Jan. 30, 1968 U. WALCHHÜTER 3,366,253

DEVICE TO PILE UP AND TO COUNT TILES

Filed March 31, 1964 3 Sheets-Sheet 1

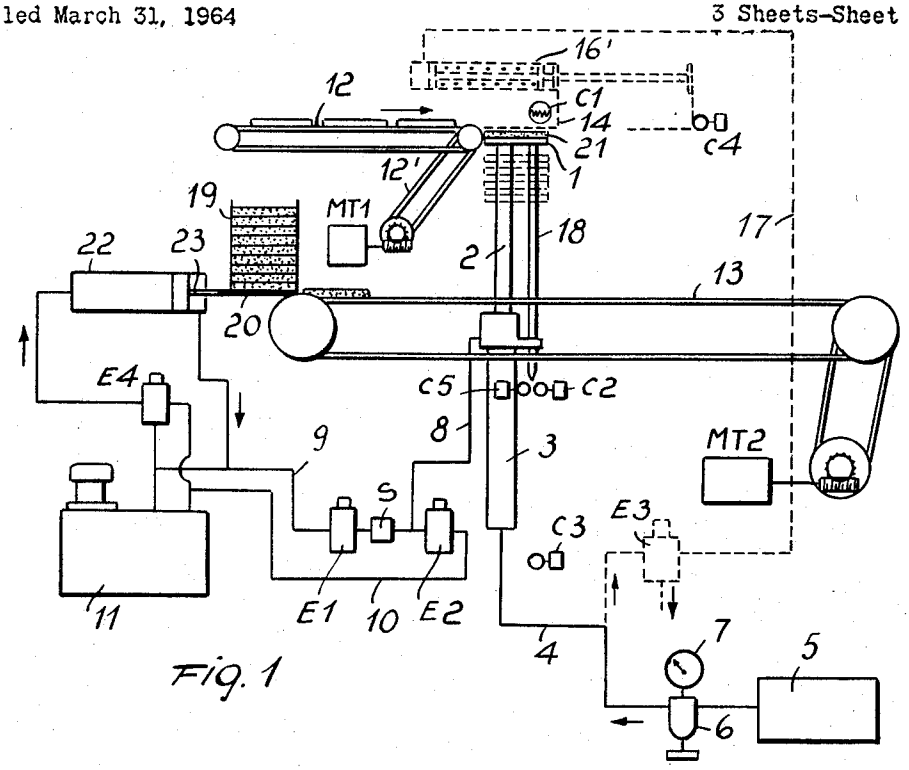


Fig. 1

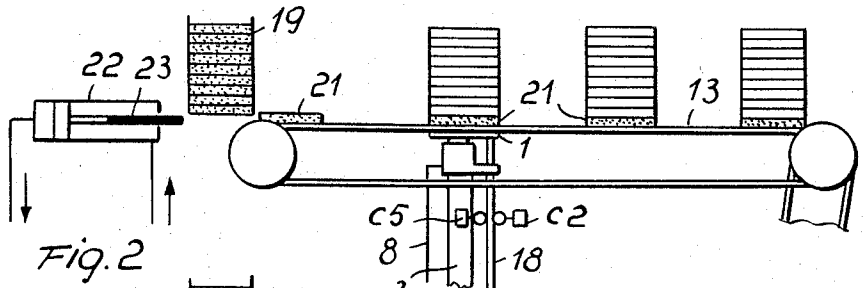


Fig. 2

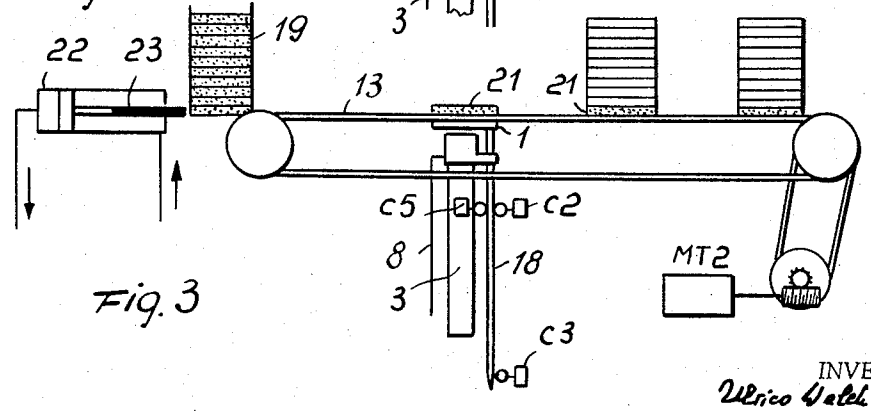


Fig. 3

INVENTOR
Ulrico Walchhütter

BY
Michael J. Striker
ATTORNEY

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DEVICE TO PILE UP AND TO COUNT TILES

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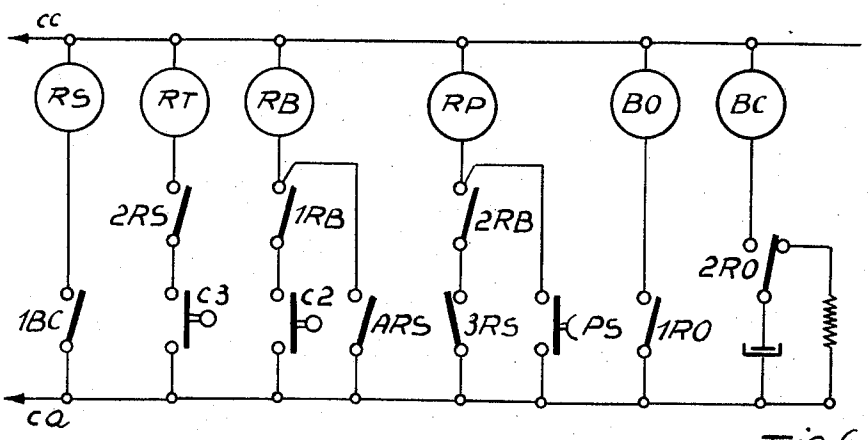


