space with the use of a minimum amount of power and equipment.

The apparatus of the invention is of durable and highly efficient construction, while at the same time being relatively compact and inexpensive. This is made possible in significant part by the order and manner in which the various steps of the dehacking operation are performed. By progressively acting upon units of courses, double-layer rows and then single-layer rows of brick, and by performing upon each of such units only the maximum number of operational steps commensurate with low-cost and efficient construction of the unit-handling component in question, the present apparatus overcomes many of the various deficiencies associated with dehacking apparatus heretofore proposed.

The foregoing and other features and advantages of the invention will be more apparent from the following description of a preferred embodiment thereof, which should be read in conjunction with the accompanying drawings, in which:

FIG. **1** is a partially schematic top plan view of apparatus embodying and suitable for practice of the invention, some of the upper right-hand components being broken away for clarity;

FIG. **2** is a side elevational view of the apparatus of FIG. **1**;

FIG. **3** is an enlarged perspective view of one of the pusher assemblies of the apparatus;

FIG. **4** is an enlarged fragmentary perspective view of one of the clamping assemblies of the apparatus; and

FIGS. **5** and **6** are enlarged elevational and sequential views of another clamping assembly and adjacent components of the apparatus, illustrating sequential steps in the operation thereof.

In FIGS. **1** and **2** of the drawings, the numerals **10** and **12** respectively designate the dehacking apparatus in its entirety and a kiln car having fired bricks conventionally arranged thereon in a plurality of stacks S each comprised of a plurality of alternating header-oriented and stretcher-oriented courses C formed of a plurality of laterally spaced and double-layer rows R. In each row R the horizontally adjacent bricks are spaced from each other while the vertically adjacent bricks have their face sides confronting and in coextensive engagement, the bricks having been so arranged for firing purposes. While the numbers may vary in any given case, the drawings show a conventional stacking arrangement in which there are eight courses C in each stack S, four double-layer rows R in each course C, and 20 bricks (10 in each layer) in each double-layer row R.

In accordance with the present invention, successive courses C are removed one at a time from each stack S and, following planar reorientation of alternate ones and longitudinal compacting of the rows R in each, the four courses C from the upper portion of the stack S are loaded in succession upon a first transfer conveyor and the four courses C from the lower stack portion are loaded upon a second transfer conveyor. The transfer conveyors extend in parallel and closely adjacent relationship to each other and the double-layer rows R of the courses upon one conveyor are aligned with the rows R upon the other conveyor as the rows are moved longitudinally of the conveyors to a discharge platform at one end thereof. Each pair of aligned double-layer rows R reaching the discharge platform is transported therefrom, as a single double-layer unit, to a position wherein it overlies and extends parallel to a delivery conveyor. The lower layer of each such unit is deposited upon and moved longitudinally of the conveyor, while the upper layer is first rotated 180° about its longitudinal axis and then deposited upon the same conveyor in alignment with the lower layer. In the resulting single-layer line of bricks conveyed from the apparatus, the bricks alternate in row groupings of those from the upper and lower stack portions and all have their face sides facing upwardly.

For performing the foregoing and related functions, apparatus **10** generally includes an input or feed conveyor **14** and an output or delivery conveyor **16**, both of the endless-apron type; two transfer conveyors **18**, **18'**, both of the dead-roller type, which extend in laterally adjacent and parallel relationship to each other between and at right angles to con-

veyors 14, 16; car unloading means including a course-gripping head 20; means including a hydraulic ram 22 for loading courses C deposited upon input conveyor 14 by head 20 onto one or the other of conveyors 18, 18'; two pusher assemblies 24, 24' for moving the courses loaded by ram 22 onto conveyors 18, 18', respectively, longitudinally thereof toward a discharge platform 26 at one end thereof; and two row-clamping assemblies 28, 30 which are sequentially engageable with the bricks deposited on platform 26 and thereafter on delivery conveyor 16.

