United States Patent

Schneider et al.

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[45] **May 2, 1972**

[54] PLANT FOR MANUFACTURING SMALL STRUCTURAL ELEMENTS

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[30] **Foreign Application Priority Data**

July 13, 1968 Germany ..... P 17 71 807.9

[52] **U.S. Cl.** **425/62,** 425/88, 425/186, 425/155, 259/145

[51] **Int. Cl.** **B28b 15/00**

[58] **Field of Search** ..... 25/2, 133, 143, 135, 142 F, 25/142 D, 142 B, 142 M, 142 R

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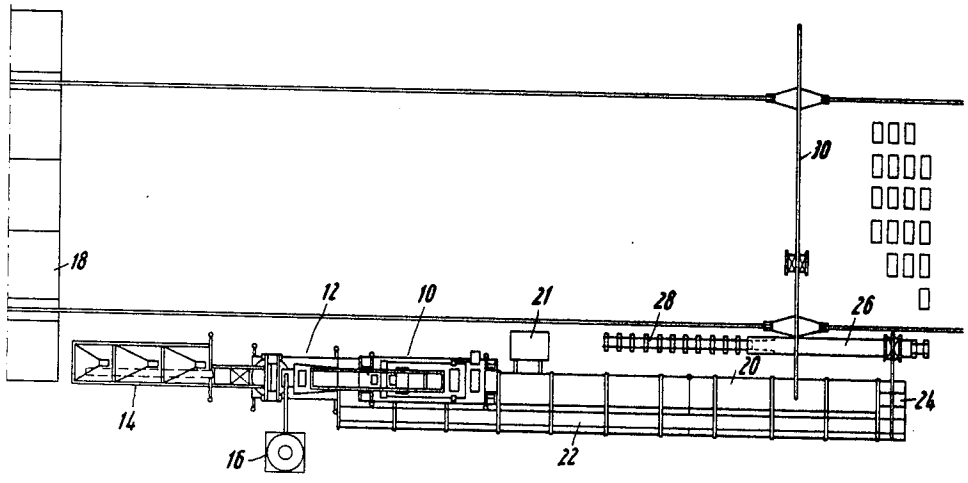
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Assistant Examiner—Ben D. Tobor
Attorney—Young & Thompson

[57] **ABSTRACT**

A plant for manufacturing small structural concrete elements comprises a production station and a hardening station which both are provided with means for loading or unloading from a carrier vehicle. The hardening station is formed by a steam treatment tunnel consisting of two sections which are connected by hinge means in that way that for transport of the hardening station, one section is swung in position parallel to, and alongside of the other section. During operation, both sections together form a straight elongated tunnel.

3 Claims, 17 Drawing Figures



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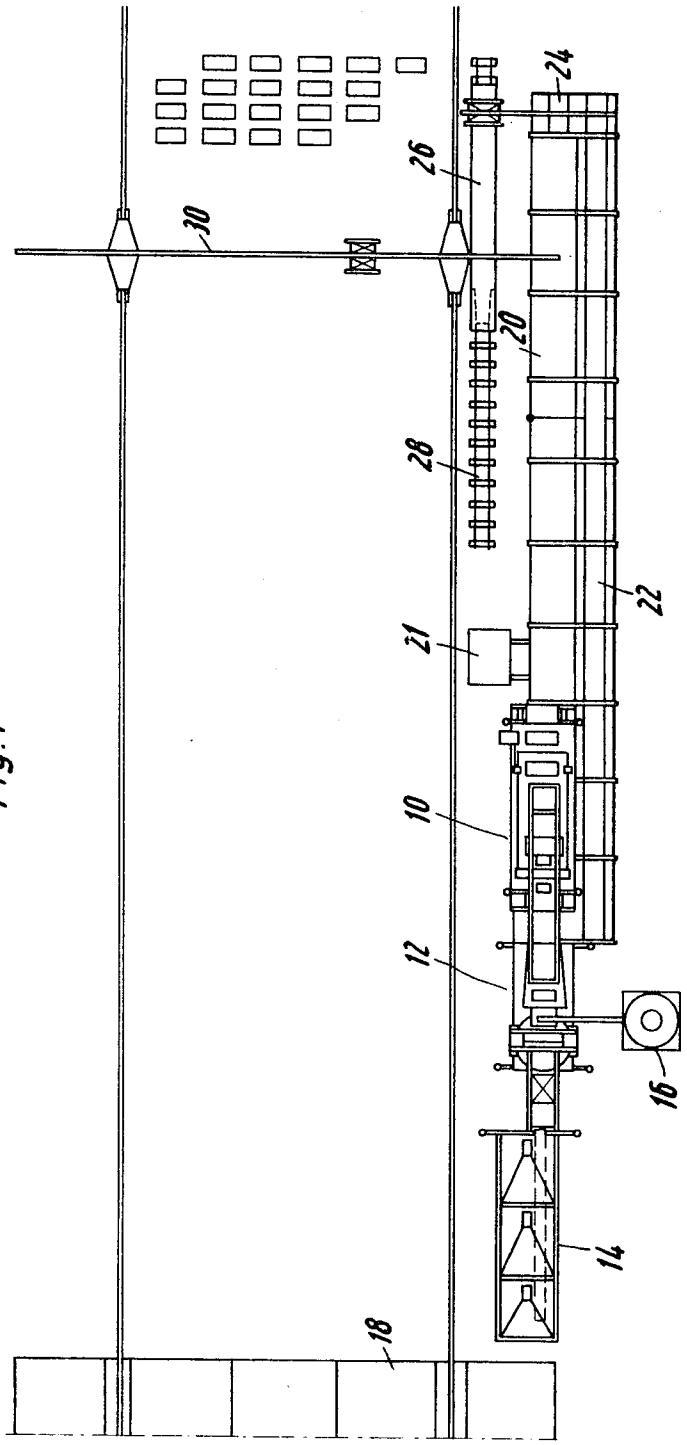


