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54 **A method and machine for automatic setting of bricks on a supporting layer.**

57 The application disclosed a method and machine for the automatic setting of bricks onto a supporting layer. So far, prefabricated wall panels have been made by setting the bricks manually into a mold equipped with brick compartments and intended for the said panel. A separate mold had to be prepared for each different panel shape.

The object of the present invention is to facilitate, speed up and decrease the cost of the setting of bricks. In the machine according to the invention, the method is carried out by feeding into a cassette conveyor (1, 2, 3, 4) a batch of filled cassettes, of which the first is directed to below the brick take-off device (5). When the cassette conveyor is full and the first cassette is under the take-off, the automatic operation of the machine is started. The brick take-off lifts the topmost brick layer from the cassette and lowers it onto a brick conveyor (6), wherefrom the brick rows are directed onto a transverse belt conveyor (8). A rotating wheel (9) has been fitted to receive one brick at a time into a compartment at its periphery and, after rotating half a round, to lower it onto a flight conveyor (10). The flight of the flight conveyor takes the brick fed by the turning device, or remains vacant if the rotating wheel has been programmed not to rotate and not to deliver a brick onto the flight. A full row of bricks is formed on the flight conveyor, and a pushing device (11) pushes the row onto a centering table (12), on which the distances between the bricks are evened out. A pick-up device above lifts the centered bricks, centering them in their longitudinal direction, and lowers them into the mold in one, two or several batches, in accordance with the desired bond, the machine moving forward one step between the lowerings in accordance with the programmed bond. The machine stops at the latest upon the panel being completed and also

upon the cassettes having been emptied.

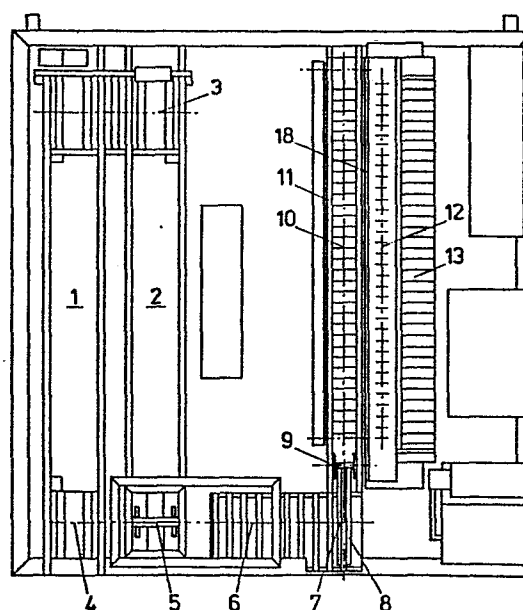


Fig. 1

A method and machine for automatic setting of bricks on a supporting layer

The present invention relates to a method and machine for automatic setting of bricks on a supporting layer, as indicated in the preambles of accompanying Claims 1 and 8.

In casting panels from bricks or the like, it has so far been necessary to make molds provided with brick compartments, into which the bricks have been disposed manually. This is heavy and relatively slow work, and the making of the molds is very laborious. In addition, it is necessary to make separate molds for each different shape and dimension of wall panels. This slows down the manufacture of wall panels and makes it more expensive.

The object of the present invention is to speed up the making of panels and to simplify the adjustment of the dimensioning of the molds.

This has been achieved by the method according to the invention and the machine according to the invention for carrying out the method. The main characteristics of these are given in the characterizing parts of accompanying Claims 1 and 8.

The method is based on a logic-controlled system in which cassettes fed onto the cassette conveyor of the machine are emptied automatically and the bricks set onto the brick conveyor are directed automatically one by one into a turning device and further onto the following brick conveyor, into a row which corresponds to one transverse row in a wall panel, as seen in the manufacturing direction of the panel to be formed, i.e. one vertical row as seen in the using position. The formed row is transferred all at one time into a centering

device which has separate centering devices for each brick space, in which the position of the brick is centered in relation to the centering devices, and in the transverse direction the distances between the center points of the bricks become the same for all bricks. A pick-up device which is located above the centering device and has pick-up means for each brick space, grips the bricks, centers them in the longitudinal direction, and lowers them, in a controlled manner, onto the base in the mold in accordance with the programmed setting pattern. The mold is an open mold without any compartments or partitions.