Fig. 6

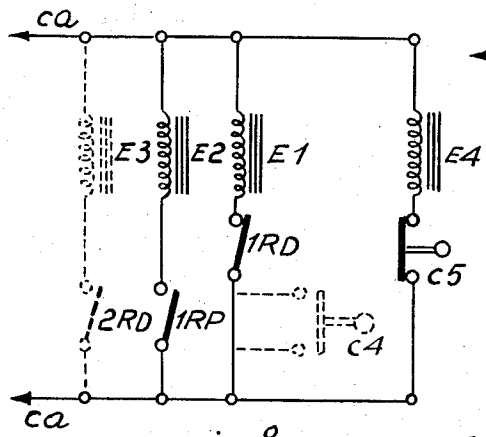


Fig. 8

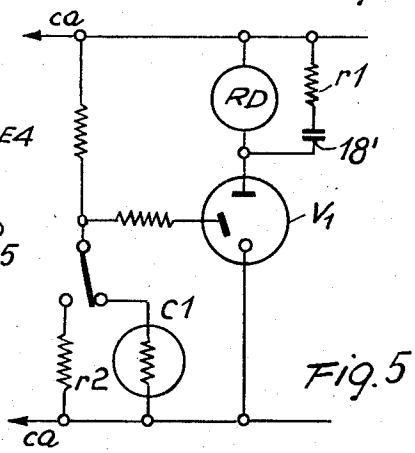


Fig. 5

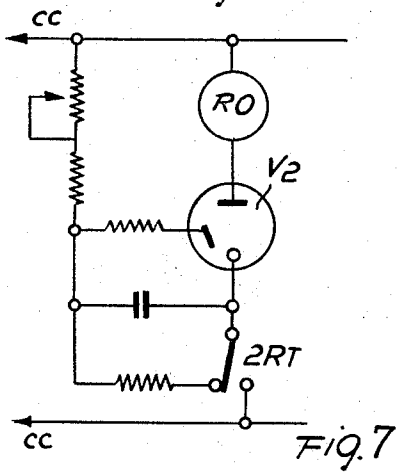


Fig. 7

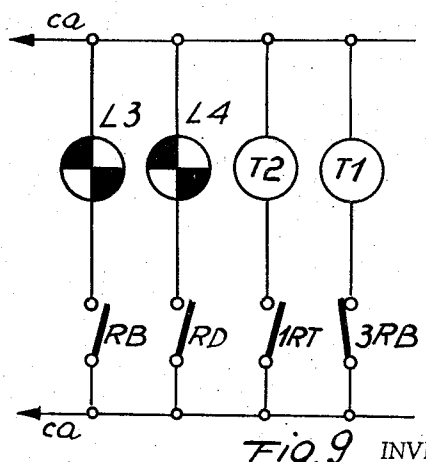


Fig. 9

INVENTOR
Ulrich Walchhütter

BY

Michael J. Striker
ATTORNEY

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DEVICE TO PILE UP AND TO COUNT TILES

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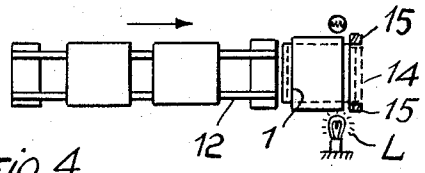


Fig. 4

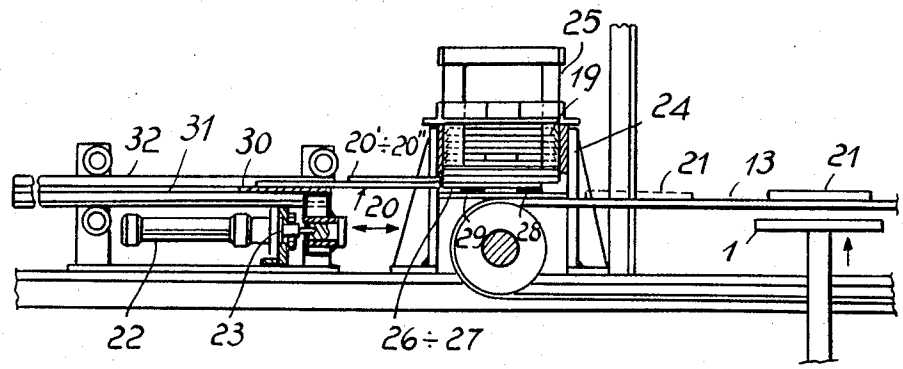