Fig. 1

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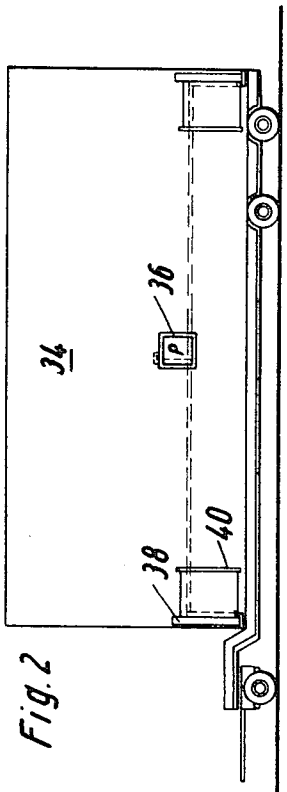


Fig. 2

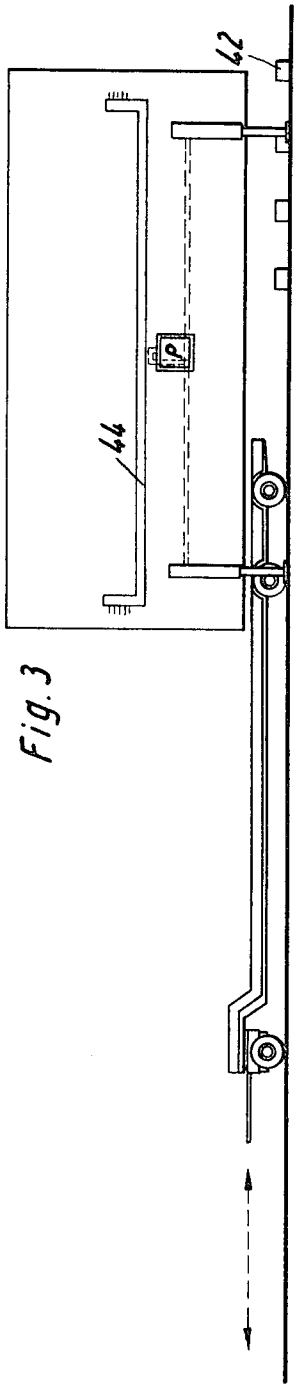


Fig. 3

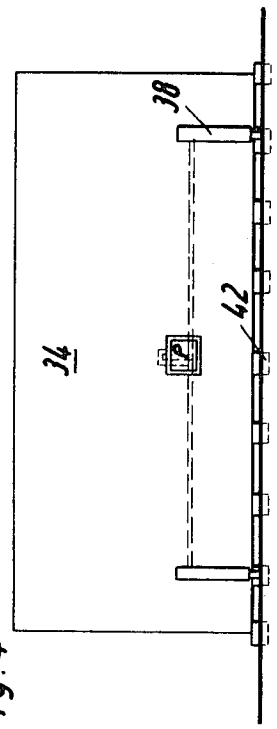


Fig. 4

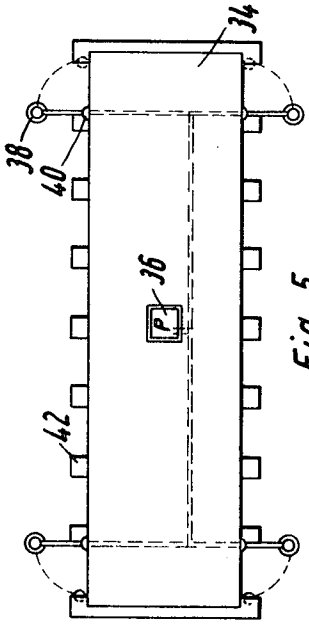


Fig. 5

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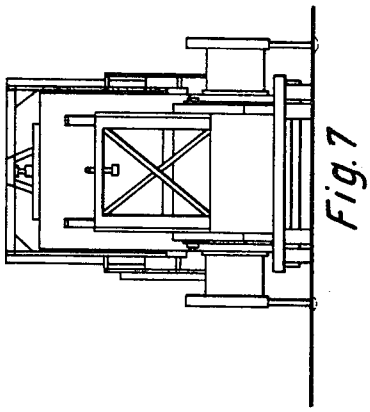