It is possible to form in the panel rectangular openings of different sizes, and the setting pattern can be, for example, stack bond (a straight pattern of bricks), or 1/2 running bond or 1/3 running bond. For forming a certain panel, the logic control of the machine is given the data of the panel, i.e. the length and the height, the dimensions of the openings, and the bond. A certain control, of course, works only with bricks of a certain size. The machine works normally with lime sand and clay bricks 85 x 285 x 16-45. For bricks of different thicknesses, certain adjustments must be made in the machine. The machine can also be adjusted to work with bricks of 60 mm, 75 mm or any other size, in which case certain devices must be replaced.

The machine is driven by electric, pneumatic and hydraulic devices. The machine has a compressor and a hydraulic mechanism, and only electric power needs to be introduced into it via a cable or conductor rails.

The machine, drawn by a hydraulic motor, moves above the mold on rails installed on both sides of the mold. The travel distance in the machine is measured by a pulse sensor from a measuring wheel which also moves along the rail, together with the machine.

The control panel of the machine has switches for all of the actuating devices of the machine, and so the machine can also be controlled manually.

The efficiency of the machine is in the order of one brick site per second.

A preferred embodiment of the machine according to the invention is described below with reference to the accompanying figures, in which

Figure 1 depicts a plan view of the machine.

Figure 2 depicts, on a larger scale, a vertical section of the centering device of the machine, and

Figure 3 depicts a partial section along line III-III in Figure 2.

The same reference numerals are used in the different figures to indicate the corresponding parts.

In Figure 1 the cassette conveyors are indicated by reference numerals 1 and 2 and the crosswise conveyors by numerals 3 and 4. A cassette (not shown) filled with bricks is lifted to the beginning of the cassette conveyor 1, on top of the roller chains. The conveyor is started and the conveyor rotates until the stepping limit stops it. After the conveyor has stopped, a new cassette is lifted to the beginning of the conveyor and the conveyor is restarted. This procedure is continued until the first cassette on the conveyor 1 reaches the end of the conveyor 1 and comes above the crosswise conveyor 3 which, lifted by a pneumatic cylinder, rises and transfers the cassette to the beginning of the cassette conveyor 2. Thereupon the crosswise conveyor 3 is lowered and the cassette is left on the cassette conveyor 2. The cassette conveyor 2 conveys the cassette until the stepping limit on the conveyor stops it, where-

upon the crosswise conveyor can transfer the next cassette to the beginning of the conveyor 2. The filling of the cassette conveyors 1 and 2 continues in this manner until the first cassette has come under the brick take-off device 5 at the end of the cassette conveyor 2, where the limit stops the cassette. The first site on the conveyor 1, alongside the brick take-off 5, is, however, left vacant so that the first cassette to be unloaded can, after being emptied, be transferred to it. The cassettes circulating on the cassette conveyor, numbering thirteen when the conveyor is full, thus gradually become empty cassettes. After the last cassette has been emptied, the empty cassettes are removed from the conveyor and a new batch of full cassettes is fed to replace them.

When the first cassette has arrived under the brick take-off, the automatic operation of the machine can be switched on and the machine begins the setting of bricks.

The brick take-off 5 lifts from the brick cassette being unloaded one layer of bricks at a time, in total 12 bricks, which have been arranged in two rows, the long side of the bricks being parallel to the conveying direction. The brick take-off is made up of a suction box fitted in a carriage moving above the cassette being unloaded and the brick conveyor 6 subsequent to it. The bottom of the suction box has 24 suction pads, 2 suction pads for each brick. The vacuum of the suction pads is produced in the suction box by means of a suction fan through a pipe. The suction box is secured to guides which move between the rollers of the carriage and by means of which a pneumatic cylinder lifts and lowers the suction box. The carriage is moved on runner rolls in guides in the frame of the brick take-off 5 by a pneumatic cylinder.

