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J. LINGL

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METHOD AND APPARATUS FOR SETTING BRICKS

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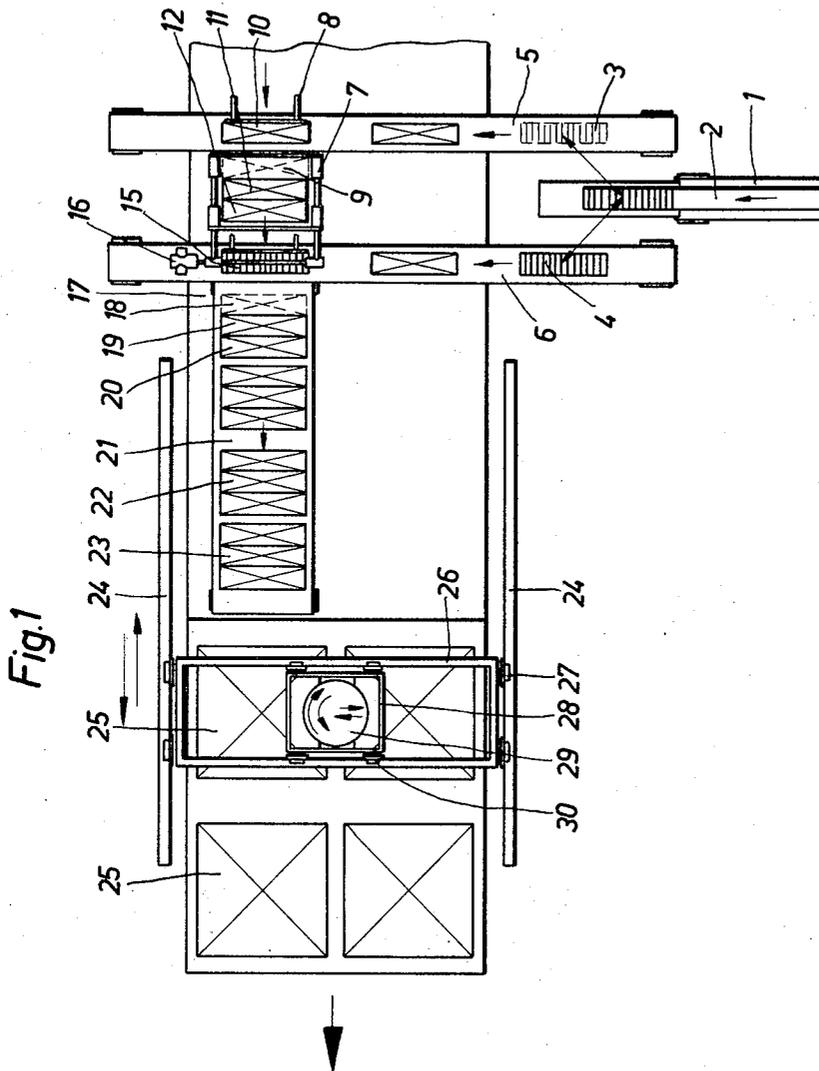


Fig. 1

Inventor:  
**JOHANN LINGL**  
By *Steward & Steward*  
his Attorneys.



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J. LINGL

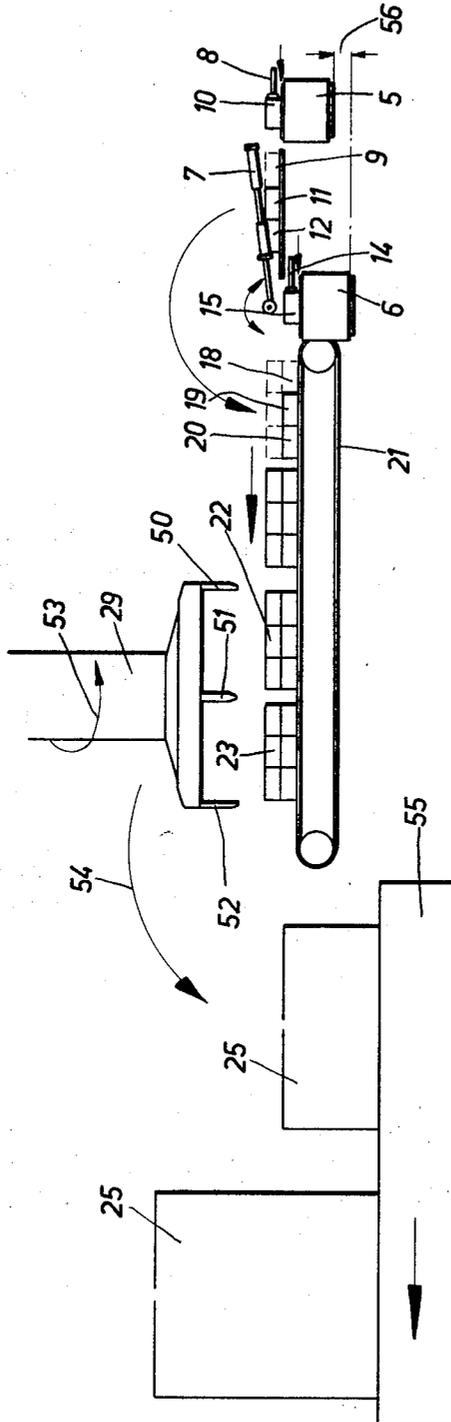
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Fig. 4