Fig. 7

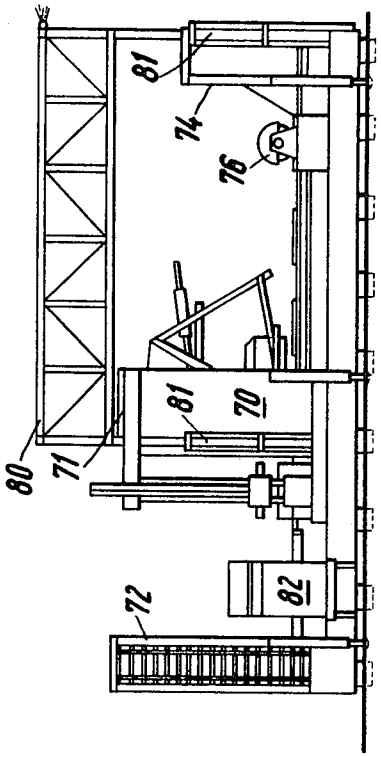


Fig. 8

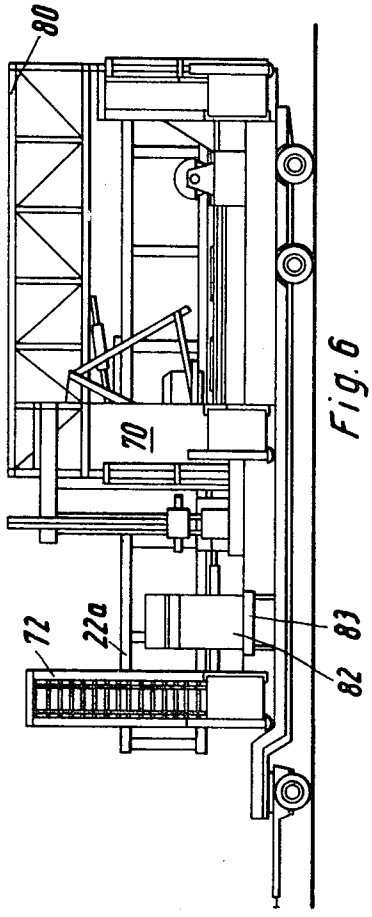


Fig. 6

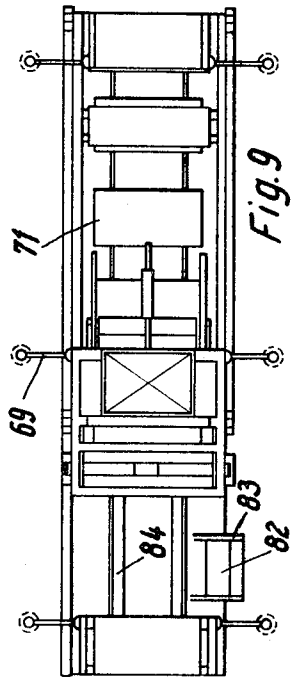


Fig. 9

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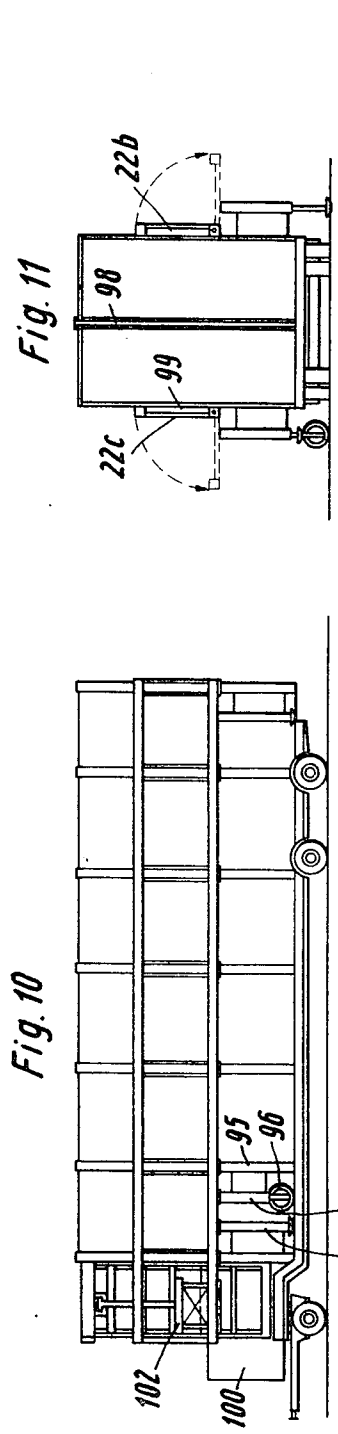


