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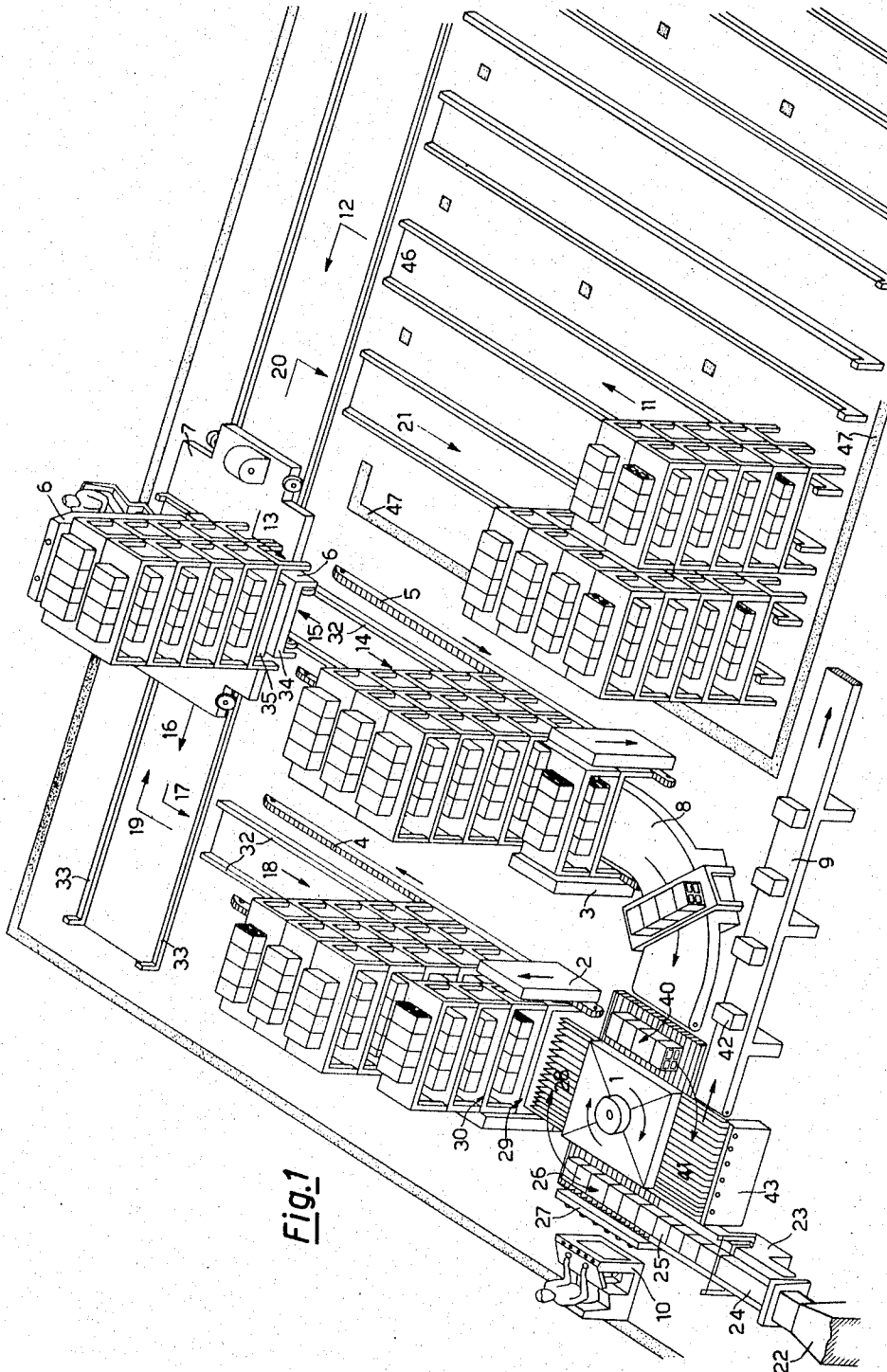
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3,363,781

STACKING MECHANISM

