United States Patent

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Bayern, Germany
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[33] Great Britain
[31] 43448/68

[54] **TRANSFER APPARATUS FOR EXCHANGING ARTICLES BETWEEN TWO CONVEYORS**
24 Claims, 13 Drawing Figs.

[52] U.S. Cl. 198/20, 198/30, 198/106
[51] Int. Cl. B65g 47/26, B65g 47/52
[50] Field of Search ..... 198/31 AA, 31 AC, 20, 30, 106

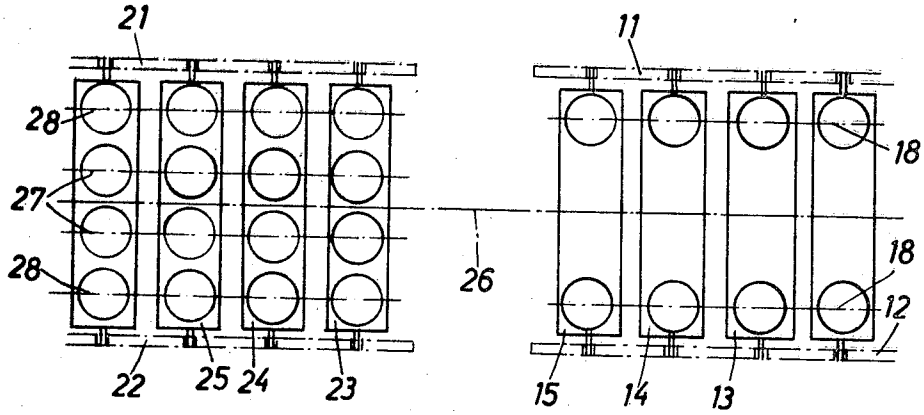
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Primary Examiner—Edward A. Sroka
Attorney—Karl W. Flocks

ABSTRACT: Apparatus for transferring molds for ceramic blanks or the like between a first conveyor associated with a molding machine, and a second conveyor which is associated with a drier and receives molds filled with blanks from the first conveyor and delivers empty molds back to it, twice as many molds being disposed one beside the other on the second conveyor as on the first conveyor.