Fig. 10

Fig. 11

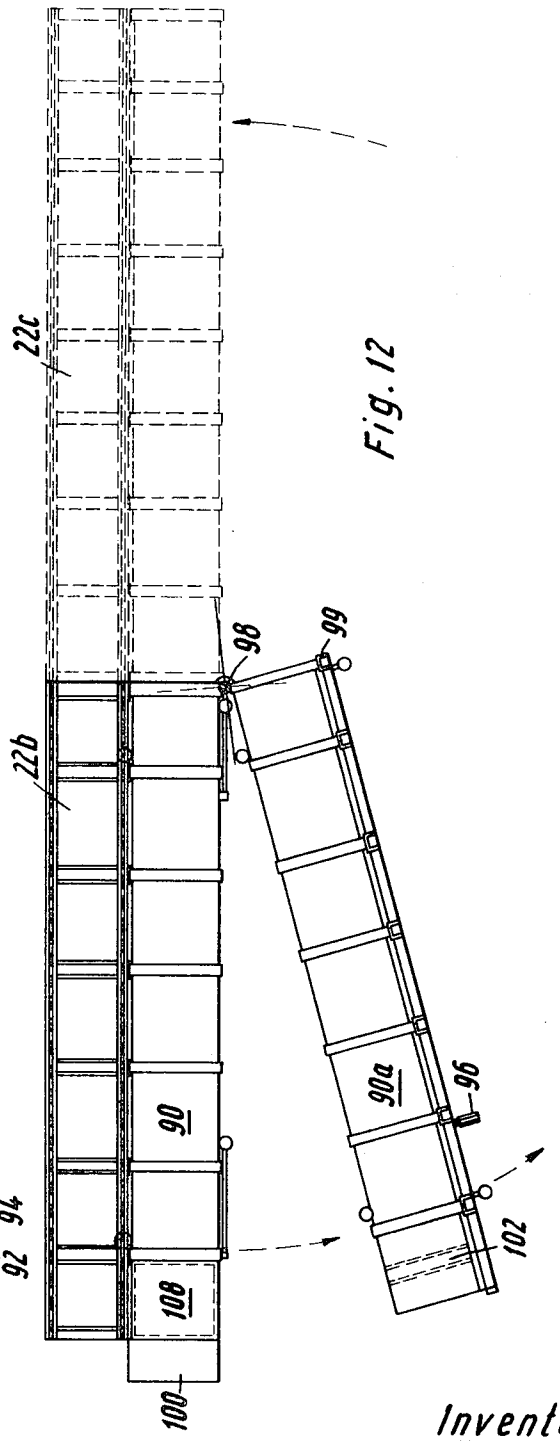


Fig. 12

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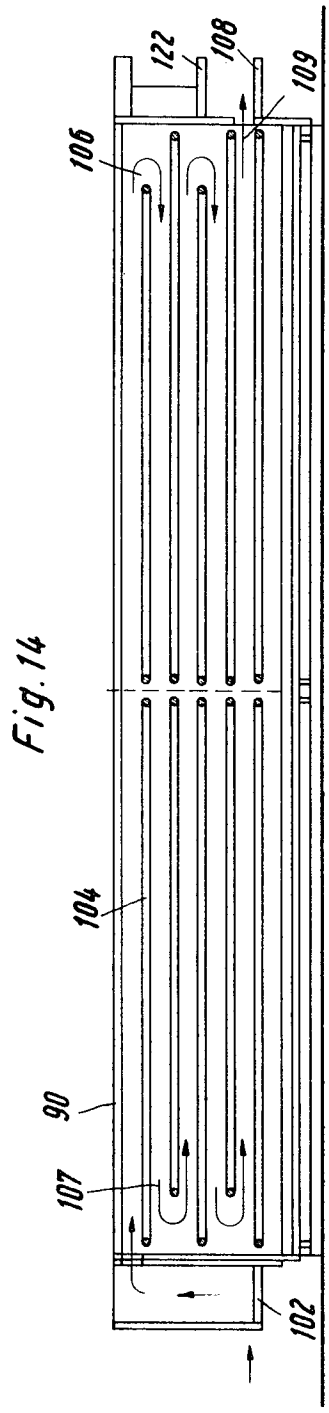