Fig. 10

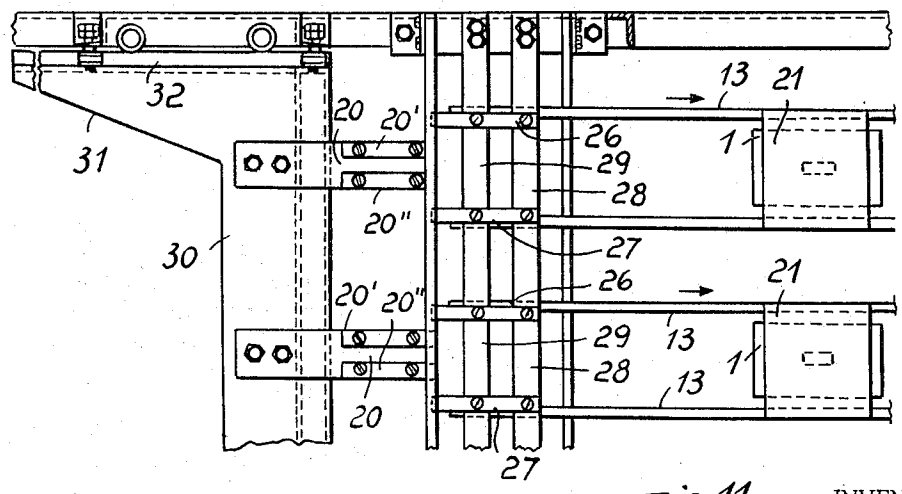


Fig. 11

INVENTOR
Ulrich Walchhüter

BY

Michael S. Striker

ATTORNEY

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3,366,253

DEVICE TO PILE UP AND TO COUNT TILES

Ulrico Walchhüter, Via Abamonti 2, Milan, Italy

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Claims priority, application Italy, Apr. 11, 1963, 7,469/63; Mar. 26, 1964, 6,644/64
10 Claims. (Cl. 214—6)

This invention relates to a device for piling up or stacking and counting tiles.