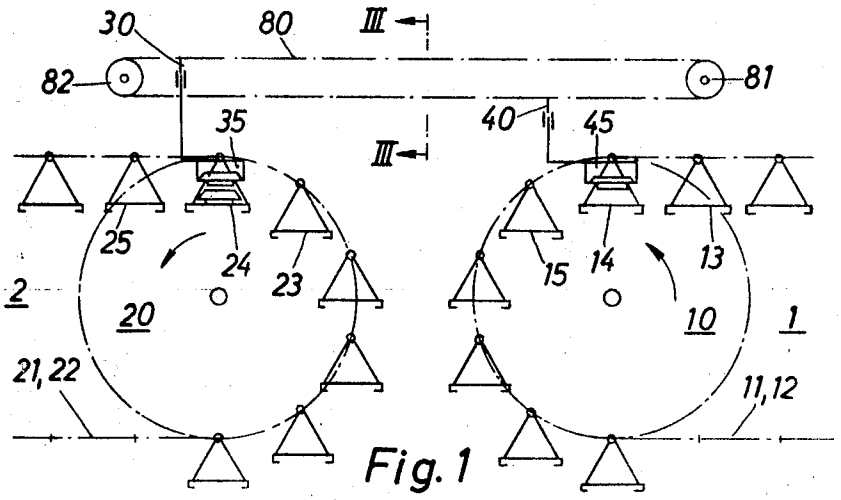


Fig. 1

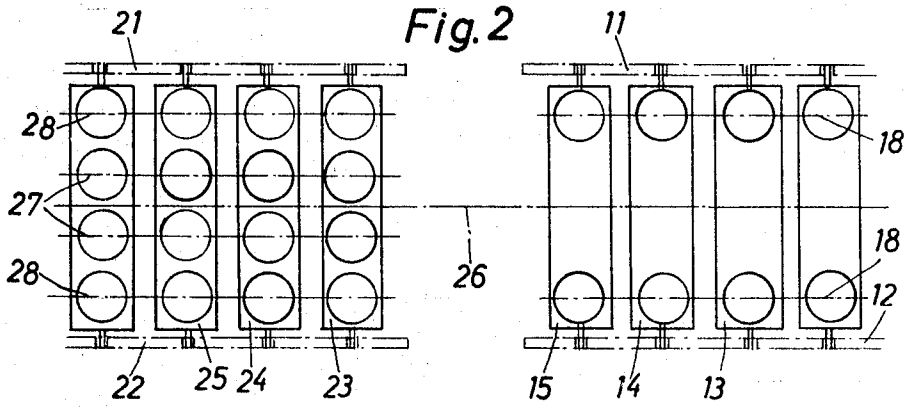


Fig. 2

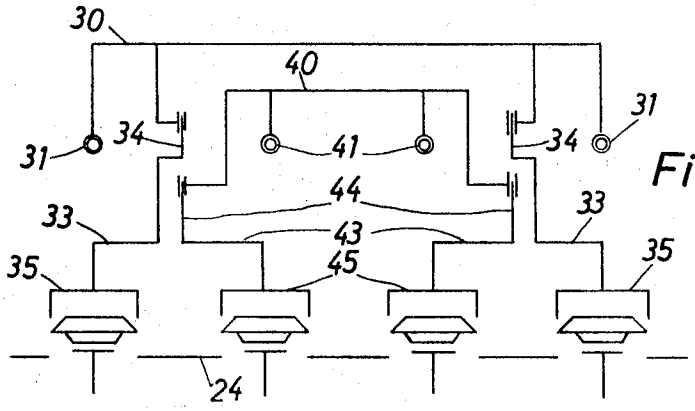


Fig. 3

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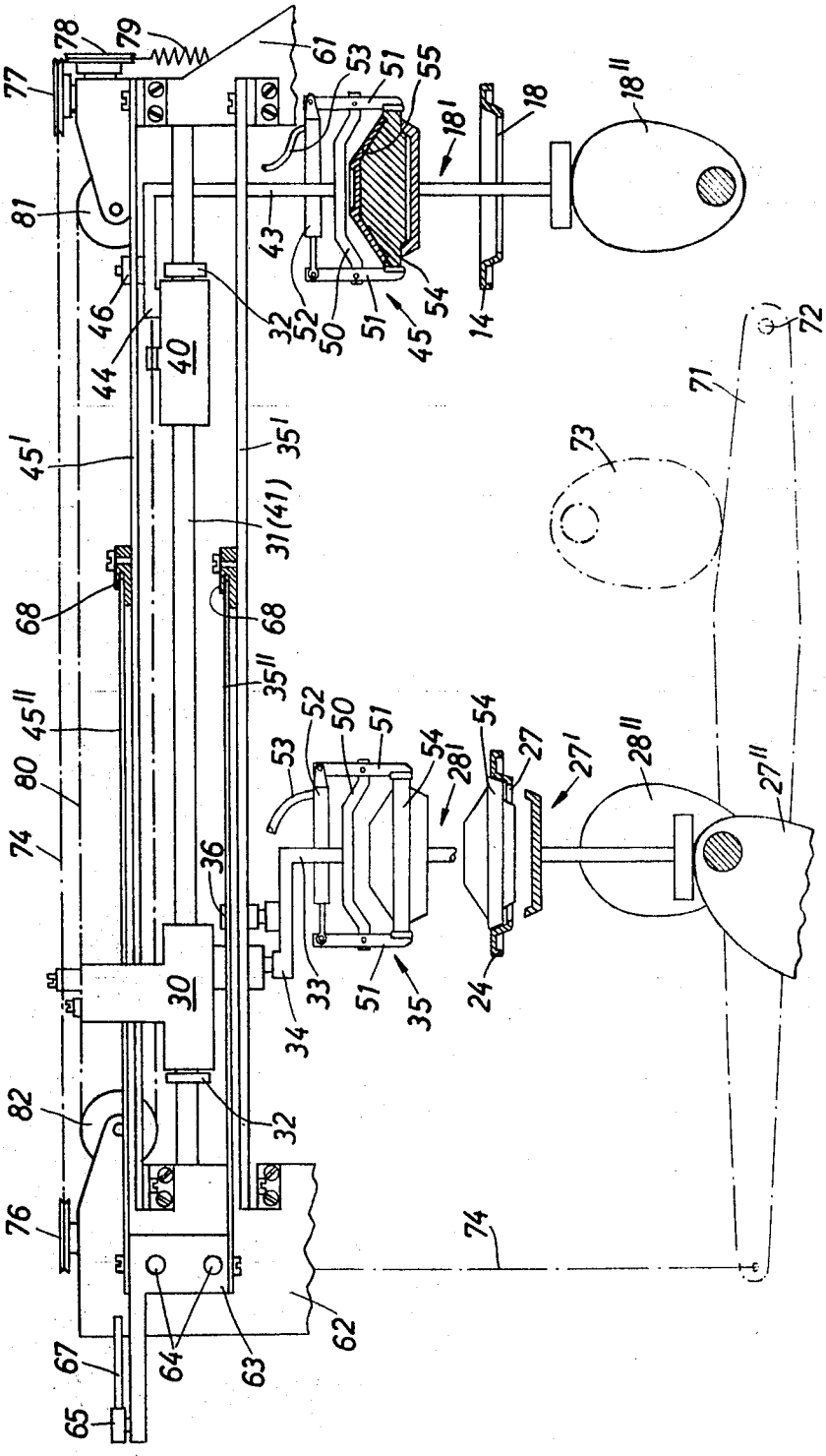