Fig. 14

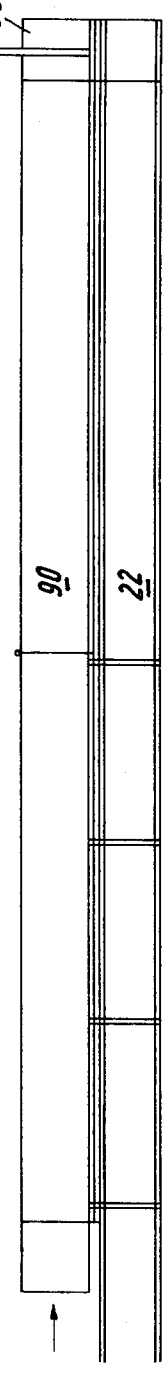


Fig. 13

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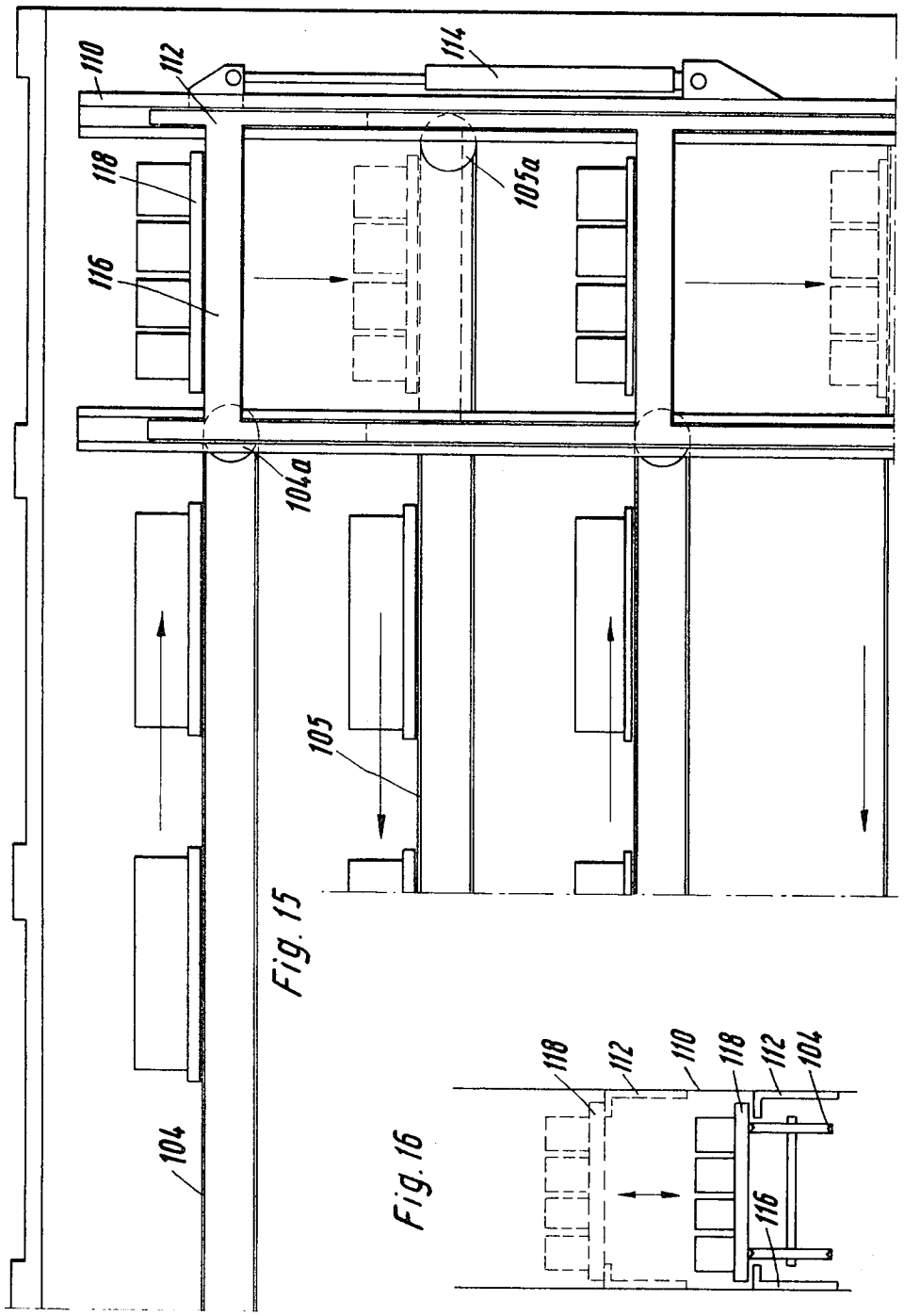
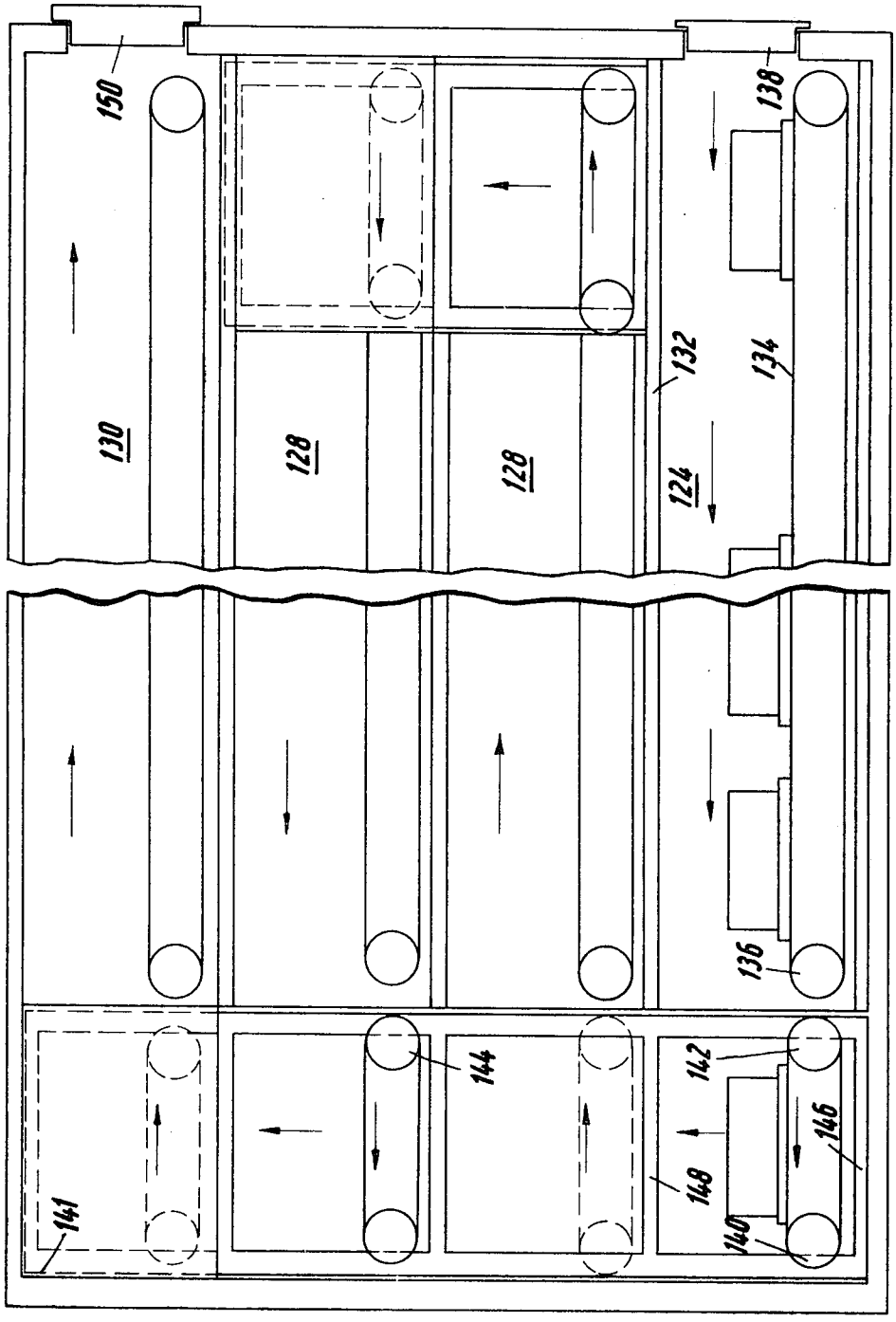


Fig. 15

Fig. 16

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Fig. 17



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PLANT FOR MANUFACTURING SMALL STRUCTURAL ELEMENTS

The invention relates to manufacturing of small structural elements made of high density concrete and light weight concrete. Such elements are used both in building construction and in civil engineering, particularly for road construction and hydraulic engineering.

Such small structural concrete elements which may have the most varied shapes, and the sizes of which are in the order of bricks or pavement stones or slabs, have hitherto been manufactured in stationary, relatively large plants. These stationary works are operated for a consumer region the extension of which is restricted and the consuming power of which is exhausted after a relatively short time, while deliveries cannot be made to more remote areas because of the excessive transport costs for the elements.

Therefore it is the main object of the present invention to provide a plant for manufacturing concrete elements of the above mentioned type which plant may be easily moved to a new site. This object is achieved substantially by a plant comprising a production station and a hardening station, and which, according to the invention, is characterized in that the production station and the hardening station each are provided with means for loading and unloading said stations as units onto carriers, or from such carriers, respectively, and that the hardening station is a tunnel, the entrance of which is immediately connected to the outlet of the production station, and that at the outlet of the hardening station, delivery means are provided which are connected by conveyor means with an entrance of the production station.