Tile piling up devices are known which comprise piling up means provided with an upwards movement in order to bring the tiles between two grippers or pairs of grippers sustaining the pile of tiles in formation. The so conceived devices are necessarily complicated due to the system to pile up the tiles from the lowest to the highest position of the piling up device, and further due to the necessity to synchronize the movement of the piling up device with the movement of opening and closing theg rippers. Although such devices have been built, they did not work satisfactorily because of a delay in opening the grippers the tiles struck one another, thus being subjected to a more or less severe damage, or because of premature opening of the grippers the whole pile of tiles was dropped resulting in still more severe breakage and damage.

In said known piling up devices the piling up of crude tiles, which are very soft in their structure, was practically impossible due to the hereabove mentioned drawbacks, and due to the hard clasping of the grippers, which are the cause of said breakage or other damages.

The tile piling up device of this invention offers the advantages of being of simple construction and low cost price, further eliminating the aforesaid drawbacks, also permitting to pile up soft tiles, in other words tiles in crude state.

A first object of this invention is to provide a device to pile up tiles from above, and which is provided with a piling up member carrying out successive downward movements, the stroke of which is equal to the thickness of the tiles thus manipulated, the succession of said movements taking place from the level of a conveyor of the belt type.

A further object of this invention is to provide a device in which the piling up member is provided with means responsive to the arrival of each one tile, so as to cause a displacement downwards of the pile each time that a tile has been placed onto the pile of tiles in formation.

Still a further object of this invention is to provide a piling up device with means which cause a continuous lowering of the formed pile of tiles at the instant at which the required number of tiles for each one pile of tiles has been completed, said lowering taking place in such a manner that the piling up device is situated underneath the level of a belt conveyor having the task to bring away the piles of tiles, by causing them to be situated in convenient manner onto said conveyor.

Another object of this invention is to provide the piling up device with means for braking the feed conveyor each time that the required number of tiles for the formation of a pile of tiles has been reached, and for starting again said conveyor as soon as the piling up device has been liberated from the preceding pile of tiles just completed, and said piling up device has been raised to the level of the feed conveyor.

Another object of this invention is to provide the piling up device with means capable to move forward the belt transporting the piles of tiles for a bit each time that the piling device has left thereon a pile of tiles.

According to the present invention the piling up member of the device is situated at the end of a piston shaft of appropriate length, said piston being a double action piston, and sliding within a cylinder, wherein onto one

side of the piston compressed air exerts its proper action in order to sustain and throw upwards said piling up device, while by directing onto the other side of said piston oil under pressure will serve to maintain the same in equilibrium for the phases of stopping and the following successive downward displacements, said oil under pressure being opportunely fed in according quantities, which are controlled by electrovalves. The use of compressed air permits a very quick upwards return of the piling up device.

Although the device as per this invention may be used for crude tiles, for a few types which are particularly soft or of great fragility, it is provided with a particular plate disposed at the level of the conveying belt for the arrival of the tiles, and upon which the tiles are disposed one by one as they are arriving, to avoid imparting a shock onto the already piled up tiles, said plate being provided with a retracting movement in combination with stopping members for the tile, so that said plate can be drawn from beneath the arriving tile and so that the latter is left to softly lie onto the pile of tiles in formation.

Still a further object of this invention—for the case of piling up crude tiles—is to provide the piling up device with means to automatically dispose a tile of refractory material onto the transporting conveyor before the tiles are piled up thereon, thus avoiding the manual insertion of such a refractory plate, which would require considerable work and a particularly difficult operation for the operating personnel, especially in cases of multiple piling up arrangements working in synchronisation.

One embodiment of this invention is shown in a not limiting view, in the attached drawings, in which:

FIGURES 1, 2 and 3 are schematic views of the piling up device in different working steps;

FIGURE 4 is a partial plane view of the embodiment shown in FIG. 1;

FIGURES 5, 6, 7, 8, and 9 show several portions of the electric circuit for the automatic controlling of the piling up device;

FIGURES 10 and 11 respectively show a lateral view and a plane view of the means for the automatic insertion of the refractory plate.

Referring particularly to FIGURES 1, 2 and 3, the device of this invention comprises a piling up device **1** constituted by a plate or support means situated at the end of a piston rod **2**, of appropriate length and projecting from a piston which is slidably guided within the cylinder **3**.