The suction box is lowered on top of the brick layer in the cassette, whereupon the bricks adhere to the suction pads. The suction box rises and is transferred to above the brick conveyor 6, where it is lowered. After the bricks have reached

the surface of the rollers, the suction ceases, the bricks are detached and the suction box rises to fetch a new layer of bricks from the cassette. When the suction box rearrrives above the brick conveyor it waits there until the bricks have moved away from the beginning of the brick conveyor, and then lowers new bricks onto the conveyor. The movement of the bricks on the brick conveyor 6, which is a chain-drawn roller conveyor, is controlled by light cells. The bricks travel on the chain conveyor until a light cell located before the next transverse conveyor, which is a belt conveyor 8, stops them if there are bricks on the belt conveyor. If there are no bricks on the belt conveyor, the end 7 of the brick conveyor 6 is raised by pneumatic boxes, and the bricks are transferred from the brick conveyor onto the belt conveyor 8, with the short side of the bricks first. The end 7 of the brick conveyor is relowered and the bricks remain on the belts.

By rotating the belt conveyor 8 the bricks are fed into the brick-turning device 9, which is a rotating wheel with 12 compartments at its periphery, into each of which there is fed in turn one brick, the long side first. After the bricks have been brought on the belt conveyor 8 into a compartment in the turning device 9, the cylinder of the turning device rotates it 30° and the next brick comes into the next compartment of the turning device. This procedure continues until there is a brick in five compartments of the turning device. When the turning device rotates the next time, the brick is in a position turned above a flight conveyor 10.

The turning of the brick has been included in the setting process for the reason that, during the transfer by means of suction pads, the smooth inner surface of the brick must be upwards in order for the suction pads to adhere to the brick. However, the smooth inner side is the surface which has to be against the bottom of the mold so that the upper surface having the desired pattern will become the upper surface of the panel.

The flight conveyor 10 is a closed conveyor driven by a hydraulic motor, having two groups of flights, one on the lower level and the other on the upper level. The two parallel chains of the chain track have flights at 100 mm distances. This 100 mm distance corresponds to a brick 85 mm wide, in which case a 15 mm casting clearance is formed between the bricks. Each group of flights has preferably 34 flights. The conveyor has plastic slide surfaces along which the bricks move, drawn by the flights.

When the flight conveyor begins to rotate, the brick which has arrived on the conveyor from the turning device remains in the flight and is moved forward. Each flight in turn gives, by means of a limit, an order to the turning device to rotate and thereby to lower a new brick onto the flight conveyor. The belt conveyor 8, the turning device 9 and the flight conveyor 10 operate synchronically in conjunction with one other. The upper level of the flight conveyor is gradually filled. A full row of the flight conveyor corresponds to a transverse row of bricks in the wall panel to be formed, i.e. a vertical row of bricks as seen in the position in which the wall panel is used.

When, according to the stacking pattern, no brick but a vacant site is desired on the flight conveyor, the limit is programmed to stop the turning device for the duration of one or more steps. After the flight conveyor has been filled, it stops when the first flight reaches the limit at the other end of the conveyor.

From the flight conveyor the brick row is transferred by means of a pushing device 11 to the centering table 12. The pusher is moved on guides located at its both ends by a pneumatic cylinder across the flight conveyor, pushing the bricks as one row onto the centering table. In order to ensure a straight movement of the pusher there is a toothed shaft installed across the pushing path, and a toothed stabilizing wheel has

been fitted to travel along it. When the pusher has reached its back limit it returns to the side of the flight conveyor, whereupon the stacking of a new row on the flight conveyor can begin.

On the centering table 12 the bricks come between centering springs situated at 100 mm distances, the distance between the center points of the bricks being evened out and set at 100 mm. Above the centering table there is a brick pick-up device, which is made up of a row of tongs 13. The number of tongs corresponds to the number of bricks fitting in one row to be set, which is thirty-four for 85 mm bricks. The jaws 14 of the tongs are closed and opened by a pneumatic cylinder. The tong-fastening piece, jaw piece 15, is secured to guides 16, which move in sleeves in the tong-supporting frame 17. The lowering movement of the tongs can be limited by means of a stopper at the upper end of the guides 16 and by means of a limiter 18, which is located alongside the guides 16 and is operated by a pneumatically working cylinder. The height of the limiter 18 is adjusted by means of screws at its both ends, according to the thickness of the bricks.