According to the invention, the individual stations of the plant, particularly the hardening station, may be erected at any point of concentrated need, and may be removed to a new operation point when the demand for concrete blocks is not longer present. By making use of the present invention, a plant for manufacturing concrete stones may be provided which plant needs only very little floor space for the erection and operation. A further object of the invention is the provision of a plant which is operated largely without additional conventional conveyor means as used in conventional stationary plants for transporting of blanks and finished products.

In a preferred embodiment of the invention, especially the hardening station is equipped with a hydraulic installation with which hydraulic jacks mounted at the outside of the station and having vertically downward extending plungers, are operated in that way that the plungers in the jacks are extended or retracted either simultaneously or individually, for vertical adjustment.

According to a further feature of the invention, the width of the tunnel is about one half of the width of a road vehicle, and one half of the tunnel may be pivoted for road transport to a position parallel and alongside of the other half. Both halves of the tunnel are preferably connected one to the other at a swivel axis, around which one of the halves may be swung for the erection of the plant, that swingable half being equipped with at least one supporting wheel means which is adjustable in height.

Further to this the invention is concerned with a tunnel which comprises a plurality of substantially horizontal conveyor tracks provided one above the other, which tracks being connected at their ends by a lift with the next higher or lower track, respectively. These tracks may be heat insulated one against the other, and the temperatures of the successive tracks may increase in the direction of passage. A particularly simple lay-out of the plant is achieved by positioning the tunnel with its axis of passage in prolongation of the axis of passage of the production station which is also in straight prolongation of the axis of passage of a mixing station.

Other and further objects and advantages of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show preferred embodiments of the present invention and the principles thereof and what are

now considered to be the best modes for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the arts, without departing from the present invention and the purview of the appended claims. In the drawings:

FIG. 1 shows a lay-out for a manufacturing plant according to the invention;

FIG. 2, 3 and 4 are diagrammatic illustrations of the lowering of a device forming a part of a manufacturing plant according to the invention, from a carrier;

FIG. 5 is a simplified plan view of a device forming a part of a manufacturing plant according to the invention;

FIG. 6 shows a side view of a production station which is a part of a plant according to the present invention;

FIG. 7 shows the device of FIG. 6, seen from the input side, during lowering;

FIG. 8 shows a side elevation of the device of FIGS. 6 and 7, in the operational state;

FIG. 9 shows a plan view of the device shown in FIGS. 6 to 8;

FIG. 10 shows a device serving as a hardening station for the plant according to the invention as shown in FIG. 1, in side elevation on a carrier;

FIG. 11 shows the device according to FIG. 10, seen from the right hand end of that Figure;

FIG. 12 is a plan view of the device according to FIGS. 10 and 11, during the lowering and erection,

FIG. 13 is a plan view of the device according to FIGS. 10 to 12, after erection;

FIG. 14 shows schematically a longitudinal vertical section through the device according to FIG. 13;

FIG. 15 is a simplified illustration of the end section of a hardening station according to FIGS. 10 to 14;

FIG. 16 shows a diagrammatic end view of a lift shown in FIG. 15; and

FIG. 17 is a diagrammatic representation of a longitudinal vertical section of another embodiment of a hardening station to be employed in a plant according to the invention, the middle part of the hardening station being omitted for simplification.

The lay-out illustrated in FIG. 1 affords a basic general view of a plant according to the invention. The plant comprises a production station 10, a mixing station 12, a first silo station 14 for aggregates, and a second silo station 16 for cement. The production station 10 is linked up with a steam treatment tunnel 20 at the outlet of which a delivery device 24 is mounted. On a conveyor track 22 which is leading from the delivery device 24 along the outside of the steam treatment tunnel 20 to an input of the production station 10, pallets used as a support for the blanks during production and hardening, are returned from the delivery device 24 to the input of the production station 10. The steam treatment tunnel 20 is forming the hardening station. The production station 10 is immediately connected to the mixing station 12 which links up with the silo stations 14 and 16. The axis of passage of the production station 10 is the straight prolongation of the axis of the passage of the material through the mixing station 12. In further prolongation of this axis, the blanks are passed through the hardening station 20. A rail track 28 is positioned in parallel to the steam treatment tunnel 20, a carriage 26 being movable along that track. The carriage 26 receives the concrete elements delivered from the delivery device 24 which separates the elements from the supporting pallets. A gantry crane 30 is operable for transfer of the elements from the carriage 26 to road trucks.

Besides, the gantry crane 30 may be operated for supplying raw material to the silo station 14 from a bulk storage 18. Silo stations 14 and 16 are equipped with known per se automatic controls for metering of the aggregates and the cement according to a predetermined program.

The manufacturing plant according to the invention comprises, according to FIG. 1, the stations 10, 12, 14, 16, and the

hardening station 20 which is connected to a mobile steam generator plant 21. The delivery device 24 and a section of the conveyor track 22 is mounted on the hardening station 20; a second part of the conveyor track 22 is mounted on the production station 10.

All the devices 10, 12, 14, 16 and 20 are distinguished in that they can be loaded onto low bed trailers and unloaded from these trailers without any cranes being necessary. A basic principle which is realized in the devices 10, 12, 14, 16 and 20, is illustrated in FIGS. 2 to 5. A device 34 which is equipped with a complete hydraulic installation 36, is mounted on a low bed trailer 32. The hydraulic installation comprises a conventional pump, a supply of pressure fluid and a motor for driving the pump. The motor may be an electric motor for example which is supplied either by a generator or through a mains connection available at the site where the plant is to be operated. The device 34 is provided with at least three hydraulic jacks 38. In the present case, the device 34 comprises four such jacks 38 which are hinge-mounted on holders 40 secured to the ends of the longitudinal sides of the device 34. In order to unload the device 34, the jacks 38 are moved outwards on the holders 40 and the plungers in the jacks are extended downwardly until they come into contact with the ground. The jacks are adapted for actuation either simultaneously and uniformly or individually, an appropriate control being provided on the hydraulic device 36 for this purpose. In addition, at least one hose levelling instrument 44 or a similar means is mounted on the device 34 to permit observation of the position of the device 34 during and after the unloading.

