

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Apparatus for Transporting Articles

We, REDLAND TILES LIMITED, a British Company, of Castle Gate, Reigate, Surrey and ARTHUR HAROLD HARRIS, a British Subject, of 9, Heathcote Drive, East Grinstead, Sussex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 The invention relates to apparatus for transporting articles, and is more particularly, but not exclusively, concerned with apparatus for transporting tiles from a production line to an oven or kiln in batches for curing.

15 The invention provides apparatus for loading and unloading a rack for articles, especially tiles or pallets carrying tiles, which rack has supports for the articles arranged one below the other, the apparatus comprising a first horizontal article conveyor for leading articles to a loading and unloading station, a second horizontal article conveyor aligned with the first conveyor for leading articles from the loading and unloading station, a loading conveyor extending transversely to the horizontal conveyors for leading a rack to a position from which it is lowered through the loading and unloading station, moving apparatus for moving the rack stepwise through the loading and unloading station, and an unloading conveyor below the loading conveyor for receiving the rack which has passed through the loading and unloading station and conveying it away from the apparatus.

35 Preferably the first and/or second article conveyor is/are a belt or like conveyor. The loading and/or the unloading conveyors is/are preferably a gravity conveyor.

40 Preferably the moving apparatus is arranged to lower the rack through the loading and unloading station.

Preferably there is also provided a counter,

preferably located under the first article conveyor, arranged to control the moving apparatus to move the rack through one step when a determining number of articles are moved on to the rack.

Preferably means is provided for preventing movement of articles into the loading and unloading station when the rack is being moved by the moving apparatus.

One embodiment of the invention will now be described by way of example and with reference to the drawings accompanying the provisional specification, in which:—

Figure 1 is a front elevation of a crate for supporting tiles;

Figure 2 is a plan of the crate;

Figure 3 is an end elevation of the crate;

Figure 4 is a front elevation of the apparatus;

Figure 5 is a plan of the apparatus;

Figure 6 is an elevation of part of the apparatus;

Figure 7 is an end elevation of the part shown in Figure 6;

Figure 8 shows, diagrammatically, the electric circuit of the apparatus; and

Figure 9 shows, diagrammatically, the pneumatic circuit of the apparatus.

The apparatus is intended for use in the manufacture of roofing tiles and each tile is supported throughout its passage through the apparatus on a pallet 11 and batches of pallets are supported by receptacles or crates 12. Each crate 12 comprises three pairs of upright channel members 13 which support between them a series of racks 14, each of which comprises two parallel L-section members 15. The members 15 extend along the length of the crate. Pallets 11 can rest between the horizontal parts of the L-section members 15, being supported as shown in Figure 4. Each crate 12 is provided at each end with two pairs of rods 16, a pair being supported by

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a channel member 13 on each side of the crate. In each pair, one rod is parallel to and above the other. Each pair of rods 16 is situated slightly more than half-way below the top of the crate 12 and each pair passes through a casting 17 accommodated in the channel member 13 carrying the rods 16.

Crates 12, containing tiles which have been "cured" approach the device on an upper roller conveyor 20, which comprises parallel horizontal members 21 in which are journaled upright rollers 22. When the crates 12 reach the apparatus they are correctly positioned and steadied by horizontal rollers 23 journaled in horizontal members 24, there being horizontal rollers 23 to engage a crate at each of its ends.

A succession of fresh (i.e. "uncured") tiles each supported by a pallet 11, approaches the apparatus from a tile making machine (not shown) in a path on a conveyor belt 30 (see Figure 6). Each pallet 11 as it leaves the conveyor belt 30 runs onto a runway comprising two parallel stationary flanges 31, which extend from the end of the conveyor belt 30 towards, and at the same level as, the uppermost racks of a crate 12, which is brought into position at the end of the flanges 31 remote from the conveyor belt 30 by means to be described subsequently. The conveyor belt 30 is driven by an electric motor 32, by means of sprockets 33, 34 and a sprocket chain 35 (see Figure 7). Pallets 11 on the conveyor belt 30 push pallets, already on the flange 31 of the runway, towards the crate 12. Each pallet 11 is integral with an interrupting piece 36 which engages an upright toothed wheel or counter sprocket 37, as the pallet 11 passes over the toothed wheel and rotates it by one tooth. The wheel 37 is mounted on a horizontal counter shaft 38 extending between the flanges 31. One end of the shaft 38 carries a switch-actuator 39 which actuates a switch 40, twice in every revolution of the wheel 37. Thus, pallets 11 are transported from the conveyor belt 30, along the flanges 31 of the runway and into a rack of a waiting crate 12. Each pallet bearing a fresh tile pushes a pallet bearing a cured tile out of the crate and ejects it onto another conveyor belt (not shown). The passage of sufficient pallets 11 over the wheel 37 to fill the first rack 13 of the crate 12 ensures that the switch 40 is actuated by the switch-actuator 39. This stops the conveyor belt driving motor 32 and it will be noted that, although sufficient pallets 11 to fill a rack pass over the wheel 37, the passage over the wheel 37 of the last pallet for that rack causes the switch actuator 39 to stop the motor 32 driving the conveyor belt 30. Thus the last pallet is not pushed by pallets behind it onto the rack. However, switch 40, on