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Fig. 4

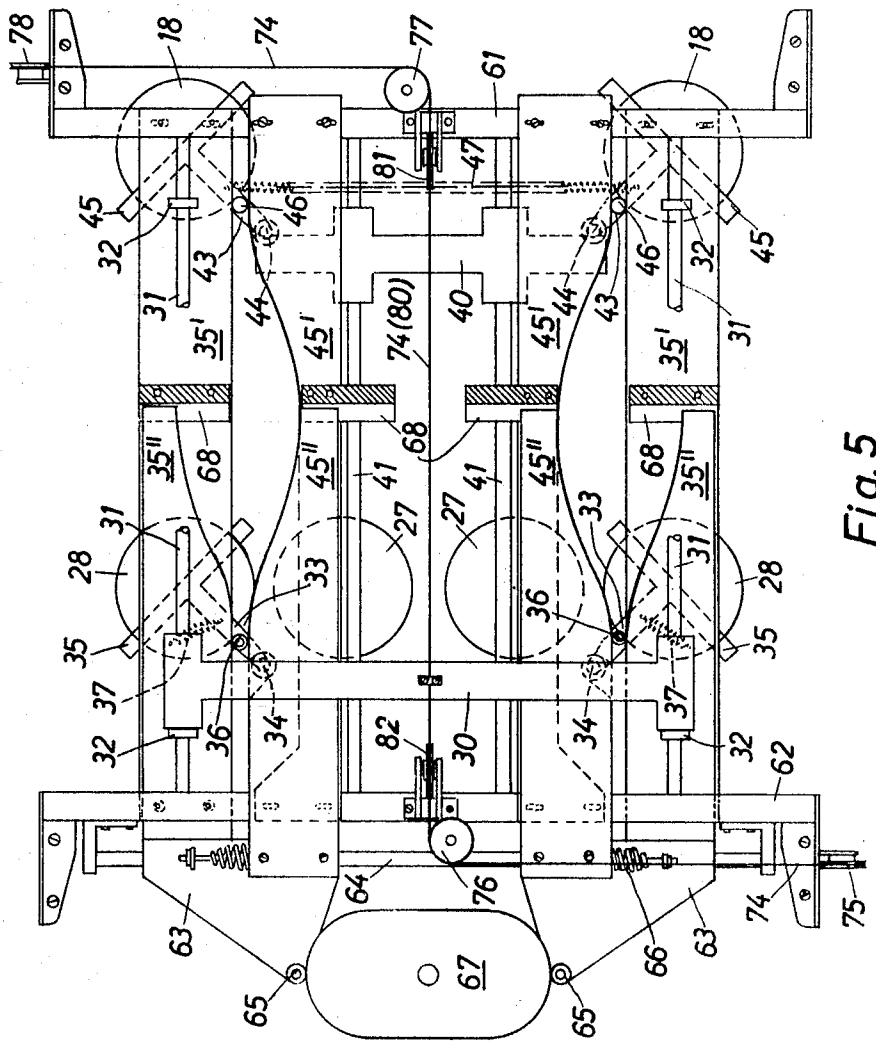

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Fig. 5

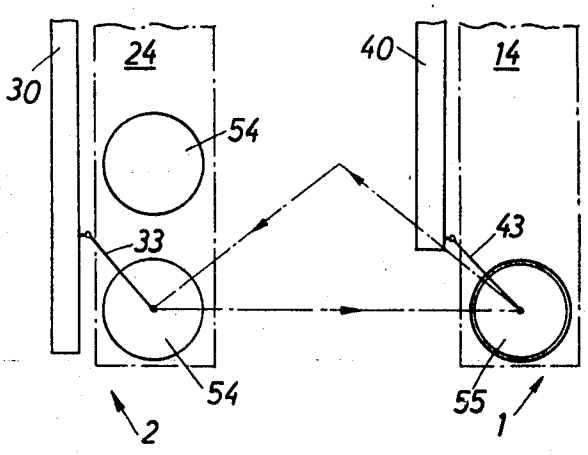


Fig. 6a

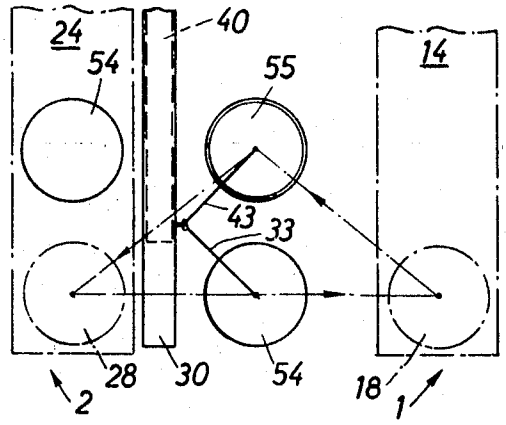


Fig. 6b

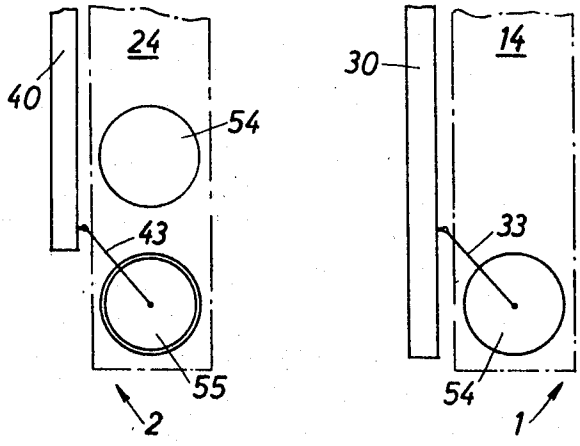


Fig. 6c

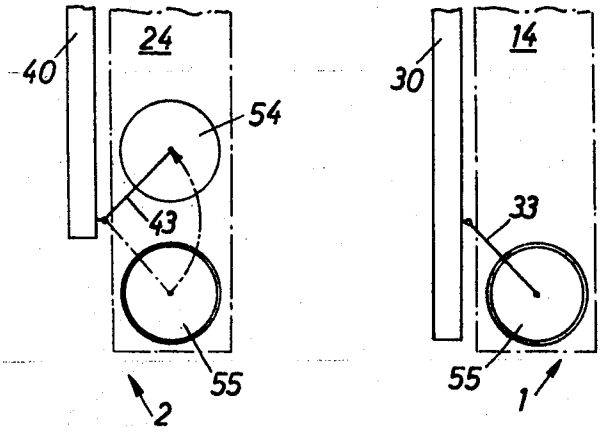


Fig. 6d

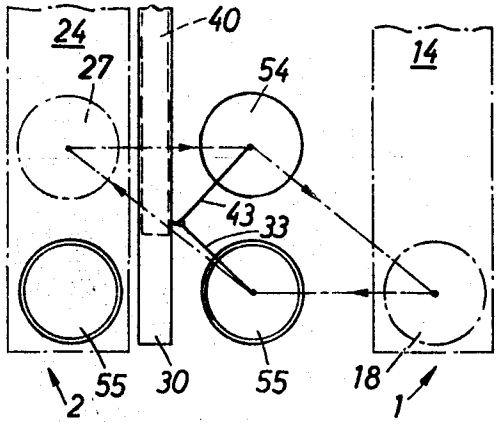


Fig. 6e

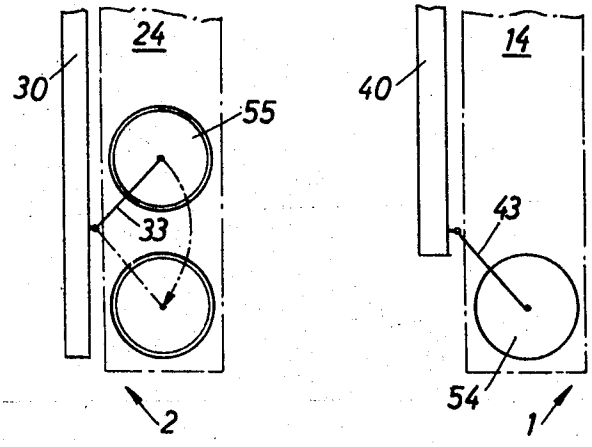


Fig. 6f

Fig. 7a

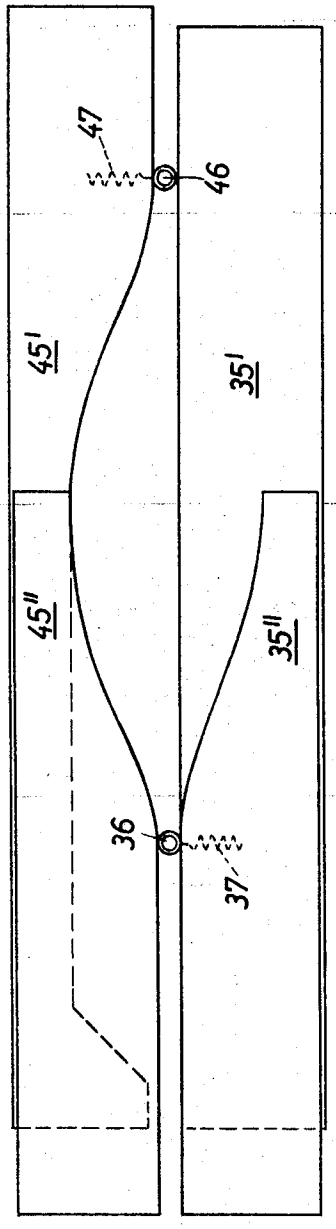
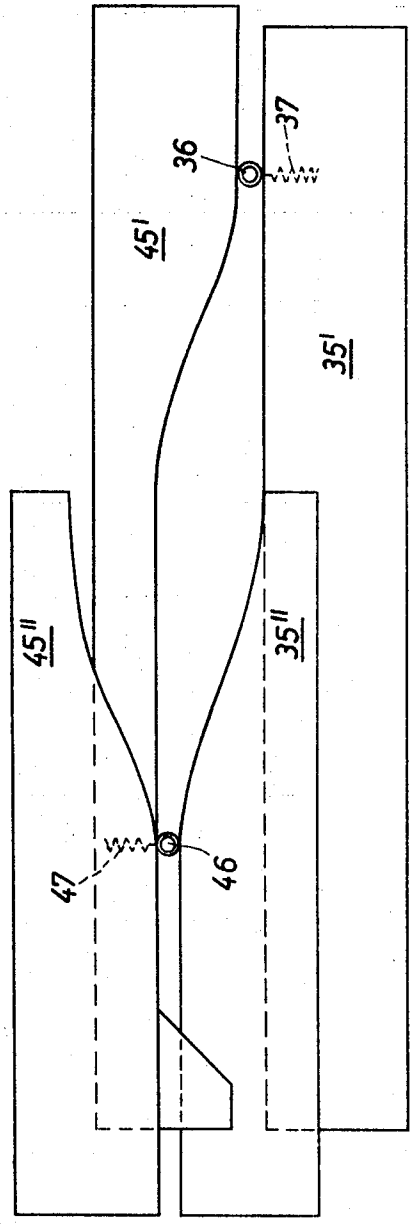


Fig. 7b



TRANSFER APPARATUS FOR EXCHANGING ARTICLES BETWEEN TWO CONVEYORS

This invention relates to transfer apparatus for exchanging articles between two conveyors. One application, to which the invention is particularly though not exclusively applicable, is to apparatus for transferring molds for ceramic blanks or the like between a first conveyor, for instance associated with a molding machine, and a second conveyor which is associated, for instance, with a drier, and receives molds occupied by blanks from the first conveyor and delivers empty molds back to it, twice as many molds being disposed one beside the other on the second conveyor as on the first conveyor.

According to the present invention, in transfer apparatus for exchanging articles arranged in one line along a first conveyor with articles arranged in two or more lines along a second conveyor, the conveyors are advanced step by step but the second conveyor is advanced only at alternate steps of the first conveyor.

Thus, in one form of the invention, transfer apparatus for exchanging articles arranged in one line along a first conveyor of endless chain type with articles arranged side by side in two or more lines along a second conveyor, also of endless chain type, arranged in line with the first conveyor end to end, includes means for plates each conveyor step by step by a distance corresponding to the spacing of the articles in a line, a step of the second conveyor only being effected with alternate steps of the first conveyor, means for transferring articles from the first conveyor to a first passing position between the conveyors and then alternately to whichever line of the second conveyor has a vacant place, and means for transferring articles alternately from one or the other line of the second conveyor to a second passing position laterally spaced from the first passing position, and then to the line of the first conveyor.