Inventor:  
**JOHANN LINGL**  
By *Steward & Steward*  
his Attorneys.



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**METHOD AND APPARATUS FOR  
 SETTING BRICKS**

Johann Lingl, Finninger Strasse 70,  
 Neu-Ulm (Danube), Germany  
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 10 Claims. (Cl. 214-6)

The present invention relates to a method and apparatus for setting brick, and it is the principal object of the invention to set raw or "green" brick coming from an extrusion press so that the packs may be moved immediately on a kiln car into the kiln.

More particularly, it is an object of this invention to set facing bricks which, if there is a danger that they might become discolored in burning, have to be placed in the kiln with their face sides applied against each other so that these sides will be shielded from the direct influence of the hot gases in the kiln and will thus be protected from discoloration.

Although different types of conveying apparatus have been designed for this purpose prior to this invention, these apparatus have the disadvantage that they cannot operate automatically if the setting has to deviate from a uniform shape or pattern, for example, if a base layer of bricks is to be provided with recesses into which the arms of a fork lift are to engage for lifting and transporting the packs. Furthermore, these known apparatus only permit a relatively low hourly output. Thus, for example, for setting the bricks coming from an extruder with an hourly output of only 20,000 bricks, it is already necessary to employ two of these known apparatus.

It is therefore another object of this invention to provide a method of setting packs of brick of different patterns or arrangements which may also be faced automatically by suitable adjustments of a program control device.

It is another object of the invention to provide a method of setting brick which permits a considerably higher hourly output to be attained than that which was attainable by any of the methods and apparatus as were known prior to this invention so that a single apparatus will suffice for hacking the entire output of a brick extruder. This extruder which does not constitute a part of the present invention should be one of the type in which the green bricks are compressed to such an extent that they will be extruded from the press in a condition of sufficient stability to resist practically any deformation during the subsequent setting operation.

As previously indicated, the present invention primarily concerns a method of setting bricks coming from an extrusion press in such a manner that the face sides of each pair of adjacent bricks within the pack will rest upon and cover each other completely.

The method according to the invention consists of the steps of first conveying the bricks from the extrusion press on a conveyer, of then transferring the bricks from this conveyer alternately in the form of equal rows to two other parallel conveyers, of then pushing these rows laterally of these parallel conveyers, preferably near the end thereof, and upon two separate platforms until a group of several rows of bricks has been accumulated behind each other on each platform, of then gripping the group which rests on the first of these platforms and swinging the same by means of a turnover device about an angle of approximately 180° so that the bricks of this group will be deposited on and in exact registry with the group which has been accumulated on the second platform so as to form a double-layer group thereon, then gripping this double-layer group at the narrow ends of the bricks by means of a gripper assembly consisting of a plurality of individual grippers, of then lifting this gripper assembly with the double-layer group thereon off the second

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platform and thereafter drawing the individual two-layer rows of bricks within this group for a certain distance laterally away from each other, and of then depositing them in this position, for example, on a tunnel-kiln car.

5 The first platform from which the groups of brick rows are consecutively picked up by the turnover device is preferably movably mounted so as to permit each group to adapt itself to the most suitable position in which it will be picked up by the turnover device. The second platform upon which the groups of brick rows are laterally pushed from the first conveyer coming from the press preferably consists of a plate conveyer which is operated so as to move periodically whenever one doublelayer group of brick rows has been deposited thereon.