Loaded kiln cars supporting stacks S of fired bricks are moved along conventional tracks (not shown) to an unloading station, occupied in the drawings by the car 12, adjacent head 20 and input conveyor 14. The car is halted while the two stacks closest to conveyor 14 are removed therefrom, and then is indexed forwardly for one-half of its length, passing beneath conveyor 14. After unloading of the remaining two stacks S, the empty car is moved further forward, in the direction of the previously emptied car 12', and passes eventually from apparatus 10 beneath delivery conveyor 16.

Head member 20 is mounted for multidirectional movement above a car 12 at the unloading station by means of first and second wheeled carriages 80, 32, a vertically movable shaft 34 depending from carriage 32, and a pivotally movable frame 36 interconnecting the lower end of shaft 34 and head 20. Carriages 80, 32 permit horizontal translatory movement of head 20 in two directions, while shaft 34 and frame 36 permit translatory vertical movement and horizontal pivotal movement thereof, respectively, the latter being through an arc of at least 90°. In unloading a car 12, head 20 is lowered onto the uppermost course C of a stack S and grippers (not shown) therewithin grip the course and compact the rows R thereof in the direction of their length (the width direction of the individual bricks). Head 20 is then raised, moved to a position closely above conveyor 14, and caused to release the compacted course C upon the conveyor. While transporting alternate courses C between car 12 and conveyor 14, head 20 pivots 90° in a horizontal plane so that each course deposited upon the conveyor has its rows R extending in the length direction of the conveyor, notwithstanding the alternating header-stretcher orientation of the courses C within the stacks S. After unloading the uppermost course C from a stack S, head 20 similarly unloads the remaining three courses in the upper portion of the same stack and then the four courses in the lower stack portion, one course at a time and working from top to bottom, before moving to and commencing the unloading of another stack upon car 12.

Each compacted course C deposited by head 20 upon conveyor 14 is moved by such conveyor longitudinally thereof, in the direction indicated by the arrow in FIG. 1, to its opposite end portion. Roller conveyors 18, 18' extend from one side of such end portion of conveyor 14, while on the opposite side thereof rails 31 mount a wheeled carriage 33 for reciprocating movement, under the impetus of a piston and cylinder assembly 36, parallel to conveyor 14 between the solid-line and phantom-line positions shown in FIG. 1. Carriage 33 mounts ram 22 and a stop plate 38 which extends above and across conveyor 14 for engagement with each course C transported thereto by the conveyor. Carriage 33 remains in its full-line position while four courses C from the top portion of a stack S engage stop plate 38. As each such course engages plate 38, actuation of ram 22 moves the same from conveyor 14 onto roller conveyor 18'. Carriage 33 then is moved by cylinder 36 to its phantom-line position, so that the next four courses C — from the bottom portion of a stack S — will similarly be moved by ram 22 onto roller conveyor 18. Reciprocation of carriage 33, at four-course intervals, continues throughout the operation of apparatus 10, with the result that all courses C from the upper portions of the stacks S are loaded upon conveyor 18', while all courses C from the lower stack portions are received by conveyor 18.

Identical pusher assemblies 24, 24' mounted respectively above conveyors 18, 18' move the courses deposited thereon along the conveyors toward discharge platform 26, and in so doing bring the double-layer rows R of the courses C upon one of the conveyors into longitudinal alignment with the course-rows R upon the other conveyor. As is best shown in FIG. 3, assembly 24 includes a wheeled carriage 40 mounted by rails 41 above conveyor 18 for bi-directional movement longitudinally thereof under the impetus of a suitable reversible drive mechanism such as that including the motor 40 and chain 42 shown in the drawings. A pusher plate 44 pivotally mounted by carriage 40 is movable by a piston and cylinder assembly 46 between a lowered operative position, which it occupies while assembly 24 moves during each cycle of operation toward discharge platform 26 (from left to right as viewed in the drawings), and a raised inoperative position which plate 44 occupies during return leftward movement of assembly 24, away from platform 26 and back to the starting position occupied by it in FIGS. 1 and 2.