Filed June 10, 1964

9 Sheets-Sheet 1



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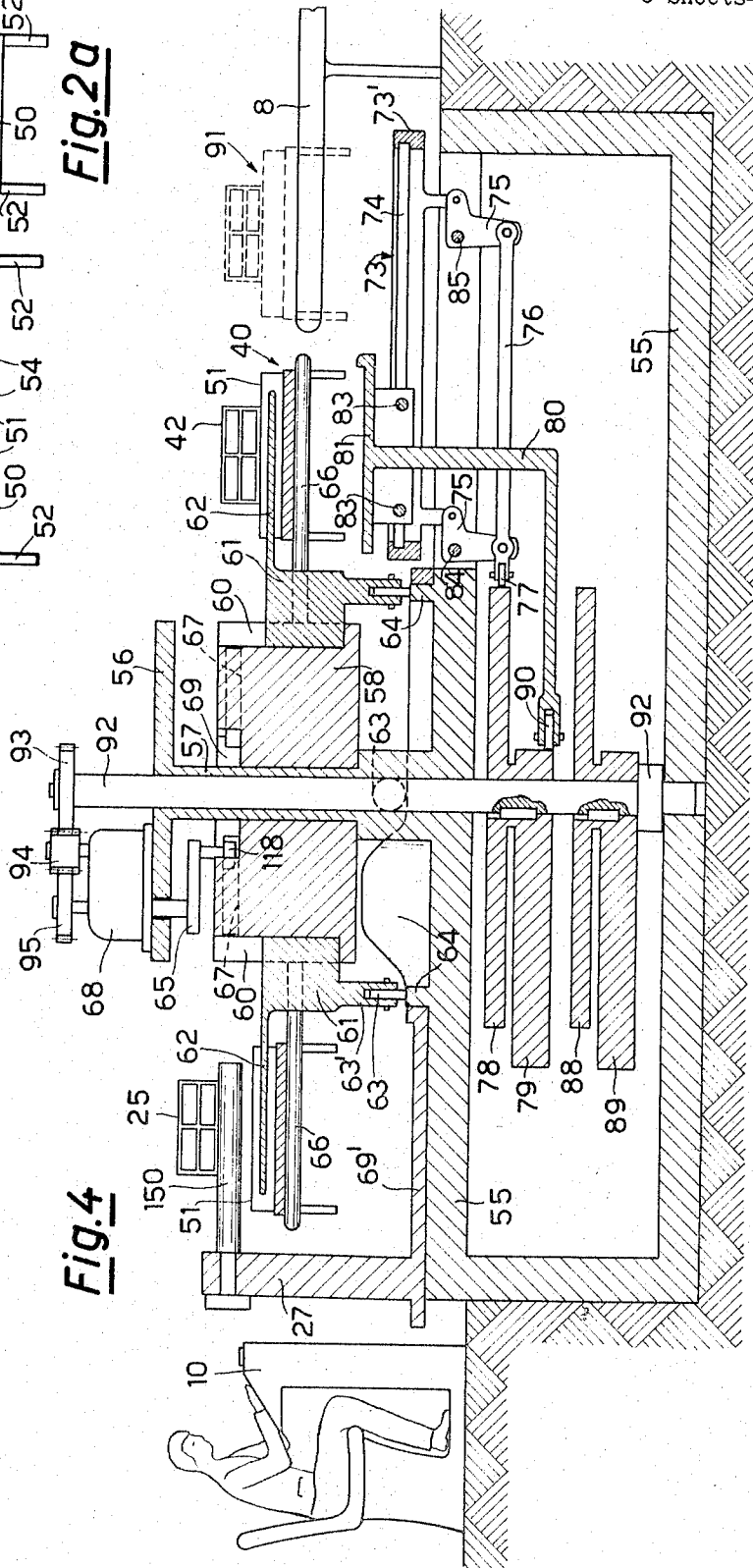
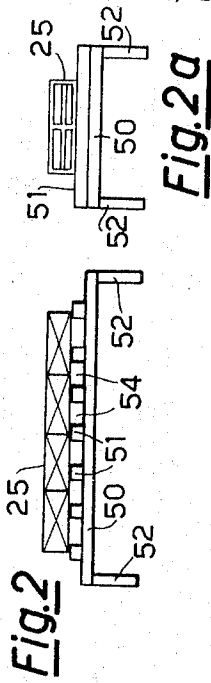