The tongs 13 lower over the distance determined by the limiter 18 onto the bricks, and the jaws 14 close around the bricks, at the same time centering them. The tongs immediately rise back, whereupon the centering table 12 moves to the side and the limiter of the pincers moves to its rear position. Of those tongs in which there is a brick, preferably only every second one lowers into the mold, where the jaws open and the bricks detach from them. When these tongs have risen, the remaining tongs with bricks take the bricks into the mold and leave them there. Thus a stacking pattern without overlap is obtained. All of the tongs can, of course, lower their bricks into the mold simultaneously, but this is less advantageous in terms of the pneumatic mechanism. When the setting pattern is something else than stack bond, the machine moves forward over the distance of a predetermined overlap between the lowerings of the tongs.

When a row of bricks has thus been set into the mold, the centering table 12 returns to below the tongs 13, and the brick row formed on the flight conveyor 10 during the lowering of the tongs is pushed onto it, while the machine moves to the area of the next row of bricks, and the next row of bricks can be lowered into the mold. The machine continues setting in this manner until the panel programmed into it has been completed, and the machine automatically shifts to set the next panel. There is a separate casting mold for each panel, and there are several molds in succession. Any necessary subsequent steps and casting are performed simultaneously on the molds, whereafter the panels are removed from the production line and the setting machine can start setting into empty molds. .

After a cassette below a brick take-off 5 has been emptied, it is moved by the cassette conveyor 4 to the vacant site at the beginning of the cassette conveyor 1. On the cassette conveyor 2 the next cassette moves to below the brick take-off. Thus the cassettes circulate on the cassette conveyor until all of the cassettes are empty.

The empty cassettes are removed from the cassette conveyor by manual control, and full cassettes are also loaded by manual control.

Claims

1. A continuous method for stacking bricks at desired distances and with a desired bond onto a supporting layer, for example in order to form a complete wall panel, in which method the bricks are arranged in cassettes and are picked out of them automatically and set onto the said layer, *characterized in* that the cassettes are fed onto a cassette conveyor (1, 2, 3, 4), that one layer of bricks at a time is lifted from the cassette to be unloaded and is transferred onto a brick conveyor (6) into one or several rows of bricks, from which the bricks, one at a time (preferably with the long side first), are transferred into a turning device (9) in order to turn the brick so that its lower surface becomes the upper surface, and further onto the next brick conveyor (10), in a number corresponding to the width of the brick pattern to be formed and at predetermined distances from one another, from which brick conveyor (10) the entire brick row at a time is transferred, keeping its orientation, laterally into a centering device (12) in order to even out the distances between the bricks in the vertical direction of the panel to be formed, in a manner known per se, from which centering device (12) the row of bricks is lifted by means of a pick-up device (13) and is lowered onto the base, in accordance with the desired bond, whereafter the next row of bricks fed onto the last-mentioned brick conveyor is in the same manner lifted and lowered onto the base by means of the pick-up device, the machine with its pick-up device moving, after each lowering onto the supporting layer, over a predetermined distance in relation to the layer, and that, after being emptied, the cassette is returned to the cassette conveyor (1, 2, 3, 4) and the next full cassette is transferred for unloading.

2. A method according to Claim 1, *characterized in* that the cassette conveyor is an endless rectangular conveyor (1, 2, 3, 4), a certain number of cassettes being fed onto its first branch (1), from which the

cassettes are transferred by a transverse conveyor (2) onto an adjacent branch (3) moving in the opposite direction, at the end of which branch the cassettes are unloaded, and that the cassette conveyor is filled with full cassettes, but so that the cassette site adjacent to the first cassette to be unloaded, as seen in the cassette circulating direction, is left vacant to receive the said first unloaded cassette.

3. A method according to Claim 1 or 2, c h a r a c t e r - i z e d i n that the bricks in a cassette are arranged in stacks in which the long side of the bricks is parallel to that brick conveyor (6) onto which the layers are transferred one by one to form one or several rows transverse to the travel direction of the brick conveyor, in accordance with the stacking arrangement of the brick layer, the first row being transferred from the said first brick conveyor (6) to another (8), transverse brick conveyor, from which the bricks are transferred one by one into the turning device (9).

4. A method according to Claim 3, c h a r a c t e r - i z e d i n that after the turning device (9) the bricks are transferred onto a third brick conveyor (10) by means of flights situated in it at distances of the desired brick space (height of a brick + clearance between the bricks) from one another.