Assembly 24 returns to its starting position and plate 44 pivots downwardly after each four courses have been loaded by ram 22 onto conveyor 18. The trailing row R of such courses is engaged by plate 44 upon rightward movement of assembly 24, causing all of the courses then upon conveyor 18 to first be brought into engagement and then to move unitarily with each other and assembly 24 toward platform 26. As such movement transpires, the identical pusher assembly 24' associated with conveyor 18' similarly moves courses C previously loaded upon that conveyor toward platform 26. Assemblies 24, 24' are driven in out-of-phase relationship to each other so that ram 22 is at all times free to load additional courses C upon the appropriate one of the conveyors 18, 18'. Thus, when assembly 24 is just commencing its rightward stroke, assembly 24' has moved sufficiently from ram 22 to permit the same to begin loading four additional courses C upon conveyor 18', as is shown in the drawing. When that loading operation has been completed, assembly 24 will have moved sufficiently far along its rightward stroke for ram 22 to immediately commence loading of the next four courses C onto conveyor 18. The unloading of courses C from kiln car 12 therefore can and does progress on a substantially continuous basis during operation of apparatus 10.

Each pair of aligned double-layer rows R passing from conveyors 18, 18' onto platform 26 is moved horizontally therefrom by clamping assembly 28, which comprises (see FIG. 4) a wheeled frame movable by a piston and cylinder 46 along extensions of rails 42 toward delivery conveyor 16. Extendable and retractable clamping elements 48 of assembly 26 clampingly engage the end bricks in the lower layer of the two-row unit of bricks upon platform 26, and extension of cylinder 46 then moves assembly 28 forwardly to a position wherein the brick unit is suspended slightly above and in parallel relationship to delivery conveyor 16. This also places the end bricks in the upper layer of the unit between four clamping elements 57 of the second clamping assembly 30.

As is best shown in FIGS. 5 and 6, assembly 30 comprises a wheeled frame 49 mounted for linear vertical movement, impartable to it by a piston and cylinder assembly 50, above and relative to conveyor 16. Depending from frame 49, for vertical movement with it, are three support members 52, 54, 56, the outer members 52, 56 being wheel-mounted at their upper ends for horizontal movement toward and away from each other and the center member 54 upon actuation of piston and cylinder assemblies 58, 60. At the lower ends of members 52, 54, 56 the clamping elements 57 of assembly 30 are mounted in longitudinal alignment with each other for rotary movement through 180° about their central axes. Each element 48 is mounted upon a shaft 58 carrying a gear 60 meshing with a rack 62 movable by a piston and cylinder assembly 64. The shaft 58 carried by member 54 supports two clamping elements 57, one on each side of member 54, while the shafts 58 carried by the outer members 52, 56 each only mount a single element 57.

As has been previously discussed, and as is best apparent from FIG. 5, the movement by clamping assembly 28 of each

double-layer unit of bricks to a position slightly above delivery conveyor **16** places the bricks of the upper layers of such unit between clamping elements **57** of assembly **30**, which are then moved into gripping engagement therewith by retraction of piston and cylinder assemblies **58, 60**. Clamping assembly **28** then releases the bricks of the lower layers of the unit onto conveyor **16**, which moves the same longitudinally as cylinder **46** returns assembly **28** back to platform **26**. As the foregoing transpires, cylinder **50** slightly raises assembly **30** and the upper layers of bricks gripped by its elements **57**. Cylinders **64** then rotate axes **57** and the bricks 180° about their central axis (FIG. **6**), through racks **62**, gears **60** and shafts **58**. Cylinder **50** lowers assembly **30** toward conveyor **16**, holds while cylinders **58, 60** are activated to release the now-everted bricks thereon, and then returns assembly **30** to its FIG. **5** position for another cycle of operation.