More particularly in the ceramics industry, the automation of manufacturing process is faced with the problem that a processing system, which acts on each individual workpiece for only a brief time, must be interlinked with another apparatus, which treats each individual workpiece for a very much longer period of time. This applies, for instance, to the manufacture of plates from ceramic blanks. The plates are formed in a few seconds by a molding machine and then, while still lying on their molds, they must stay in a drier until they have attained the so-called leather-hard condition in which they can be removed from the molds for further processing, whereafter the molds are returned to the molding machine and used there again. In an instance of this kind it would not be advisable to make the same conveyor, which conveys the molds with the blanks away from the molding machine and returns empty molds thereto, to run through the drier also, since the view of the relatively high conveying speed of the conveyor, adapted to the operating speed of the molding machine, the distance covered by the conveyor in the drier would have to be very long for the blanks to stay long enough in the drier. When using a common conveyor for the molding machine and the drier, conditions in the drier become particularly unfavorable if it is associated with a modern molding machine, which simultaneously processes two or more blanks arranged side by side on the conveyor, the blanks being arranged in a number of longitudinal lines along the conveyor. In this case the distances between the individual molds transversely of the conveying direction must be substantially larger than the space required for each individual mold, so that the individual molding devices do not impede one another. If the same conveyor also passes through the drier, the space left between two molds disposed one beside the other on the conveyor is not used in the drier.

It is, therefore, convenient for the molds with the blanks to be conveyed through the drier by a separate conveyor on which twice as many molds are disposed one beside the other as on the conveyor of the molding machine.

By means of this invention, the molds delivered with the blanks from one conveyor can be exchanged for the empty molds returned by a second conveyor in a very simple and reliable manner.

In one convenient form the apparatus includes two carriers (which may, for example, be arranged to grip the articles) arranged to reciprocate horizontally in opposite directions between the two conveyors so that while one carries an article from the first conveyor to the second conveyor, the other carries an article from the second conveyor to the first conveyor; the paths of the carriers being chosen so as to avoid one another. Each carrier may be supported by a carriage mounted to travel in a direction parallel to the length of the conveyor, the carrier being mounted to move transversely relative to the carriage to align itself with either line of articles on the second conveyor and to avoid collision with the companion carrier.

As indicated above, the invention is applicable in cases where articles are arranged in two longitudinal lines on the first conveyor and in four longitudinal lines on the second conveyor. In such a case the apparatus may include four carriers carried in pairs by two carriages one of which forms a bridge below which the other can pass. Thus each carrier may be associated with one longitudinal line of articles on the first conveyor and two longitudinal lines of articles on the second conveyor on one side of its longitudinal central plane. The carriages may be connected to the two runs of an endless belt (such as a chain) so as to be simultaneously moved in opposite directions. This provides a simple means of avoiding inaccuracy in matching the timing of the movements of the carriages. Conveniently each carrier is mounted on a pivoted arm the pivotal axis of which lies in the vertical central plane between the two longitudinal lines of articles of the second conveyor. The pivotal axis may itself be vertical.

In one form of the invention the transverse movement of a carrier is controlled by a cam follower cooperating with a stationary cam rail extending in the direction of movement of the carriage, at least a part of the cam rail being movable to modify the transverse movement of the carrier so as to pick up or deliver articles to or from different lines in the second conveyor in alternate steps. The two movable cam rails associated with carriers that pass one another on each movement of the carriages may be attached to a common transverse carriage. Where the first conveyor has two longitudinal lines of molds and the second transverse carriages moving in opposite directions and associated respectively with the carriers on opposite sides of the longitudinal central plane.

The transverse movements of each carrier can be controlled by moving the whole of the cam rail associated with it. The cycle of movement required is, however, achieved more simply if the movable cam rail extends along half the distance of travel of the carriages and in one position forms a continuation of a fixed cam rail at the center. In this way the inert mass of the movable cam rails can be reduced so that they can be more readily reciprocated in rapid succession.

Conveniently, particularly in the case of molds for ceramic blanks, each article is retained on the conveyors in a recess from which it can be removed only in an upwards direction. To avoid the necessity for the grippers to reciprocate vertically as well as horizontally, each conveyor may be provided with one or more lifters which can be moved upwards through holes in the conveyor to lift an article to a carrier or lower it from a carrier. If the second conveyor carries four lines of articles side by side, two inner lifters can reciprocate vertically alternately with two outer lifters.

The invention may be put into practice in various ways but one specific embodiment will be described by way of example with reference to the accompanying drawings in which:

FIG. 1 is a highly simplified side elevation of the two adjacent ends of two conveyors and a transfer device interconnecting the conveyors;

FIG. 2 is a plan view corresponding to FIG. 1, omitting the transfer device;

FIG. 3 is a diagrammatic section, to a somewhat enlarged scale, taken along the line III–III in FIG. 1, with further details;

FIG. 4 is a side elevation of the transfer device, showing further details;

FIG. 5 is a plan view corresponding to FIG. 4;

FIGS. 6*a*—6*f* are diagrams showing in a simplified manner details of FIG. 5 at various successive times; and

FIGS. 7*a* and 7*b* are also diagrams showing different details of FIG. 5 at successive times.

The object of the embodiment illustrated is to exchange molds, each of which is occupied with a ceramic blank and is disposed on a first conveyor **1**, for empty molds disposed on a second conveyor **2**. The first conveyor **1** runs through a known molding machine (not shown) in which ceramic disc-shaped blanks are deformed into plates, and the second conveyor **2** runs through a known drier (not shown) in which enough moisture is removed from the blanks to enable them to so moved from the molds in the so-called leather-hard condition. Of the two conveyors **1**, **2**, in each case two deflecting wheels **10**, **20** spaced apart along a common shaft are shown, over which chains **11**, **12**; **21**, **22** run. Suspended from the two chains of each conveyor at uniform distances are oscillating plates **13—15**; **23—25** which will be conventionally referred to as swings. Each of the swings of the first conveyor **1** is formed with two mold recesses **18** disposed symmetrically on opposite sides of the common central plane of the two conveyors; in contrast, each of the swings of the second conveyor **2** is recesses **27** and two outer recesses **28**, also symmetrically arranged.