10 The gripper assembly which is employed in carrying out the inventive method is preferably designed as described in my copending application, Ser. No. 190,307, filed on Apr. 26, 1962, now Patent No. 3,270,897. This gripper assembly will therefore be described in the present application only to the extent as may be necessary to understand the method and apparatus according to the present invention.

15 For carrying out the inventive method it is advisable that the first platform from which the groups of brick rows are picked up by the turnover device, and also the part of the first of the two parallel conveyers from which the individual rows of bricks are pushed laterally upon this first platform be located above the level of the second conveyer and the second platform at a distance equal to the height of one brick. This has the advantage that, when the turnover device has picked up the group of brick rows from the first platform and is then pivoted about an angle of exactly 180°, it will deposit this group accurately on another group which has just been pushed from the second conveyer upon the second platform which, as previously described, preferably consists of a periodically operated plate conveyer. In this manner, the object will be attained that the face sides of the individual bricks of both groups will lie accurately on each other and will thus be prevented from discoloration during the subsequent burning of the bricks in the kiln.

20 For pushing the individual rows of bricks laterally off the two parallel conveyer belts upon the two adjacent platforms or upon the first platform and upon the plate conveyer, the invention provides a pair of pushers which start to act when the row of bricks on each conveyer abuts against a back stop. These back stops may therefore be designed, for example, in the form of switches to start the movement of the pushers.

25 By transferring the one group of brick rows by means of the turnover device upon the other group in the manner as above described, a double-layer group is formed which is then further conveyed to a position in which this group or two adjacent double-layer groups, may be gripped by the gripper assembly. This gripper assembly comprises a plurality of individual grippers which grasp the double-layer group or groups on the opposite narrow ends of the individual rows which extend longitudinally on the plate conveyer. If two double-layer groups are to be grasped and picked up simultaneously by the gripper assembly, tongues are inserted between the two groups and the ends of the individual longitudinal double-layer rows of bricks of both groups are pressed against the tongues by gripping plates which are actuated by pressure means. When the double-layer group or the two adjacent double-layer groups are then lifted off the plate conveyer by the gripper assembly, the adjacent grippers will be drawn apart to the desired distance in the manner as described in my copending application previously referred to, so that the individual longitudinal double-layer rows of bricks will be spaced from each other as much as necessary for being properly exposed to the oven gases.

The operations of drawing the adjacent grippers apart and of moving those on the opposite ends of the longitudinal double-layer rows of bricks relative to each other may be controlled automatically by a program device so that, for example, for forming the base layer of a pack of bricks, certain rows of bricks will not be picked up, while other rows will be drawn apart for more than the normal distance so that the fork of a stacker may subsequently engage into the spaces which are thus formed. The bricks which are not picked up from the plate conveyer are then dropped off the end of the latter during its further movement and fall upon a belt which carries them off for further use.

For setting the brick rows in different patterns, it is possible to move the gripper assembly on a suitable hoist either longitudinally or transversely or to turn it about a vertical axis, especially when employing two gripper assemblies.

An important advantage of the method according to the invention is attained by the fact that the double-layer groups of bricks will be assembled into a compact form and will in this form be picked up by the gripper assembly which permits the bricks within these groups to be quickly and safely conveyed until the individual longitudinal double-layer rows of bricks are drawn apart by the movement of the grippers themselves during the transfer of the double-layer groups to the support on which the hacks are formed so that no additional time will be required for this operation. The apparatus which is employed for carrying out this method is therefore extremely efficient, operates without danger of breakdown, and forms the packs of bricks very accurately.

It has previously been mentioned that the bricks which are supplied on a conveyer from the extrusion press are at first transferred in equal rows alternately to two parallel conveyers. For this alternate transfer of the brick rows to the two parallel conveyers it is advisable to employ a reciprocating gripper mechanism which comprises two adjacent gripper units which are rigidly connected to each other and are movable along guides extending above and at right angles to the conveyers. These two gripper units are spaced from each other at a distance equal to the distance between the conveyer coming from the extrusion press and one of the two other conveyers at both sides thereof. It is further advisable to mount this transfer-gripper mechanism on rocking levers which are pivotable upwardly and downwardly and thereby permit this mechanism to lift the rows of bricks off the first conveyer coming from the extrusion press and subsequently to set them down upon one or the other of the two conveyers extending at both sides of this first conveyer.