The bricks deposited as aforesaid upon conveyor **16** extend in single-layer alignment with those previously and subsequently deposited upon the conveyor, and all have their face sides facing upwardly. It will also be apparent that the line of bricks moved from apparatus **10** by conveyor **16** is comprised of alternating groupings, each grouping being defined by a row of ten bricks, from the upper and lower portions of the stacks S. Subsequent reorientation or blending of the bricks, preparatory to their shipment and use, is therefore not required.

While a preferred embodiment of the invention has been specifically shown and described, this was for purposes of illustration only, and not for purposes of limitation, the scope of the invention being in accordance with the following claims.

That which is claimed is:

1. A method of dehacking bricks arranged in stacks each having in its upper and lower portions a plurality of courses comprised of a plurality of double-layer rows of bricks, the bricks in the upper layer of each double-layer row having downwardly facing face sides engaging upwardly facing face sides of the bricks in the lower layer of the row, comprising the steps of:

removing successive courses from the stacks;

pairing each course removed from each one of the stack portions with a course removed from the other of the stack portions such that the double-layer rows of each of the paired courses are in longitudinal alignment;

separating successive aligned double-layer rows, as individual double-layer units, from the paired courses;

everting one of the layers of each separated double-layer unit and longitudinally aligning the everted layer and the other layer of the unit to form a single-layer line of row-blended bricks each having their face sides extending in the same direction.

2. A method as in claim **1**, wherein the stacks have alternating header-oriented and stretcher-oriented courses, and further including changing the orientation of alternate ones of the courses removed from the stacks to the orientation of the other courses before pairing thereof.

3. A method as in claim **1**, and further including compacting each course in the row direction during removal thereof from a stack.

4. A method as in claim **1**, wherein the step of pairing the courses includes directing all those from upper stack portions along a first path of travel and directing all those from lower stack portions along a second path of travel disposed parallel to and closely said first path.

5. A method as in claim **1**, wherein the steps of everting and aligning include raising the upper layer of each separated double-layer unit out of engagement with the lower layer thereof, rotating the raised upper layer approximately 180° about an axis extending longitudinally therethrough, moving the lower layer longitudinally from beneath the vertical projection of the raised upper layer, and lowering the upper layer into a position of longituidinal alignment with the lower layer.

6. Apparatus for dehacking bricks arranged in stacks each having in its upper and lower portions a plurality of courses comprised of a plurality of double-layer rows of bricks, the bricks in the upper layer of each double-layer row having downwardly facing face sides engaging upwardly facing face sides of the bricks in the lower layer of the row, comprising:

means for removing successive courses from the stacks;

means for pairing each course removed from each one of the stack portions with a course removed from the other of the stack portions such that the double-layer rows of each of the paired courses are in longitudinal alignment;

means for separating successive aligned double-layer rows, as individual double-layer units, from the paired courses;

and means for everting one of the layers of each separated double-layer unit and longitudinally aligning the everted layer and the other layer of the unit to form a single-layer line of row-blended bricks each having their face sides extending in the same direction.

7. Apparatus as in claim **6**, wherein said pairing means includes first and second elongate course-supporting means extending in laterally adjacent and parallel relationship to each other, means for loading courses from the upper stack portions onto one of said supporting means and courses from the lower stack portions onto the other of said supporting means, first and second pusher members movable independently and in out of phase relationship relative to each other longitudinally of said first and second supporting means respectively for moving courses supported thereby away from said loading means and toward said everting and aligning means.

8. Apparatus as in claim **7**, wherein said course supporting means comprises first and second roller conveyors, and said loading means includes a ram assembly translatorily movable adjacent one end of said roller conveyors to alternative positions of alignment therewith for loading courses thereon.

9. Apparatus as in claim **6**, wherein said everting and aligning means includes a clamp assembly adapted to engage end portions of said one layer of each double-layer unit of bricks, and means mounting said clamp assembly for linear translatory movement in a vertical direction and for rotational movement about an axis translatorily movable therewith.

10. Apparatus as in claim **9**, wherein said everting and aligning means further includes a delivery conveyor adapted to support said line of row-blended bricks, said clamp assembly being mounted for said movement thereof above said delivery conveyor.

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