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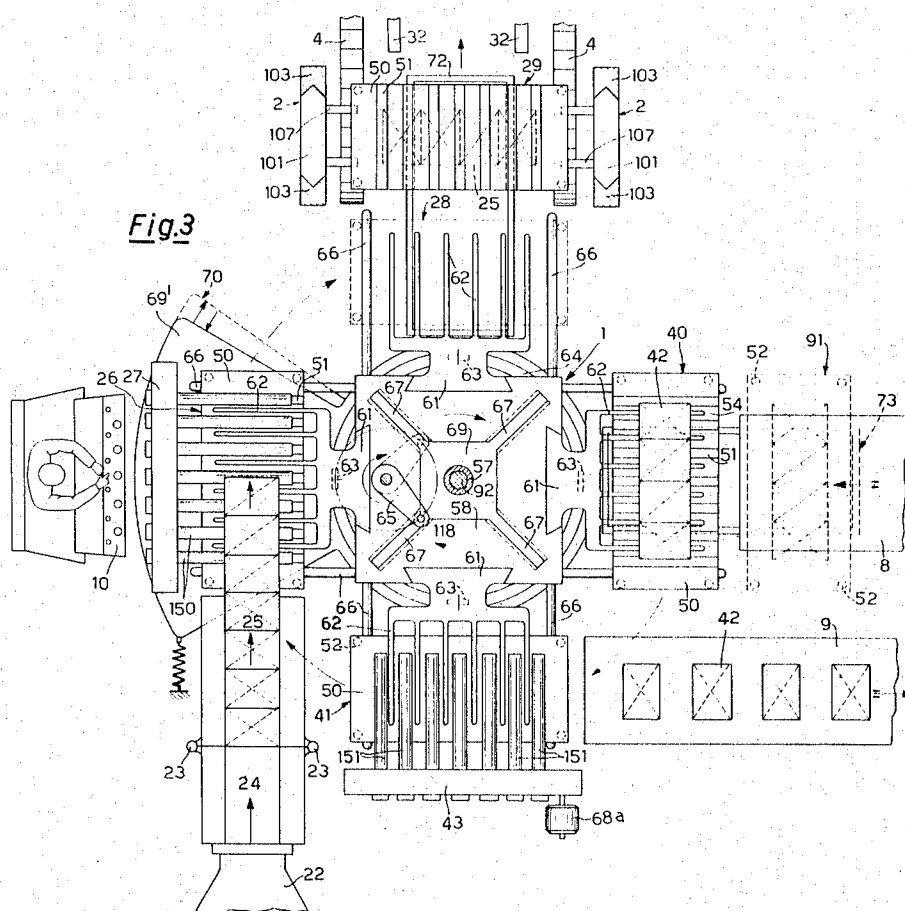
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