5. A method according to Claim 3 or 4, c h a r a c t e r - i z e d i n that the turning device (9) works synchronically with the second brick conveyor (8), which feeds bricks onto the turning device, and with the flight conveyor (10) located at a point subsequent to the turning device, and that the turning device is programmable so that according to the desired brick pattern it delivers a brick or does not deliver a brick onto a flight in the third conveyor (10).

6. A method according to any of the above claims, c h a r - a c t e r i z e d i n that the brick row on the flight

conveyor is moved in a direction transverse to the longitudinal direction of the row into a centering device (12), in which the center point of the bricks sets in the middle of a preset brick space (height of a brick + clearance between the bricks).

7. A method according to any of the above claims, characterized in that the bricks centered in the transverse direction are lifted by means of a pick-up device (13), which centers the bricks in their longitudinal direction, that the centering device (12) moves to the side, and that the pick-up device lowers the bricks onto a supporting layer, preferably in two batches each comprising every second brick, or, the bond being one with overlap, according to the desired overlap, in which case the machine with its pick-up device moves forward over the desired distance after each lowering.

8. A continuous-working brick-setting machine for the automatic setting of bricks at the desired distance and with the desired bond onto a supporting layer, especially on the bottom of a casting mold, to form a complete wall panel, characterized in that the machine has a cassette conveyor (1, 2, 3, 4) for a certain number of cassettes; a moving brick take-off device (5), known per se, at the end of the cassette conveyor, the take-off lifting one brick layer at a time from the cassette to be unloaded and transferring it onto a brick conveyor (6); a turning device (9) which turns the bricks fed onto it preferably with the long side first, one at a time, so that their lower surface becomes their upper surface, and delivers them onto the next conveyor (10), which is preferably a flight conveyor known per se and which receives from the turning device (9) turned bricks in a number corresponding to the height of the panel to be set; a conveyor (8) which feeds bricks into the turning device, the turning device (9) and the flight conveyor (10) being mutually synchronized; that, further, the machine has a

centering device (12), known per se, onto which the brick row formed on the flight conveyor is transferred all at the same time by means of a pushing device (11), known per se, which is located alongside the flight conveyor and in which the bricks are centered in the transverse direction; a vertically moving pick-up device (13) which has tongs (14) or similar gripping means in a number corresponding to the spaces between the tongs, the gripping means lifting the transversely centered bricks from the centering table and at the same time centering them in the longitudinal direction and lowering them onto the supporting layer, the machine moving forward over the distance required by the desired overlap after the lowering, the functions of the machine being logic-controlled on the basis of panel dimensions fed into the logic.

9. A machine according to Claim 8, c h a r a c t e r - i z e d i n that the cassette conveyor (1, 2, 3, 4) is a rectangular conveyor, its first branch (1) being a chain conveyor from which there branches out perpendicularly a crosswise conveyor (2) which, lifted by pneumatic cylinders, can rise and transfer a cassette to the beginning of the third chain conveyor (3), which moves in the opposite direction and ends under the brick take-off device (5).

10. A machine according to Claim 8 or 9, c h a r a c t e r - i z e d i n that a brick layer lifted by suction pads is lowered onto the first brick conveyor (6), which is preferably a roller conveyor and the end (7) of which can be raised pneumatically in such a way that the rows of a brick layer can one after the other be transferred onto a transverse, second brick conveyor (8), which is preferably a belt conveyor.

11. A machine according to Claim 10, c h a r a c t e r - i z e d i n that the first brick conveyor (6) has light cells which prevent the suction pads from lowering their bricks onto the said brick conveyor before it is empty of bricks.

level when the group on the upper level has been filled.

18. A machine according to Claim 17, c h a r a c t e r - i z e d i n that the flight conveyor (10) has been fitted to stop when the first flight reaches the limit at the other end of the conveyor.

19. A machine according to any of Claims 8-18, c h a r - a c t e r i z e d i n that a pushing member (11) is fitted on one side of the flight conveyor (10), in parallel to it, to push the row of bricks onto a parallel centering table (12) located on the other side of the conveyor, the centering table having a centering device known per se, and to return from its extreme position to its initial position.

20. A machine according to any of Claims 8-19, c h a r a c - t e r i z e d i n that a pick-up device (13), moved in the vertical direction preferably by a pneumatic cylinder, is fitted above the centering table (12) and to grip the bricks centered transversely, centering them in the longitudinal direction, in order to lower the bricks onto the forming base.