being actuated, also starts an electric motor 55 which is provided, on its output shaft 56, with a sprocket-wheel 57. This drives a sprocket-wheel 58 by means of an endless sprocket-chain 59. The sprocket-wheel 58 is keyed to a vertical shaft 60, which also carries, adjacent the sprocket-wheel 58, a crank 61 which is also keyed to the shaft 60. The crank 61 is connected by a connecting rod 62 to a push-rod 63, which has a rectangular cross-section and is supported for horizontal movements, slightly below the flanges 31 of the runway between two pairs of horizontal wheels 64 each of which is formed with a circumferential V-section groove. The sides of the V-section are substantially at right angles and so conveniently receive two sides of the push-rod 63 which is arranged with its longitudinal faces inclined at substantially 45° to the vertical. The wheels 64 are freely rotatable on stub axles 65 carried by cross-members 66 supported by the underside of the girders constituting the flanges 31.

The end of the push-rod 63 adjacent to the crate being filled is provided with two parallel upwardly extending trunnions 67. A trip-catch 68 is pivotally supported between the trunnions 67 on a bolt 69 which passes through them at their upper ends. The trip-catch 68 is pivoted at a point slightly above its centre of gravity so that, when free to do so, it assumes an upright position with its upper end 70 only slightly above the upper sides of the flanges 31 on the runway. Thus, as pallets 11 pass along the runway, their interrupting pieces 36 depress the end 70 of the trip-catch which afterwards swings back upwardly behind each interrupting piece. When the motor 32 driving the conveyor belt 30 stops, the last pallet for a rack of a crate is in such a position on the runway that the end 70 of the trip-catch is behind the interrupting piece 36 of that pallet. Thus, when the push-rod 63 is moved towards the crate by the connecting rod 62 and crank 61 the pallet is pushed onto the rack. The trip-catch 68 is prevented from turning past its upright position during this by a cross-piece 71, provided on the lower end of the trip-catch 68, which cross-piece cannot pass between the trunnions 67. After the last pallet has been pushed onto the rack, the crank 61 continues to turn in the same direction and withdraws the push-rod 63 to its original position. The lower end of the shaft 60 carries a horizontal radial arm 120, which is provided at its free end with a projection 102 for actuating two switches 103, 104 in turn as the shaft 60 turns. The switch 103 is actuated during the early part of the second half revolution of the shaft 60, that is, while the push-rod 63 is returning. The switch 104 is actuated during the later part of the second half revolution of the shaft 60 and



stops the motor 55. Actuation of the switch 103 starts another electric motor 41 (see Figures 4 and 5) which drives a gear-box 42 (by means not shown). The gear-box 42 drives a main shaft 43 by means of a chain 44, which passes around a wheel 45, on the output shaft of the gear-box 42, and a wheel 46 keyed to the main shaft 43. The chain 44 is kept at the correct tension by means of a jockey-wheel 47. The main shaft 43 also carries a switch-actuator in the form of a pin-wheel 48.

Two chain-wheels 49 are also keyed to the main shaft 43. An endless chain 40 passes around each chain-wheel 49 and around a co-operating chain-wheel 51 mounted on a shaft 52 below the main shaft 43. Each chain 50 is provided with dogs 53, and successive pairs of co-operating dogs (one on each chain) support successive crates 12 on the endless chains.

After a crate leaves the upper roller conveyor 20, it is supported on the top of a crate which is already being supported by a pair of dogs 53 on the endless chains 50. As the crates descend, the next pair of dogs 53 move around the upper chain-wheels 49 into position below the castings 16 to support the upper crate which has just left the upper roller conveyor 20. Crates are held against the chains by an upright row of rollers 95 and, below them, a skid 96.

The motor 41 continues to rotate the main shaft 43 until the crate being filled has been lowered sufficiently to bring the next rack opposite the ends of the flanges 31 of the runway. The pin-wheel 48, simultaneously, turns with the main-shaft 43 until a pin on the pin-wheel actuates a switch 54 just as the next rack reaches its position to be filled. The switch 54, on being actuated, stops the motor 41 (driving the main shaft 43) and re-starts the motor 32 (driving the conveyor belt 30). Thus, the next rack of the crate is filled as already explained.