At the lower end of cylinder **3** there is attached a conduit **4** for feeding compressed air supplied by a compressor **5**, said conduit **4** being intercepted by a pressure compensator **6** bearing a pressure gauge **7**.

At its upper end, cylinder **3** is provided with a conduit **8** for feeding of oil under pressure thereinto; said conduct **8** can be put in communication with a feeding main conduit **9**, or with the conduit **10** for exhaustion of the oil used, an oil pressure central plant **11**, under the control of two electrovalves E1 and E2. Electrovalve E1 is connected in series with a throttle valve S.

By means of such a connection, when conduit **8** is connected with the exhaust side **10**, the compressed air throws upwards the said piston into the position wherein member **1** stays exactly at the same level with a conveying belt **12** arranged for feeding the tiles to be piled onto the member **1**; said conveyor is driven by a reduction gear drive MT1. By subsequently closing the electrovalve E2 and providing for the communication of the conduit **8** with the feeding conduct **9**, under the opening of the electrovalve E1, oil under pressure is sent to the cylinder **3**, the oil pressure being such that it overcomes the air pressure, so that said pistons is lowered. When a sufficient

quantity of oil under pressure is fed into cylinder 3 so that said piston is displaced for a distance equal to the thickness of one tile, the piling up device will be moved through the same distance. Thus, by introducing into said cylinder successive equal quantities of oil under pressure through the electrovalve E1, the piling up device will be displaced each time in accordance with the timing of supply of the tiles to be piled up, while the said device will be lowered each time it receives a tile. When the required number of tiles is reached, electrovalve E1 is opened for a given time period so that the piston together with the piling up device is subjected to a continuous downward displacement, till it reaches the level of a transporting belt 13 the purpose of which is to transport the thus formed pile of tiles away from the member 1. The throttle valve S serves to limit the stream of oil under pressure into the cylinder 3 in order to avoid a brusk lowering of the piling up device.

By closing the electrovalve E1 and opening the electrovalve E2, the conduit 8 is connected to the exhaust and therefore the pressure of the compressed air is subsequently acting again to bring the piling up device back to its upper working position by a single stroke upwards.

The conveyor belt 13 is intermittently driven by means of a reduction gearing MT2 through appropriate belts 13', as will be explained hereinunder.

As shown in FIGURES 1 and 4, in the case of tiles of particular softness, the piling up device is provided with transfer means including a thin plate 14 onto which the tiles are fed and on which they are stopped against appropriate stops 15, after which the plate 14 is made to return to its starting position in order to receive the next tile. The movement of said plate 14 takes place under the action of a cylinder provided with a return spring 16', and supplied with compressed air coming from the conduit 4 through a conduit 17 which is controlled by a further electrovalve E3.

As shown in FIGURES 1, 2 and 3, a plurality of tiles may be fed from a magazine 19 by being subjected to the action of an expulsion member 20, which preferably acts upon the lowest tile or refractory plating the magazine 19, in spaced intervals onto the conveyor 13.

The position of the refractory plates 21 on the conveyor belt 13 is such that during intermitted movement of the conveyor 13, a respective plate 21 will be aligned with the piling up device 1.

The expulsion member 20 is driven by the piston rod 23 of a double acting hydraulic jack 22. The cylinder space through which the piston rod 23 extends is directly connected with the feeding conduit 9 whilst the other opposed space may be connected through an electrovalve E4 either with the feeding conduit 9 or the exhaust line 10. Thus, when both cylinder spaces of the jack 22 are connected with the conduit 9 under pressure the expulsion member or pusher 20 will be moved towards the right to extract a tile from the magazine 19. When on the contrary, the cylinder space at the left hand is put in communication with the exhaust conduit, by means of the electrovalve E4, the jack piston will be moved to the left side, in a position wherein the expulsion member 20 is located laterally of the magazine 19 as shown in FIG. 2.

The means to introduce the refractory plate is shown in more details in FIGURES 10 and 11. It comprises besides the jack 22, its piston rod 23 and expulsion member 20, a supporting frame 24, wherein a small case 25 is situated with a downwardly facing open end, which contains the reserve of refractory plates. This reserve lies on two projecting supporting members 26 and 27 supported in turn by parallel traverses 28 and 29.