The operation of the two gripper units of this mechanism is controlled in such a manner that the gripper unit which is disposed above the first conveyer coming from the press picks up a new row of bricks from this conveyer, while the other gripper unit which has previously picked up a row and is then disposed above one of the two other conveyers deposits this row upon this other conveyer. Since the gripper mechanism moves back and forth in a certain sequence transversely to the conveyers, the rows of bricks will in this manner be transferred from the first conveyer alternately to one and then to the other conveyer at both sides of the first conveyer.

The features and advantages of the present invention will become more clearly apparent from the following detailed description thereof which is to be read with reference to the accompanying drawings, in which—

FIG. 1 shows a general plan of the apparatus according to the invention;

FIG. 2 shows a perspective view of the transfer gripper mechanism which transfers the bricks coming from the extrusion press in equal rows to two parallel conveyers;

FIG. 3 shows a diagrammatic front view of the transfer mechanism according to FIG. 2 to illustrate the principle of operation thereof;

FIG. 4 shows a side view of the parts of the apparatus which extend at right angles to the two parallel conveyers, including the gripper assembly; while

FIG. 5 shows a perspective view of the turnover mechanism for transferring the groups of brick rows from the first platform upon the corresponding groups on the plate conveyer so that the face sides of the individual bricks of both groups completely cover each other.

The invention will hereafter first be described with reference to the general plan of the apparatus as illustrated in FIG. 1 to explain the basic principle thereof. The green bricks 2 coming from an extrusion press are first conveyed along a conveyer belt 1 from which rows of bricks 3 and 4 of a certain length are alternately transferred upon one or the other of the two conveyer belts 5 and 6. Although these two conveyer belts 5 and 6 run parallel to each other, the outer belt 5 is guided so that the upper surface of the part thereof from which the bricks are transferred to an adjacent platform is elevated by the height of one brick above the surface of the conveyer belt 6, as illustrated in FIG. 4.

The individual rows of bricks 3 and 4 are moved on the conveyer belts 5 and 6 until they abut against back stops which are designed, for example, in the form of switches to start the operation of pushers 8 and 14 which push the individual rows 3 laterally upon a platform 49 and the rows 4 laterally upon a plate conveyer belt 21. As soon as three rows of bricks have been pushed successively off each belt 5 and 6, a turnover device 7 starts to act which places the directly engaging rows 12, 11, and 10 on top of and in registry with the rows 18, 19, and 20 so that the face sides of the individual bricks engage upon each other and will thus not be acted upon by the hot oven gases during the subsequent burning. FIG. 1 illustrates the position in which at first only the two rows of bricks 11 and 12 are placed adjacent to each other on the platform 49 as illustrated in FIG. 5 and the two rows 19 and 20 on the plate conveyer belt 21, while the two third rows 10 and 15 are moved to the positions 9 and 18, respectively.

The turnover device 7 which is only illustrated in principle in FIG. 1 is driven either pneumatically or hydraulically and pivoted about the axis of a shaft 16.

After two groups of brick rows each consisting of three rows are placed with their face sides upon each other, the plate conveyer belt 21 is moved in the feeding direction so that the double-layer groups 22 and 23 will be passed to a position in which they may be acted upon by a gripper assembly 29. This gripper assembly is mounted on a carriage 26 which is movable on wheels 27 along rails 24 in a direction parallel to the plate conveyer belt 21. The gripper assembly 29, is, however, also movable in a direction at right angles to the conveyer belt 21 by being mounted within a frame 28 which is movable on wheels 30 from one side of the carriage 26 to the other. The gripper assembly 29 may therefore be moved not only in the direction of the plate conveyer belt 21 but also at right angles thereto so as to permit the double-layer groups of brick rows 22 and 23 to be deposited in the form of packs 25 on a tunnel-kiln-car which has previously been moved to the proper position.

In place of a gripper assembly 29 which is movable in two directions at right angles to each other, it is also possible to employ a gripper assembly which consists of two double grippers which are rotatable about their vertical axes in either direction.