As a crate is filled with fresh tiles it is lowered (in steps) by the endless chains 50 as each rack is filled and by the time a crate is full it has reached a lower roller conveyor 80 which comprises horizontal members 81, in which are journaled upright rollers 82a.

On reaching the lower-roller conveyor 80, the crate depresses one end 81 of a tilting lever 82 which is pivoted at 83. The other end 84 of the lever 82 rises and in so doing operates a pilot air valve 85 which, in turn, pneumatically operates an air valve 98. This admits air from a supply inlet 99 into a cylinder 86 to operate a piston 87 in the cylinder which pushes the crate off the dogs 53 on to the lower roller conveyor 80. The lever 82 then returns to its original position under the action of a spring 100, thus closing the pilot valve 85. A renewable grid 101

is provided on the end 81 of the lever 82.

The pilot valve 85 also pneumatically operates two air valves 97 which admit air to two cylinders 88 to operate pistons 89 each of which is provided with a tapered head 90. The end of each head 90 remote from the tapered part terminates in a shoulder 91 which engages with the rods 15 on either end of a crate and the pistons 89 pull the next crate off the upper roller conveyor 20 on to the dogs 53 supported by the endless chains 50. The crate pushes in a buffer 106, centrally situated between the pistons 89, which operates a pilot valve 105. The pilot valve 105 pneumatically operates the two air valves 97. These admit air to the cylinders 88 to restore the pistons 89 to their fully extended positions in which the tapered parts of the heads 90 ride over the rods 15 of a crate as it approaches, the cylinders 88 meanwhile pivoting about pivots 93.

The pilot valve 105 also pneumatically operates the air valve 98 to admit air to the cylinder 86 to restore the piston 87 to its retracted position. A pneumatic shock-absorber 119 is provided for the lever 82.

The sequencing arrangement is pneumatic but it may equally well be hydraulic.

WHAT WE CLAIM IS:—

1. Apparatus for loading and unloading a rack for articles, especially tiles or pallets carrying tiles, which rack has supports for the articles arranged one below the other, the apparatus comprising a first horizontal article conveyor for leading articles to a loading and unloading station, a second horizontal article conveyor aligned with the first conveyor for leading articles from the loading and unloading station, a loading conveyor extending transversely to the horizontal conveyors for leading a rack to a position from which it is lowered through the loading and unloading station, moving apparatus for moving the rack stepwise through the loading and unloading station, and an unloading conveyor below the loading conveyor for receiving the rack which has passed through the loading and unloading station and conveying it away from the apparatus.

2. Apparatus as claimed in Claim 1 wherein the first article conveyor is a belt or like conveyor.

3. Apparatus as claimed in Claim 1 or Claim 2 wherein the second article conveyor is a belt or like conveyor.

4. Apparatus as claimed in any one of the preceding claims wherein the loading conveyor is a gravity conveyor.

5. Apparatus as claimed in any one of the preceding claims wherein the unloading conveyor is a gravity conveyor.

6. Apparatus as claimed in any one of the preceding claims wherein the moving apparatus is arranged to lower the rack through the loading and unloading station.



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WHAT WE CLAIM IS:—

1. Apparatus for loading and unloading a rack for articles, especially tiles or pallets carrying tiles, which rack has supports for the articles arranged one below the other, the apparatus comprising a first horizontal article conveyor for leading articles to a loading and unloading station, a second horizontal article conveyor aligned with the first conveyor for leading articles from the loading and unloading station, a loading conveyor extending transversely to the horizontal conveyors for leading a rack to a position from which it is lowered through the loading and unloading station, moving apparatus for moving the rack stepwise through the loading and unloading station, and an unloading conveyor below the loading conveyor for receiving the rack which has passed through the loading and unloading station and conveying it away from the apparatus.

2. Apparatus as claimed in Claim 1 wherein the first article conveyor is a belt or like conveyor.

3. Apparatus as claimed in Claim 1 or Claim 2 wherein the second article conveyor is a belt or like conveyor.

4. Apparatus as claimed in any one of the preceding claims wherein the loading conveyor is a gravity conveyor.

5. Apparatus as claimed in any one of the preceding claims wherein the unloading conveyor is a gravity conveyor.

6. Apparatus as claimed in any one of the preceding claims wherein the moving apparatus is arranged to lower the rack through the loading and unloading station.



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- 5 7. Apparatus as claimed in any one of the preceding claims further comprising a counter arranged to control the moving apparatus to move the rack through one step when a determining number of articles are moved off to the rack.
8. Apparatus as claimed in Claim 6 wherein the counter is located under the first article conveyor.
- 10 9. Apparatus as claimed in any one of the preceding claims wherein means is provided for preventing movement of articles into

the loading and unloading station when the rack is being moved by the moving apparatus.

10. Apparatus substantially as hereinbefore described with reference to and as illustrated in the drawings accompanying the provisional specification.

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