The expulsion member 20 is made of an elongated plate of lesser width than the interval between said supporting members 26 and 27 so that its free end may move between the latter. Two parallel projecting members 20' and 20'' are set in order to interfere with the refractory plates at the lowest position, and to draw them from the magazine 19, when the expulsion member 20 is moved forward underneath the magazine 19.

In the case that the piling up device includes only a single conveyor 12 and a single conveyor 13, the expulsion member 20 is directly connected with the rod 23 of the jack piston 22.

In the case that the device is a multiple one, more conveyor belts are provided, as at 12, in parallel positioning, and feeding an equivalent number on piling up devices, the so formed piles being discharged onto an equivalent number of lower transporting belts 13, also set in parallel position, a plurality of expulsion members 20 has to be provided, i.e., one for each transporting belt (FIGURE 11). In this case, the expulsion members 20 will be connected to a plate 30 moved by a jack 22. Said plate 30 has lateral walls 31 of larger sizes, and a profiled member 32 which is engaged by guiding rollers 33, 34 and 35 which facilitate the movement of said plate 31.

The piling up device includes a rod 18 the end of which is adapted to move in turn three microcontacts C2, C3 and C5 for controlling the stroke end. The microcontacts C2 and C5 are situated at the same level.

For the automatic control of the piling up device 1, a member responsive to the arrival of the tiles is provided. The same is constituted f.i. by a photoelectric cell C1 and an electric lamp L respectively arranged on opposite sides of the piling up device, so that every tile arriving into the according position will influence the photoelectric resistance.

As shown in FIGURE 5, the photoelectric resistance C1 is disposed in the electric circuit of the trigger electrode of a tube V1 through a switch 1RS, such that, when lowering of the electric resistance C1 will cause firing of the tube V1, the relay RD will be excited. In order to shorten the excitement of this relay, there is inserted in parallel position with it an electric resistance *r*1 and a capacitor 18'.

The so described electric circuit operates with alternate current.

The excitement of relay RD causes the closing of the contact 1RD (FIG. 8), thus actuating the electrovalve E1, which opens to permit oil under pressure to flow into the cylinder 3. The piling up device begins to lower till the lowering of the tile permits light from the lamp L to impinge again on the photoelectric cell C1, thus cancelling the excitation of relay RD and reopening 1RD which closes again the electrovalve E1 in order to stop the further lowering movement of the piling up device, thus deexciting RD. As soon as the piling up device begins to lower, also contacts C2 and C5 are acted upon by the rod 18. Contact C2 is closed, whilst contact C5 is opened. Contact C5 (FIG. 8) is in the circuit of the electrovalve E4, which is thus de-excited.

The operation cycle continues in the herein explained mode till the required number of piled tiles is reached. Said number of tiles being reached, the counting coil BC (FIG. 6) closes the contact 1BC thus energizing the relay RS (FIG. 6). Relay RS closes first of all the switch 1RS (FIG. 5) on the resistance *r*2, thus causing the continuous insertion of tube V1, and consequently de-exciting in continuation RD, which opens in a continuous manner the electrovalve E1 through contact 1RD, thus permitting the flow of oil under pressure into the cylinder 3, so that the piling up device will continuously move in downward direction.

Relay RS also closes the contact 2RS on the vertical line of relay RT, which doesn't excite, since the microswitch C3 is still open. Relay RS also opens contact 3RS, thus impeding an eventual excitation of relay RD. A further contact of relay RS, more exactly 4RS, is closed which causes exciting of relay RB, which closes the contact 1RB so that, since switch C2 is closed, relay RB will remain excited even if 4RS is opened. The excitation of RB further closes the contact 2RB on the vertical line