The transfer device comprises two carriages **30**, **40** each of which is provided with two carriers in the form of grippers for the molds, and which can move between end positions on two guide rods **31**, **41** extending parallel to the lengths of the two conveyors **1**, **2**. The two end positions of one carriage **30** are determined by end stops **32** adjustably attached to the associated guide rods **31**. As shown diagrammatically in FIG. 3, the two carriages **30**, **40** are do disposed symmetrically in relation to the common central plane **26** of the two conveyors that one carriage **30** bridges the second carriage **40** and can be moved over it without touching it. Two gripper arms **33**, **43** are pivotally mounted on each of the two carriages **30**, **40**. The pivoting axes **34**, **44** of the gripper arms **33** each extend vertically exactly in the center between the two planes in which the inner and outer recesses **27**, **28** on each side of the longitudinal central plane are disposed. At the bottom of each gripper arm **33**, **43** is a gripper **35**, **45**. Also disposed on each gripper arm **33**, **43** is arm, at a distance from its pivoting axis **34**, **44**, is a cam follower **36**, **46**. Each of the two gripper arms **33** is so connected by a spring **37** to its gripper carriage **30** that the arms **33** tend to pivot away from one another; in contrast, the two gripper arms **43** are interconnected by a spring **47** so as to tend to pivot towards one another (see FIG. 5).

Each of the grippers **35**, **45**, which are identical, includes a yoke **50** which is attached to the associated gripper arm **33**, **43** and, pivoted to each end of the yoke is a two-armed lever **51**. The top ends of the two levers **51** of each gripper are so interconnected by a pneumatic piston-and-cylinder unit **52**, that when compressed air is supplied to the cylinder via a flexible hose **53**, the bottom arms of the levers come towards each other and grip a mold **54**, made, for instance, of gypsum. The mold, shown in FIG. 4 as held by the gripper **35**, is empty, while the mold held by the gripper **45** is occupied by a freshly molded plate **55**.

To enable the grippers **35**, **45**, which can move only in a in plane in the embodiment illustrated, to engage with the gypsum lever **71** **54**, which are normally disposed in the recesses **18**; **27**, **28** of the two conveyors **1**, **2**, and to lower the molds carefully again into the recesses, after they have been exchanged between the conveyors, a lifter **18'**; **27'**; **28'** is associated with each recess in that particular swing **14**; **24** of each conveyor which is in the transfer position. The lifters are mounted to move up and down between an upper position, shown in FIG. 4 for the lifters **18'**, **28'**; and a lower position shown for the lifter **27'**. The two lifters **18'** associated with the recesses **18** in the swing **14** of the first conveyor **1** are rigidly connected to one another and controlled by a common cam disc **18''**; correspondingly, the two lifters **27'** associated with the inner recesses **27** in the swing **24** of the second conveyor **2**, and the two lifters **28'** associated with the outer recesses **28** in the swing **24**, are interconnected in pairs and controlled by a cam disc **27''**, **28''**.

The guide rods **31**, **41** of the two carriages **30**, **40** in attached to two fixed bridges **61**, **62** spaced apart, and lever **71** transversely over the adjacent ends of the two conveyors **1**, **2**. Attached to the bridges **61**, **62** is a bottom fixed cam rail **35'** for each gripper **35** of the upper carriage **30**, and a top fixed cam rail **45'** for each gripper **45** of the lower carriage **40**. As shown in FIGS. **5** and **7**, the two bottom fixed cam rails **35'** are straight, while the two top fixed cam rails **45'** have curved portions in their centers. Part of each bottom fixed cam rail **35'** is covered by a bottom movable cam rail **35''**, and part of each top fixed cam rail **45'** is covered by a top movable cam rail **45''**. The movable cam rails **35''**, **45''** each extend symmetrical only over half the length of the associated fixed cam rail **35'**; **45'**, are summetrical in pairs in relation to one another, and are attached in pairs to two transverse carriages **63**. The two transverse carriages **63** can be displaced on guide rods **64** which extend parallel with the bridge **62** to which they are attached. Mounted on each transverse carriage **63** is a cam follower roller **65** which bears against a cam disc **67** under the force of a spring **66** interconnecting the two transverse carriages. Attached to each fixed cam rail **35'**, **45'** is a transverse guide **68** in which the associated movable cam rail **35''**; **45''** is guided.

The drive for the movement of the two gripper carriages **30**, **40** in opposite directions along the guide rods **31**, **41** comprises a lever **71** (FIG. 4) which can pivot around a fixed axis **72** and bears against a cam disc **73**. Attached to the free end of the lever **71** is the end of a cable **74** which runs over two pulleys **75**, **76** mounted on the bridge **62**, and over two pulleys **77**, **78** mounted on the bridge **61**, and has its other end connected through a tension spring to a fixed point. Between the two deflecting rollers **76**, **77** the cable **74** is attached to the upper gripper carriage **30**. Attached to the lower gripper carriage **40** is the bottom run of an endless chain **80** which runs over two pulleys **81**, **82** on the two fixed bridges **61**, **62** and whose top run is attached to the upper gripper carriage **30**.

The apparatus described operates as follows:

The two conveyors **1**, **2** are moved by a drive, which can be of conventional construction (not shown), in steps corresponding to the spacing between adjacent groups of swings **13—15**; **23—25**, in such a way that the second conveyor **2** performs a step only during or after each alternate step of the first conveyor **1**. The cam disc **73** is so connected to the drive of the two conveyors, that at or after each step of the first conveyor **1** the cam disc **73** performs half a rotation, so that the lever **71** occupies its lower position (shown in FIG. 4) after one step by the first conveyor, and its upper position after each following step. Correspondingly, each of the two gripper carriages **30**, **40** occupies after a step by the first conveyor its position shown in FIGS. **4** and **5** and exchanges these positions after the next step of the first conveyor.