21. A machine according to Claim 20, c h a r a c t e r - i z e d i n that the pick-up device (13) is made up of a row of tongs the jaws (14) of which are pneumatically operated.

22. A machine according to Claim 20 or 21, c h a r a c - t e r i z e d i n that the tong-fastening piece (15) is guided by two guides (16), the guides passing through sleeves situated in the supporting frame (17) of the row of tongs.

23. A machine according to any of Claims 20-22, c h a r - a c t e r i z e d i n that the centering table (12) is fitted to move to the side after the tongs have gripped the bricks, in order to enable the row of tongs to lower towards the supporting layer to leave the bricks there.

12. A machine according to Claim 10 or 11, c h a r a c -
t e r i z e d i n that the first brick conveyor (6) has, at
a point immediately before the belt conveyor (8), light cells
which prevent a brick row from being transferred onto the belt
conveyor if there are bricks on the belt conveyor.

13. A machine according to any of Claims 8-12, c h a r a c -
t e r i z e d i n that the turning device (9) is made up of
a bladed wheel, the blades at its periphery each in turn
receiving one brick from the belt conveyor (8), and that the
flights of the flight conveyor (10) which constitutes the
conveyor subsequent to the turning device each in turn take
the bricks fed by the rotating wheel.

14. A machine according to Claim 13, c h a r a c t e r -
i z e d i n that the turning device (9) can be controlled to
deliver a brick onto the flight conveyor or not to deliver a
brick, in accordance with the setting pattern to be formed on
the conveyor.

15. A machine according to Claim 14, c h a r a c t e r -
i z e d i n that the limit of the flight conveyor has been
programmed to give the turning device an order to rotate or
respectively not to rotate.

16. A machine according to any of Claims 8-15, c h a r -
a c t e r i z e d i n that the flights of the flight
conveyor are spaced mutually at distances of the brick space
(height of a brick + clearance between the bricks) in the
panel being set, and that the flight conveyor has flights in a
number corresponding at minimum to the number of bricks
required by the panel to be formed.

17. A machine according to Claim 16, c h a r a c t e r -
i z e d i n that the flight conveyor (10) is an endless
conveyor, preferably a chain conveyor, which is in a rotating
motion and has two groups of flights, one being on the lower

24. A machine according to any of Claims 20-23, c h a r - a c t e r i z e d i n that the movement of the tongs (13) downwards to grip the bricks is limited by a limiter (18), and that the limiter (18) is in the rear position when the tongs are due to lower all the way to the supporting layer to leave the bricks there.

25. A machine according to any of Claims 20-24, c h a r - a c t e r i z e d i n that the tongs (13) have been programmed to release the bricks in one, two or several batches, while the machine does not move or while the machine moves, between the lowerings, over the distance required by the overlap in the panel to be formed.