As soon as the device 34 has been lifted sufficiently, the carrier 32 is pulled forwards. Then sleepers 42 are laid under the device which is lowered on to the sleepers by renewed actuation of the jacks 38. Horizontal erection, independently of minor irregularities in the ground, is possible by observing the hose levelling instrument 44 and by individual adjustment of the jacks 38. FIG. 4 shows the device fully set down in side view and FIG. 5 in plan view. For the steam treatment tunnel which is used as a hardening station 20, a modified form of this basic principle is employed as will be explained later.

The production station 10, see FIGS. 6 to 9, is provided with hydraulically actuated jacks 69 in accordance with the illustrations shown in FIGS. 2 to 5. The jacks 69 are hinge-mounted at the longitudinal sides of the station. On a rigid basic frame of the production station, a known per se production machine 70 is mounted. The production station 10 is erected in such a manner that, together with the mixing station 12, it forms a straight line. On the production station 10, a conveyor framework or rack 80 is mounted, see FIGS. 6 to 8. The conveyor rack 80 may be shifted by means of hydraulic jacks 81 from a transport position, see FIGS. 6 and 7, to an operational position, see FIG. 8. When positioning the production station 10 in a row with the mixing station 12 the rack 80 immediately links up with a cantilever arm which is provided at the mixing station for the transport of a concrete bucket. The rack 80 ends above the input opening 71 of the bunker of the production machine.

In the representation of FIGS. 8 and 9, the direction of operational progress in the production station is from the right hand end to the left. To the right of the production machine 70, a pallet silo 74 is mounted. Pallets 118 coming from the pallet silo 74 are travelling on a conveyor track 84*a* and through a pallet cleaning device 76, to the production machine 70. The pallets will be supplied to the pallet silo 74 by means of a conveyor track 22, connecting the silo 74 with the delivery means at the output of the hardening station 20. FIG. 6 shows a section 22*a* of the conveyor track 22 in upward folded state in which that section is kept during transport of station 10. In FIGS. 7 to 9 section 22*a* of conveyor track 22 is omitted in order to avoid intricacies.

Pallets coming out of the production machine 70 and carrying blanks, will be transferred on a conveyor track 84 into a lifting device or raising ladder 72. The input of the hardening station 20 is linked up with the output of the raising ladder 72.

The whole control and hydraulic installation for the operation of the individual devices and hydraulic jacks of the production station 10, are combined in a housing 10 which is mounted on a platform 83 running in a guide way. During operation of the production station 10, the housing 82 is withdrawn laterally from the path of movement of the pallets, see FIG. 9. Conversely, during transport, the housing 82 is pushed in sideways again into the base of the production station in order that the permissible width for the production station may not be exceeded.

FIGS. 10, 11, and 12 show a hardening station 20 which is a steam treatment tunnel 90. The width of tunnel 90 is preferably about one half of the admissible maximum width of a road vehicle. For the transport of the hardening station, one half 90*a* of the tunnel 90 may be swung parallel and alongside of the other half. The two halves of the tunnel 90, see FIG. 12, are connected by a hinge or swivel pin 98 around which one half is swung for bringing the tunnel into operational condition. For this purpose, the tunnel section 90*a* is provided with at least one wheel means 94 which is adjustable in height. The wheel means 94 comprises a supporting wheel 96 which is mounted by means of the device 94 at a side beam or strut 95 in that way that it may be swung outwardly and adjusted in height. For positioning the hardening station 20, first the supporting wheels 96 at the wheel means 94 will be swung outwardly and will be adjusted in height until they come into contact with the ground in the same way as the plungers of the hydraulic jacks 92 at that section of the tunnel which is not swung. After lifting the tunnel 90 from its carrier, section 90*a* is swung about the axis of rotation 98 to such an extent that a post 99 of tunnel section 90*a* abuts against the section not swung, and is interlocked with that post, sealing means being provided between the two halves of the tunnel. The tunnel 90 is supported on jacks 92 and on sleepers which were laid under the tunnel prior to lowering. The tunnel 90 may be positioned in that way, that it forms a straight prolongation of the axis of passage of the production station 10 and that the input of the tunnel 90 is immediately adjacent to the raising ladder 72. The hydraulic installation of the hardening station and the control system for conveyor tracks and lifts provided in the tunnel 90, are combined into a unit 100. The hydraulic installation comprises a supply of hydraulic fluid, a pump, a motor for driving the pump, and control means for operating individually or simultaneously hydraulic jacks 92, and for vertical adjustment of the wheel means 94.

A conveyor track 22 for returning pallets to the production station 10, may be provided at the outside of tunnel 90. This conveyor track comprises sections 22*b* and 22*c* which are mounted at those sides of the tunnel sections which are facing the outside during the transport of the tunnel, see FIG. 11, in an upward folded condition. After positioning of tunnel 90 sections 22*b* and 22*c* are folded downwardly into operational position, section 22*c* then interconnecting section 22*b* with section 22*a* at the production station 10.

FIG. 13 shows a diagrammatic plan view of the hardening station 20. In this representation, the left hand end of the station shows the input from the production station 10, and the right hand end the delivery device 108 mounted at the hardening station.

FIG. 14 shows a view of a longitudinal and vertical section through a hardening station according to FIG. 13. The pallets which are carrying the blanks, are at first fed into a lift 102, by means of which the pallets are transfered to the upper conveyor track 104 of the tunnel 90. The conveyor track 104 as well as the subjacent conveyor tracks, are cableways or chain conveyors which are driven by electric motors. The direction of passage through the tunnel is marked by arrows. During the passage through the hardening station the pallets are constantly stepwise moved. At the end of conveyor track 104, the pallets which are carrying the blanks, are pushed into a lift which for simplification, is represented in FIG. 14 by an angular arrow 106. FIGS. 15 and 16 show details of this installation.