FIG. 2 illustrates a mechanism 39 for transferring the green bricks 2 from the first conveyer belt 1 in equal rows of a certain length upon the two conveyer belts 5 and 6. This transfer mechanism 39 comprises two interconnected gripper units 46 and 47 which are movable in a direction at right angles to the conveyer belt 1, as indicated by the arrows 45 and 40, by means of a piston rod which is operated pneumatically or hydraulically

by a cylinder 38. The grippers of each of these two gripper units 46 and 47 consist of grip bars 42 and 43 which are likewise movable pneumatically or hydraulically by means of cylinders 44.

The principle of operation of these two gripper units is illustrated in FIG. 3 and is as follows: When they are in their operative positions, one of the gripper units, for example, the unit 47, will be closed so as to grip a certain number of bricks 2 on the conveyer belt 1. At the same time, another row of bricks which has previously been gripped by the gripper unit 46 is released and thus deposited upon the conveyer belt 6. Since the two gripper units are moved continuously back and forth within a horizontal plane from one end position to the other, one of these units will deposit a row of bricks either upon the conveyer belt 5 or the conveyer belt 6, while at the same time the other gripper unit picks up a new row of bricks from the conveyer belt 1.

In addition, this transfer mechanism 39 is pivotably mounted on rocking levers 37 which, in turn, are pivotable about the axes 35 and 36 so that the transfer mechanism also lifts the row of bricks off the conveyer belt 1 and, after moving it toward one side or the other, sets the row down again upon the respective belt 5 or 6.

FIGS. 4 and 5 illustrate the mode of operation of the turnover device 7 which transfers a group of three adjacent brick rows 12, 11, 9 upon a second group 18, 19, 20, in such a manner that the face sides of the bricks of both groups will lie in registry on each other. FIG. 4 also indicates that the platform 49 and the part of the conveyer belt 5 from which the brick rows are pushed upwardly on this platform are disposed on a level higher than that of the upper surfaces of the conveyer belt 6 and the plate conveyer 21 by a distance 56 which corresponds to the height of a brick.

FIG. 5 also indicates the back stop 60 which limits the movement of each row of bricks 10 on the conveyer belt 5 and then starts the operation of the pusher 8. A similar back stop, not shown, is provided on the conveyer belt 6 for the rows of bricks 15. When these rows of bricks 10 and 15 abut against the back stops 60, the pushers 8 and 14 are actuated which then shove these rows upon the platform 49 and the plate conveyer 21. Platform 49 is movable so as to permit the three rows of bricks 12, 11, 10 to adapt themselves to the proper position in which they are then gripped by the gripping bars 57 of the turnover device 7 and this group is then swung by this device about the axis 13 in the direction of the arrow 59 and placed upon and in registry with the group of rows 18, 19, 20. The movement of the gripping bars relative to each other is controlled hydraulically or pneumatically by cylinders 58.

As soon as each double-layer group of bricks is formed on the plate conveyer belt 21, the latter is moved for a sufficient distance in the feeding direction to permit another double-layer group to be deposited on its rear end. When two successive double groups of bricks 22 and 23 have arrived on belt 21 in the positions as indicated in FIG. 4, a gripper assembly 29 moves downwardly, grips these two double groups and lifts the same off the conveyer belt 21. This gripper unit comprises a plurality of movable gripping arms of which only one pair of gripping arms 50 and 52 is shown and intermediate tongues 51. Each pair of these gripping arms 50 and 52 grips the front and rear ends of each two-layer row of bricks extending in the longitudinal direction of the plate conveyer 21 and, after the entire gripper assembly 29 has been lifted, the individual pairs of gripping arms 50 and 52, each gripping one double-layer row of bricks, are drawn apart for a certain distance in a direction transverse to the longitudinal direction of the plate conveyer 21 so as to space these rows sufficiently from each other for the subsequent burning operation. The gripper assembly 29 is then moved, for example, in the direction of the arrow 54 and the two double-layer brick groups 22