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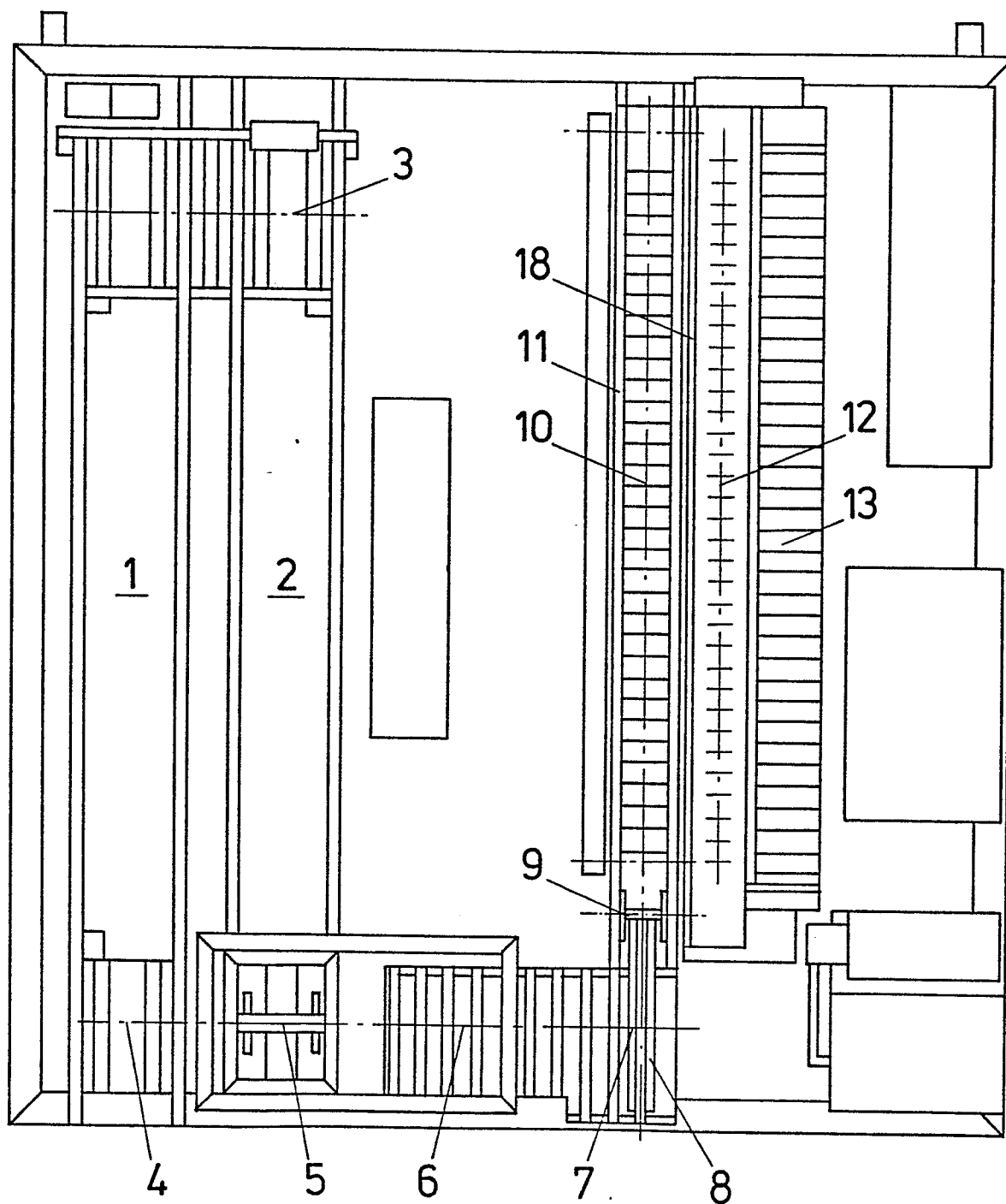
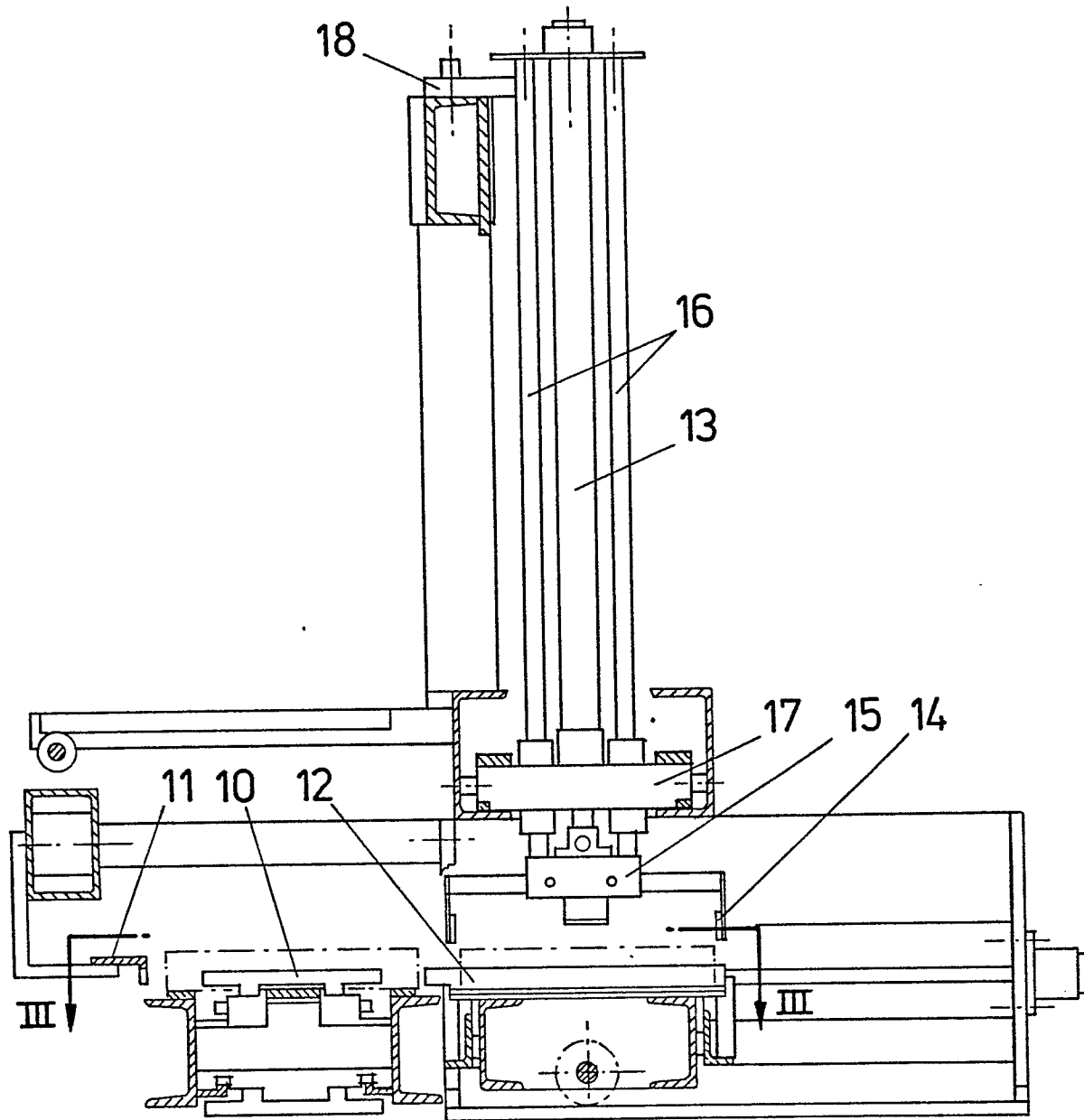
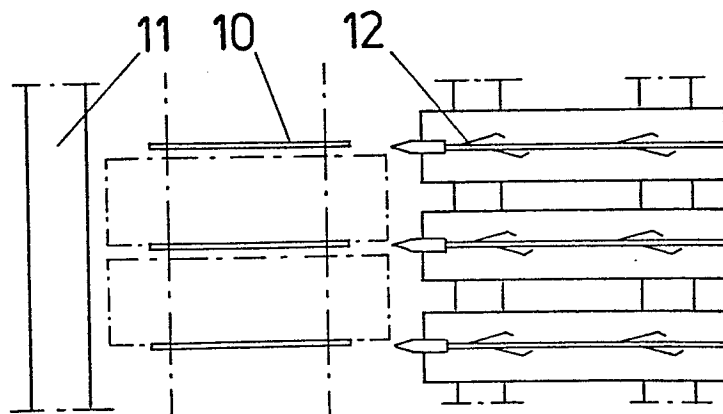


Fig. 1

*Fig. 2**Fig. 3*



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PARTIAL EUROPEAN SEARCH REPORT
which under Rule 45 of the European Patent Convention
shall be considered, for the purposes of subsequent
proceedings, as the European search report

Application number
EP 0238191
87 30 1185

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
A	DE-A-2 632 765 (KRUPP GmbH) * Figures 1,2; page 9, line 21 - page 13, line 20; claims * ---	1	E 04 C 2/04
A	US-A-3 990 934 (LINGL) * Figures; column 2, line 14 - column 4, line 17; claims 1,6,10 * ---	1	
A	US-A-3 933 570 (WRIGHT et al.) * Figures 1-4; column 3, line 35 - column 4, line 23; claims 1-5 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
			E 04 C E 04 G
INCOMPLETE SEARCH			
The Search Division considers that the present European patent application does not comply with the provisions of the European Patent Convention to such an extent that it is not possible to carry out a meaningful search into the state of the art on the basis of some of the claims. Claims searched completely: 1-5,7-25 Claims searched incompletely: Claims not searched: 6,7,8 Reason for the limitation of the search: Text is missing			
Place of search The Hague		Date of completion of the search 26-05-1987	Examiner MYSLIWETZ
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	