The pallets 118 are moved stepwise on the conveyor track 104. During each step, a pallet the edge of which project sidewise over the conveyor means 104, is pushed by following pallets onto girders 116 of a lift. The girders 116 are secured to vertical struts 112 which are movable in rails 110. For this purpose, a hydraulic jack 114 is provided, one end of which is secured to a rail 110, the other end being secured at a strut 112 cooperating with the rail. The hydraulic jack 114, the supply joints of which are not shown in the FIG. 15, may be controlled according to the stepwise movement of the pallets in the conveyor tracks. In this way, the girders 116 are on the level of the track 104 when a full pallet is to be pushed away from track 104. After transfer of the pallet into the lift, the pressure of the hydraulic jack 114 is released, and the lift comprising the struts 112, girders 116, and not shown cross beams, is lowered for a distance corresponding to the height of a conveyor track in the tunnel. The lowering movement slightly exceeds the vertical distance between the conveying plane of conveyor track 104 and the corresponding plane of the subjacent track 105, which extends into the space between girders 116. Therefore, the pallets 118 are delivered to the input end of conveyor track 105, which end projects underneath of conveyor track 104. FIG. 15 shows the position of rollers 104*a* at the end of conveyor track 104, and of rollers 105*a* at the end of track 105. Details of the relative positions of these parts are also apparent from FIG. 16.

The movement of the pallets on conveyor track 105 is in opposite direction as compared to track 104. Therefore, the pallets will be moved back to that end of tunnel 90 at which the input lift 102 is provided. The end of conveyor track 105 is spaced from that tunnel end with a similar distance as the end of track 104 at the opposite end of the tunnel. By means of lift 102, the pallets are delivered to the projecting end of the next lower conveyor track, as shown by arrow 107, in rather the same way as explained in connection with the transfer from track 104 to track 105 above.

The tunnel 90 is connected to a steam generator 21, and during the movement through the tunnel, the blanks are heated and hardened. The ready hardened concrete stones are discharged, as shown by arrow 109, from the tunnel 90 to the delivery device 108 which is equipped with tongs 122. The tongs 122 will take the stones from the pallet and put them aside. Thereafter the emptied pallet is transferred to the conveyor track 22 by the tongs.

In the above described embodiment of the hardening station, the input and the output are on different ends of the station. Besides, the pallets carrying the blanks are at first to be lifted to the level of the highest conveyor track 104, and after passing over a track, a pallet is to be lowered onto the next lower track. In this embodiment, all conveyor tracks are also substantially at the same temperature.

An embodiment which is somewhat modified with regard to these characteristics, is shown in a diagrammatic manner in FIG. 17. This tunnel is provided with four conveyor tracks 124, 126, 128, and 130. The conveyor tracks are heat insulated one against the other. For this purpose, insulating walls 132 are provided between successive tracks. The temperature of the tracks will increase from the bottom track 124 to the top track 130. Each of the tracks 124, 126, 128, and 130 is provided with a cableway or chain conveyor 134 which is driven by means of a controlled stepwise pulling drive roller 136. The drive roller 136 is rotated by an electric motor, not shown. The conveyor track 124 is provided at its right hand end which is adjacent to the production station, with an input door 138 which is controllable to open and shut according to the stepwise movement. The left hand end of the track 124 is closed by a lift 140 which is movable in a vertical duct 141. The lift 140 is provided with two reception floors which are formed by conveyor means 142 and 144, and which are, in the lower position of the lift, aligned to tracks 124 and 128, and in the upper position of the lift, to tracks 126 and 130. The conveyor means 142 and 144 may reverse the direction of conveyance in that way that in the lower position, movement goes in direction of the arrows pointing to the left in FIG. 17, thereby facilitating the transfer of pallets into the lift. After raising the lift to its upper position shown in dotted lines in FIG. 17, the conveying movement of conveyor means 142 and 144 is reversed as shown by the arrows pointing to the right. Thereby the pallets are pushed out of the lift and onto the tracks 126 and 130, respectively. The lift compartments are provided each with bottom and top walls as shown by reference numerals 146 and 148, in addition to the end wall facing the end wall of the tunnel. In this way, the tracks of the tunnel are separated by the walls of the lift. A correspondingly constructed lift 152 is provided at that end of the tunnel opposite to lift 140, for the delivery of pallets after passage of track 126, to track 128. At the output end of conveyor track 130, a door 150 is provided which is operable to open and shut in the same timing as the stepwise movement of the pallets which are supplied through this door to the delivery device. In this embodiment of the invention, the delivery device may be mounted on the production station and not on the hardening station. A conveyor track for returning the pallets is only to be provided on the production station.

We claim:

1. A plant for manufacturing small structural concrete elements, comprising a production station and a hardening station, carrier vehicle means by which each of said stations is movable as a unit relative to the other of said stations, the hardening station being a steam treatment tunnel the input of which is linkable immediately to the output of the production station, and at the output of which a delivery device is provided which, by means of conveyor means for pallets is connected with an input of the production station, the width of the tunnel being about half the admissible maximum width of a road vehicle, the tunnel being lengthwise divided into two sections of substantially equal length, and means connecting the tunnel sections for relative swinging movement for the transport of one section parallel alongside of the other section.

2. A plant according to claim 1, wherein the two sections of the tunnel are connected by means of a hinge around which for bringing the tunnel into operating position, one section may be swung which is provided with at least one supporting wheel which is vertically adjustable.

3. A plant according to claim 2, wherein at one section of the tunnel a plurality of supporting wheels is provided, each wheel being swingable from a transport position adjacent to the wall of the tunnel, to the outside.

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