of relay RT, which doesn't excite because of the contact 3RS has been opened. Relay RB also opens the contact 3RB (FIG. 9) on the vertical line of relay T1, thus de-exciting the latter and stopping the reductor-gearing MT1 (FIG. 1), and consequently stopping the belt 12. As soon as the piling up device has been lowered to the elevation of the transporting belt 13, in other words to the position indicated in FIG. 2, the microswitch C3 is closed, which causes, since 2RS is closed (FIG. 6), the excitation of the relay RT. Relay RT in a first instant closes contact 1RT (FIG. 9), thus starting the gearing MT2, and consequently starting movement of the transporting belt 13 in order to transport the thus formed pile of tiles away from the piling up device, and at the same time aligning a new refractory plate with the piling up device. Relay RT moves also the switch 2RT (thus opening the valve V2 and exciting the relay RO (FIG. 7). Relay RO thus excited moves the contact 1RO (FIG. 5) on the vertical line of coil BO to return the index to zero position of the counting element. Relay BO opens again the contact 1BC, so de-energizing relay RS, so that contacts 2RS are opened, thus de-energizing RT. Switch 4RS is also opened without any action onto relay RB, but opening of switch 1RS de-energizing the relay RD, while contact 3RS closes again, thus causing the excitation of relay RP, since switch 2RB is closed. In these conditions de-energizing of RT causes opening of switch IRT and stopping of the reduction gearing MT2, while the excitation of relay RP causes the closure of contact 1RP (FIG. 8) which excites the coil of the electrovalve E2, thus switching the conduct 8 to exhausting. In the same conditions the piling up device is enabled to return upwards, while lifting at the same time the refractory plate 21. During the upwards stroke, and through the shaft 18, the microswitch C3 is opened, without any influence whatever.

At the end of the upward return stroke of the piling up device, microswitches C2 and C5 are simultaneously disengaged from rod 18. Microswitch C2 during its opening causes the de-excitation of the relay RB.

The microswitch C5 closes the circuit of the electrovalve E4 (FIGURE 8). The electrovalve E4, due to its excitation, establishes the communication of the jack 22 with the conduit 9, so that the expulsing member 22 is moved in a direction to place a new refractory plate onto the conveying belt 13, exactly in the same position as the preceding plate has been placed thereon.

On the de-excitation of relay RB, the hold over switch 1RB is opened; and the contact 2RB is likewise opened, thus de-exciting the relay RB, while the contact 3RB closes again, thus exciting T1, and consequently starting again the reduction gearing MT1, which causes the conveying belt 12 to move forward, thus feeding new tiles.

At this point, a new cycle of operations will begin.

As soon as the first tile is brought by the conveyor 12 to the piling up device, the latter moves for the first step downwards, thus opening the microswitch C5, and de-exciting the electrovalve E4, which in this way establishes the communication of the left hand cylinder space of jack 22 with the exhaust 10, so that the piston of said jack is thrown to the left, and the member 23 is retracted, and remains in the position thus reached, for the whole cycle of operations, that is to say till the piling up device has returned to its highest position.

The feeding device for the refractory plates instead of being disposed in the position of FIGURES 1, 2 and 3, may be situated over the conveying belt 12, so as to be in condition to directly move the plates of refractory material onto the piling up device, as the latter reaches its highest position, and before the conveying belt 12 is moved.

In the case of utilization of the plate 14 for piling up very soft, fragile tiles, a switch C4 (FIGURES 1 and 6) is foreseen, the same being moved by said plate 14, and is situated in the circuit of the electrovalve E1. In this way, when the photoelectric resistance C1 is interrupted, the closure of the contact 1RT has no influence, when said plate 14 has not closed the microswitch C4, the remaining part of the piling up cycle taking place as hereabove already mentioned. In this case, the electrovalve E3 is opened by a contact 2RD moved by the same relay RD so that, as soon as one tile has been placed on the plate 14, said plate is drawn backwards by feeding pressure fluid into the cylinder 16. The forward moving of said plate 14 takes place under the influence of a spring 16' which moves the piston of cylinder 16 forward.

Of course the invention is not limited to the single embodiment described hereabove and shown in the attached drawings, but it can also executed in different other forms, without departing in any way from the spirit of the present invention.