The cam disc **67**, symmetrical about its axis of rotation, also performs a quarter of a revolution at or after each step by the first conveyor **1**, so that the two transverse carriages **63** also reciprocate horizontally in opposite directions with each pair of cam rails **35''**, **45''** in time with the conveyor movement.

The cam followers **36**, **46** of the gripper arms **33**, **43**, bear against the two associated cam rails **35'**, **35''**; **45'**, **45''** under the force of the springs **37**, **47**, and are pivoted in the manner shown in FIGS. **6***a*—**6***f* during the reciprocating movement of the gripper carriages **30**, **40** on the one hand and the transverse carriages **63** on the other. FIGS. **6***a*—**6***f* show in a simplified manner only the lower halves of the carriages **30**, **40** as shown in FIG. **5**, and of the swing **14**; **24** of the two conveyors **1**, **2** which happens to occupy the transfer position. In FIGS.

6a—6f an empty recess 18; 27 or 28 of the swings 14, 24 is shown in each case by a chain-dot circle, while an unoccupied gypsum mold 54 is shown by a solid circle, and a gypsum mold occupied by a plate 55 is shown by two concentric solid circles.

The position of the gripper carriages 30, 40 and the grippers 33, 43 in FIG. 6a corresponds to the position shown in FIG. 5, in which the gripper 35 is suspended from the gripper arm 33 has taken an empty mold 54, from the swing 24 of the second conveyor 2, and the gripper 45 suspended from the gripper arm 43 has taken a mold occupied by a workpiece 55 from the swing 14 of the first conveyor 1.

As the two carriages 30, 40 now move to a passing position, one above the other, the gripper arm 33 moves to the right without pivoting, since its cam follower 36 runs along the straight fixed cam rail 35', as shown in FIG. 7a. On the other hand, the gripper arm 43 which simultaneously moves to the left, pivots through about 90° in an anticlockwise direction, as shown in FIG. 6b, since its cam follower 46 runs along the recessed fixed cam rail 45', as shown in FIG. 7a. This pivoting of the gripper arm 43 serves to prevent a collision between the two meeting grippers and the molds carried thereby.

During the second half of the movement away from the passing positions shown in FIG. 6b to the position of FIG. 6cthe cam follower 46 running up along the curved movable cam rail 45'', pivots it back to its initial position. After the first change of position of the two carriages 30, 40, the gripper arms 33, 43 occupy the position shown in FIG. 6c in which the gripper 35 passes the empty mold 54 to the lifter 18', which at that moment occupies its upper position as shown in FIG. 4; at the same time the gripper 45 delivers the mold occupied by a plate 55 to the lifter 28', which also occupies its upper position. Then the two lifters 18', 28' lower the molds into the corresponding recesses 18; 28 in the swing 14; 24 and move into their lower positions, as shown for the lifter 27' in FIG. 4.

The first conveyor 1 then moves on by one step in the direction indicated by the arrow in FIG. 1, so that the swing 14 is previously in the transfer position passes into the position 15, while a fresh swing 13, which bears a mold occupied by a plate 55 on each side of the longitudinal central plane 26 moves into the transfer position 14. At the same time, the cam rails 35''; 45'' move out of their position shown in FIGS. 5 and 7a into the position shown in FIG. 7b. The cam follower 46 of the gripper arm 43 takes part in this displacement of the movable cam rails 35''; 45'', so that, as shown in FIG. 6d, the gripper arm 43 is again pivoted through about 90° anticlockwise, and the associated gripper 45 arrives above an empty mold 54 which has been raised by the lifter 27' from an inner recess 27 in the swing 24.

As soon as the grippers have taken the molds, the lifters 18', 27' are again lowered by their cam discs 18''; 28'', and the carriages 30, 40 start a fresh longitudinal movement.

As the carriages are approaching one another, to the passing position of FIG. 6e, the gripper arms 33, 43 remain in their angular position, as the cam follower 36 rides on the straight edge of the fixed cam rail 35', and the cam follower 46 rides on the straight edge of the fixed cam rail 45', as shown in FIG. 7b, so that the grippers 35, 45 with the molds pass one another.

When the upper carriage 30 has moved over the lower carriage 40, and the carriages are again moving away from one another, the cam follower 36 of the gripper arm 33 runs up along the movable cam rail 35'', and the cam follower 46 of the gripper arm 43 runs along the curved portion of the fixed cam rail 45' (shown on the right-hand side in FIGS. 5 and 7b), so that both gripper arms 33, 43 perform a pivoting movement and arrive in the position shown in FIG. 6f where they each deliver the mould which they are carrying to a lifter 27'; 18'.

As soon as this has been done, and all the lifters have arrived at their lower positions, the two conveyors 1 and 2 both move on by one step. At the same time the cam rails 35''; 45'' move out of their position shown in FIG. 7b back into the position shown in FIG 7a, and cause the gripper arm 33 to pivot in the direction indicated by the arrow in FIG. 6f, thus returning to the starting condition shown in FIG. 6a, so that a fresh cycle can start.

It will be obvious to those skilled in the art that various changes may be made without departing from the scope of the invention and the invention is not to be considered limited to what is shown in the drawings and described in the specification.

What we claim is:

1. Transfer apparatus for exchanging articles arranged in a line along a first endless conveyor with articles arranged in n equals two or more lines along a second conveyor, including means for advancing each conveyor step by by a distance corresponding to the spacing of the articles in a line on it, a step of the second conveyor being effected only at each n^{th} step of the first conveyor, and means for exchanging articles between the first and second conveyor in a cycle such that an article on the first conveyor is exchanged for an article in one line on the second conveyor, the first conveyor is then advanced a step, and the next article in the same line on the first conveyor is then exchanged for an article in a different line on the second conveyor.