and 23 are then deposited in this drawn-out position of its individual double-layer rows upon the tunnel-kiln car 55 and the individual gripping arms are then opened. In order to permit the next two double-layer groups to be stacked on the first two groups at right angles thereto, the gripper assembly 29 may be turned 90° about its axis, as indicated by the arrow 53, before the bricks of the second groups are deposited on the first groups so as to form packs of bricks 25.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. A method of setting bricks comprising the steps of conveying the bricks on a first conveyer in a continuous row from an extrusion press, transferring longitudinal brick rows of an equal length from said continuous row on said first conveyer alternately to one end of a second and third conveyer extending parallel thereto; pushing each of said longitudinal rows laterally from said second and third conveyers when they arrive near the other end thereof upon two separate supports so as to accumulate a group of laterally adjacent longitudinal rows on each support which then also form rows extending transverse to said conveyers, gripping said groups on the first of said supports and swinging the same off said first support at an angle of substantially 180° about an axis extending parallel to said conveyers in the direction toward and upon and in registry with the group of brick rows on the second support so as to form a double-layer group, then gripping the narrow front and rear ends of each transverse row of at least one double layer group and lifting the entire double-layer group, then drawing apart the adjacent transverse rows of at least said one double-layer group so as to be spaced at a certain distance from each other, and then depositing at least said one double-layer group in said drawn-out position on a support so as to form the base layer of a pack on which subsequently other double-layer groups may be deposited to increase the height of said pack.

2. A method as defined in claim 1, in which the upper surfaces of said first support and of the part of said second conveyer from which said longitudinal brick rows are pushed upon said first support are disposed above the level of the upper surfaces of said third conveyer and said second support at a distance equal to the height of one brick.

3. A method as defined in claim 1, in which said first support is movable so that the group of brick rows thereon will adapt itself to a position in accordance with the subsequent gripping of said group and its swinging movement from said first support.

4. An apparatus for setting bricks comprising a first conveyer for conveying a continuous row of bricks from an extrusion press, a second and third conveyer parallel to said first conveyer, means for transferring equal longitudinal brick rows laterally from said row on said first conveyer alternately upon said second and third conveyers near one end thereof, two separate supports laterally of said second and third conveyers near the other end thereof, means for pushing each of said longitudinal rows laterally from said second and third conveyers near the other end thereof upon said supports so as to accumulate a group of laterally adjacent longitudinal rows on each support which then also form rows extending transverse to said conveyers, a turnover device having first gripping means for gripping said group on the first of said supports and for swinging the same of said first support at an angle of substantially 180° about an axis extending parallel to said conveyers in the direction toward and upon and in registry with the group of brick rows on said

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second support so as to form a double-layer group, second gripping means for then gripping the narrow front and rear ends of each of said transverse rows of at least one double-layer group on said second support, means for then lifting all of said gripping means simultaneously so as to lift at least said entire double-layer group off said second support, means for then drawing apart the adjacent transverse rows of at least said one double-layer group so as to be spaced at a certain distance from each other, and means for conveying at least said one double-layer group in said drawn-out position to another support and for then releasing said gripping means so as to form the base layer of a pack on which subsequently other double-layer groups may be deposited to increase the height of said pack.

5. An apparatus as defined in claim 4, further comprising stop means for limiting the movement of said longitudinal brick rows on said second and third conveyers near said other end thereof and for starting the operation of said pushing means.

6. An apparatus as defined in claim 4, in which said second support comprises a periodically movable plate conveyer for conveying each double-layer group after being formed near one end thereof in one direction to a position near the other end thereof where at least one of said double-layer groups is gripped by said second gripping means.

7. An apparatus as defined in claim 4, in which said second gripping means comprise tongues adapted to engage between two adjacent double-layer groups, and a plurality of pairs of gripping arms for gripping said front and rear ends of each of said transverse rows of said two adjacent double-layer groups by pressing the same against said tongues.

8. An apparatus as defined in claim 4, in which said

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second and third conveyers are disposed at the opposite sides of said first conveyer and starting at a point spaced from the end thereof at a distance at least equal to the length of said equal longitudinal rows, said transferring means comprising two interconnected gripping units, guide means above and transverse to said first, second and third conveyers, and means for reciprocating said two gripping units simultaneously back and forth between said three conveyers, so that while one of said gripping units grips one of said longitudinal rows on said first conveyer, the other gripping unit which has previously gripped another of said longitudinal rows on said first conveyer and has moved the same alternately to one or the other of said second and third conveyers releases said other longitudinal row upon said second or third conveyer.

9. An apparatus as defined in claim 8, in which said two gripping units are spaced from each other at a distance equal to the distance between said first conveyer and either of said second and third conveyers.

10. An apparatus as defined in claim 8, further comprising rocking means for lifting and lowering said guide means and said gripping units thereon.

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ROBERT G. SHERIDAN, *Primary Examiner.*

R. S. SPAR, *Assistant Examiner.*