What I claim as my invention is:

1. An automatically controlled device for stacking plate-like articles such as preformed tiles or the like which may have varying thickness in groups of predetermined numbers comprising, in combination, vertically movable support means adapted to receive successive articles thereon, said support means being movable from an upper starting position in downward direction to a lower end position and back to the starting position; supply means for moving articles in succession and in a substantially horizontal plane onto said support means; moving means operatively connected to said support means for moving the same between said positions thereof; control means associated with said moving means for causing the latter to move said support means from said starting position downwardly in successive steps each time an article is supplied to said support means and for controlling each downward step in such a manner that each of the successive downward movements depends on the respective thickness of each of the plate-like articles placed in succession on said support means to align after each downward step the top surface of an article placed on said support means with said horizontal plane so that the next article moved by said supply means onto said support means may be placed without dropping onto the top surface of the preceding article; a counting device for counting the articles placed on said support means; second control means associated with said counting device and cooperating with said moving means for causing the latter to move said support means in a continuous downward movement to said end position after a predetermined number of articles has been stacked on said support means; and transporting means for removing the stack of articles from said support means after the latter has reached said end position.

2. A device as set forth in claim 1, wherein said moving means includes a vertically arranged double acting cylinder, a piston slidably guided in said cylinder, a piston rod fixed to said piston and having an upper free end carrying said support means, and fluid feeding means controlled by said control means for feeding pressure fluid into said cylinder to opposite sides of said piston.

3. A device as set forth in claim 2, wherein said fluid feeding means comprises first feeding means for feeding compressed air into said cylinder at a side of said piston so as to tend to move the latter in upward direction, and second feeding means for feeding a liquid under pressure into said cylinder at the other side of said piston and for discharging the liquid from said cylinder.

4. A device as set forth in claim 3, wherein said second feeding means includes a source of liquid under pressure, conduit means for connecting said source of liquid under pressure to the upper end of said cylinder, first valve means in said conduit means and controlled by said first mentioned and said second control means, exhaust conduit means communicating with said upper end of said cylinder, second valve means in said exhaust conduit means, and additional control means connected to said second valve means for opening the latter after

said support means has been moved to said lower end position and the stack of articles thereon has been removed therefrom.

5. A device as set forth in claim 1, wherein said control means includes photoelectric means comprising a photocell and a source of light respectively arranged to opposite sides of said support means slightly above the same in such a manner that light emanating from said light source is prevented from impinging on said photocell whenever an article has been placed on said support means until the latter has been lowered for a distance corresponding to the respective thickness of said article.

6. A device as set forth in claim 1 wherein said supply means includes a conveyor belt having an upper run substantially at the same elevation as said support means when the latter is in said starting position, and means for stepwise moving said conveyor belt; and including transfer means for transferring an article from one end of said upper run adjacent said support means onto the latter, said transfer means including a thin plate movable from an advanced position beneath an article on said one end of said upper run to a transfer position aligned with said support means into a retracted position laterally spaced from said support means, and back to said advanced position, stationary stop means arranged to engage an article on said thin plate when the latter is in said transfer position so that the article is placed on said support means during movement of said thin plate from said transfer to said retracted position, and means connected to said thin plate for moving the same between said positions thereof in timed sequence with the stepwise movement of said conveyor belt.

7. A device as set forth in claim 1, wherein said transporting means includes elongated conveyor means, and means for stepwise moving said elongated conveyor means in one direction each time said support has been moved to said end position thereof.

8. A device as set forth in claim 7 and including means for placing a support member at such a position on said elongated conveyor means while said support means is upwardly spaced from said end position so that during movement of said elongated conveyor means in said one direction and removal of the stack from said support means, said support member will be aligned with said support means to be moved upwardly with the latter, whereby the first plate-like article supplied by said supply means will be placed on said support member on said support means.

9. A device as set forth in claim 8, wherein said means for placing a support member on said elongated conveyor means includes a magazine arranged at one end of said elongated conveyor means and adapted to contain a stack of support members, pusher means movable between a retracted position and an advanced position engaging the lowermost of said stack of support members in said magazine and pushing said lowermost support member onto said one end of said elongated conveyor means, and means connected to said pusher means for moving the latter from said retracted to said advanced position each time said support means reaches its starting position.

10. A device as set forth in claim 8, wherein said support member is a refractory tile.

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ROBERT G. SHERIDAN, *Primary Examiner.*

MORRIS TEMIN, GERALD M. FORLENZA, *Examiners.*

J. E. OLDS, *Assistant Examiner.*