2. Apparatus as claimed in claim 1 in which each conveyor is provided with one or more lifters which can be moved upwards through holes in the conveyor to lift an article to a carrier or lower it from a carrier.

3. Apparatus as claimed in claim 1 for exchanging articles arranged in one or more lines along a first conveyor of endless chain type with articles arranged in twice as many lines along a second conveyor, also of endless chain type, arranged in line with the first conveyor end to end, a step of the second conveyor only being effected with alternate steps of the first conveyor, the exchanging means including means for transferring articles from a line of the first conveyor to one of two passing positions which are laterally spaced from one another between the conveyors, and thence to one line of the second conveyor while transferring an article from the said line of the second conveyor to the other passing position, and thence to the said line of the first conveyor and thereafter transferring an article from the same line of the first conveyor to one of the passing positions and thence to another line of the second conveyor, while transferring an article from the said other line of the second conveyor to the other passing position and thence to the same line of the first conveyor.

4. Apparatus as claimed in claim 3 including two carriers arranged to reciprocate horizontally in opposite directions between the two conveyors so that while one carries an article from the first conveyor to the second conveyor the other carries an article from the second conveyor to the first conveyor, the paths of the carriers being chosen so as to avoid one another.

5. Apparatus as claimed in claim 4 in which each carrier is supported by a carriage mounted to travel in a direction parallel to the length of the conveyor, the carrier being mounted to move transversely relatively to the carriage to align itself with either line of articles on the second conveyor and to avoid collision with the companion carrier.

6. Apparatus as claimed in claim 5 in which the two carriages are connected to the two runs of an endless belt so as to be simultaneously moved in opposite directions.

7. Apparatus as claimed in claim 5 in which the transverse movement of a carrier is controlled by a cam follower cooperating with a stationary cam rail extending in the direction of movement of the carriage, at least a part of the cam rail being movable to modify the transverse movement of the carrier so as to pick up or deliver articles to or from different lines in the second conveyor in alternate steps.

8. Apparatus as claimed in claim 7 in which the two movable cam rails associated with carriers which pass one another on each movement of the carriages are attached to a common transverse carriage.

9. Apparatus as claimed in claim 7 in which each movable cam rail is associated with a fixed cam rail which in one posi-

tion of the movable cam rail forms the sole guide for the cam follower.

10. Apparatus as claimed in claim 9 in which the movable cam rail extends along half the distance of travel of the carriages and in one position forms a continuation of the fixed rail at the center.

11. Apparatus as claimed in claim 7 in which the cam rails for a pair of carriers comprise fixed cam rails having portions operative irrespective of the position of any movable portions for guiding one carrier between the position of an article on the first conveyor and a first passing position, and the other carrier between the said position of such an article and a second passing position

12. Apparatus as claimed in claim 11 in which each fixed cam rail has a further portion which is straight and serves to guide the respective carrier from the position of an article in one or other line on the second conveyor and one or other passing position which is aligned therewith, and which includes movable cam rails one or other of which is advanced to mark the associated straight fixed portion and is curved to guide its carrier between the same passing position and the position of an article on the second conveyor in a line not in line with the said passing position.

13. Apparatus as claimed in claim 11 in which one of the passing positions is aligned with that of articles on the first conveyor and the fixed portion of the cam rail guiding a carrier between those positions is also straight.

14. Apparatus as claimed in claim 4 in which each carrier is mounted on a pivoted arm, the pivotal axis of which lies in the vertical central plane between the two longitudinal lines of articles of the second conveyor.

15. Apparatus as claimed in claim 14 in which the pivotal axis of the arm is vertical.

16. Apparatus as claimed in claim 3 arranged to exchange articles arranged in two longitudinal lines on the first conveyor with articles arranged in four longitudinal lines on the second conveyor.

17. Apparatus as claimed in claim 16 including four carriers carried in pairs by two carriages one of which forms a bridge below which the other can pass.

18. Apparatus as claimed in claim 16 in which each carrier is associated with one longitudinal line of articles on the first conveyor and two longitudinal lines of articles on the second conveyor on one side of its longitudinal central plane.

19. Apparatus as claimed in claim 16 including two separate transverse carriages moving in opposite directions and associated respectively with the carriers on opposite sides of the longitudinal central plane.

20. Apparatus as claimed in claim 16 in which cam rails for guiding a pair of carriers comprise fixed cam rails having portions operative irrespective of the position of any movable portions for guiding one carrier between the position of an article on the first conveyor and a first passing position, and the other carrier between the said position of such an article and a second passing position, and in which two inner lifters can reciprocate vertically alternately with two outer lifters of the second conveyor.

21. Apparatus as claimed in claim 3 in which each conveyor is provided upwards with one or more lifters which can be moved upwards through holes in the conveyor to lift an article to a carrier or lower it from a carrier.

22. Apparatus as claimed in claim 1 including two carriers arranged to reciprocate in opposite directions between the two conveyors so that while one carries an article from the first conveyor to the second conveyor the other carries an article from the second conveyor to the first conveyor, the paths of the carriers being chosen so as to avoid one another.

23. A conveyor system for conveying molds for ceramic blanks past a molding machine and a drier, including a first conveyor on which the molds are arranged in one or more longitudinal lines, a second conveyor on which they are arranged in a greater number of longitudinal lines, and, for exchanging molds between the two conveyors, transfer apparatus as claimed in claim 1.

24. A system as claimed in claim 23 in which the second conveyor has four longitudinal lines of molds, and the first conveyor has two such rows spaced apart a distance equal to the spacing between the outermost rows on the second conveyor.