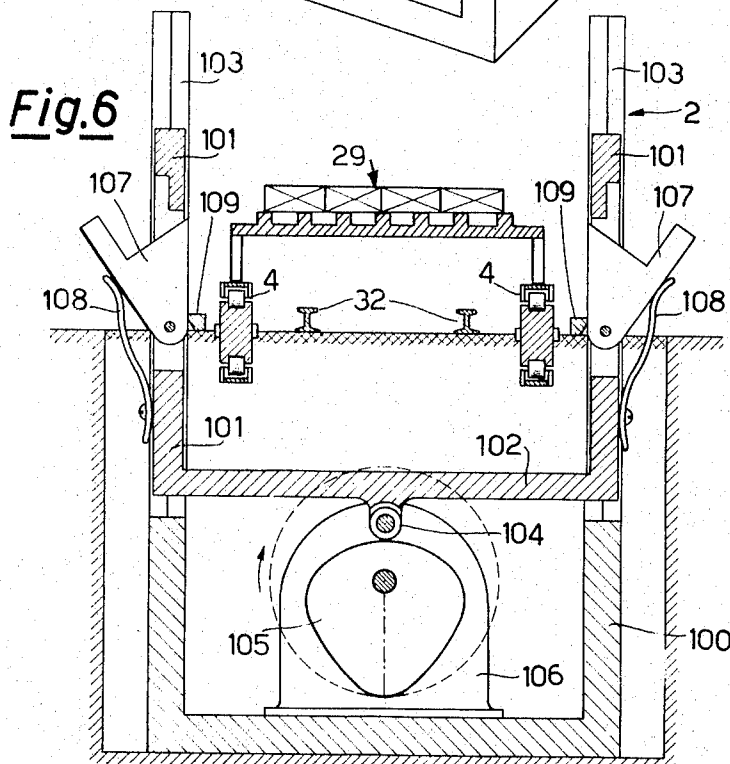
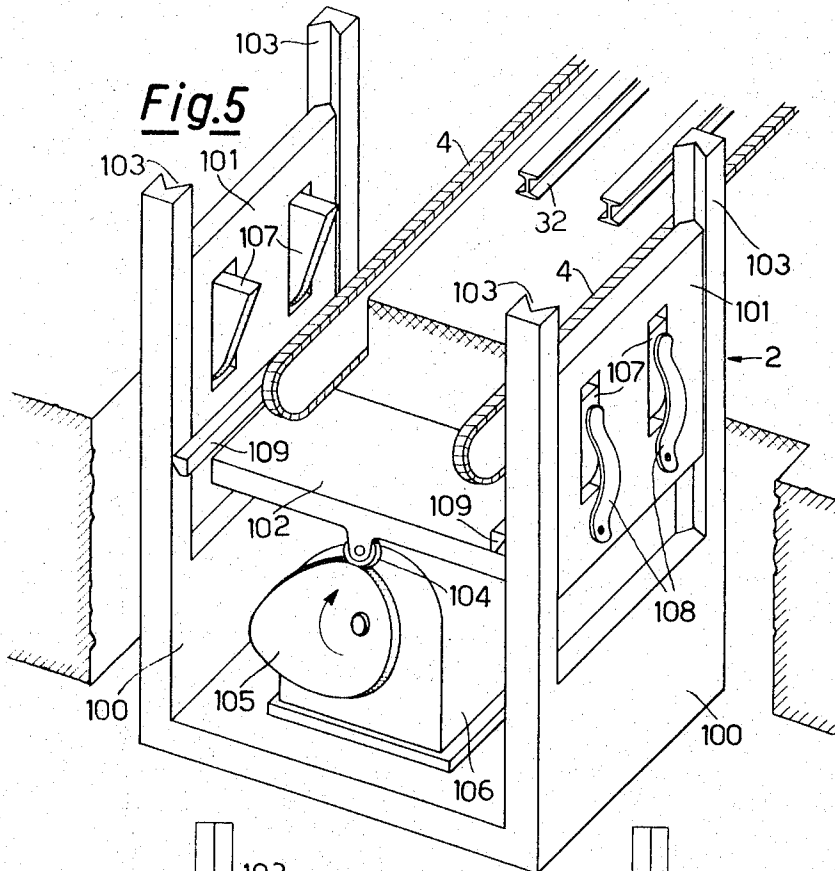
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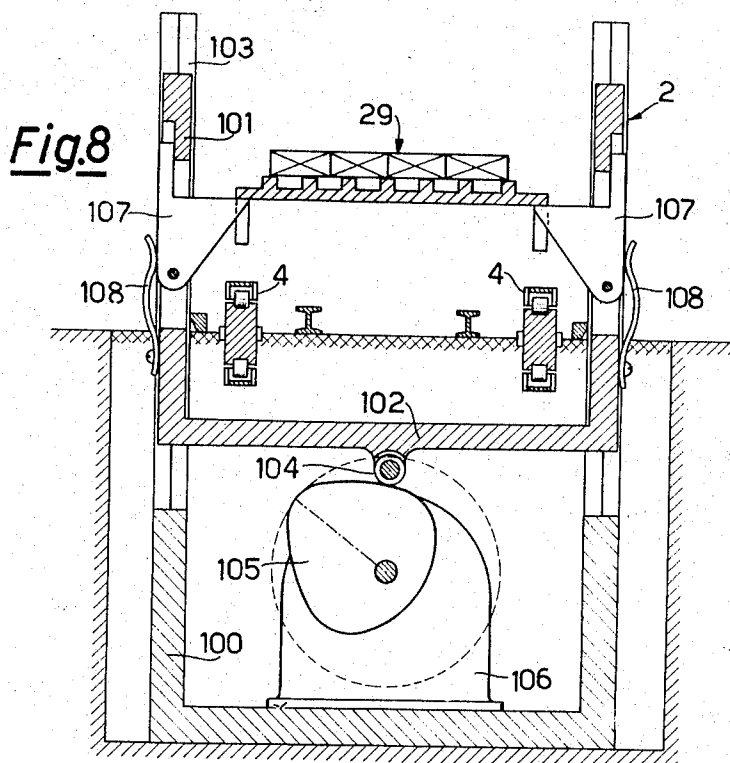
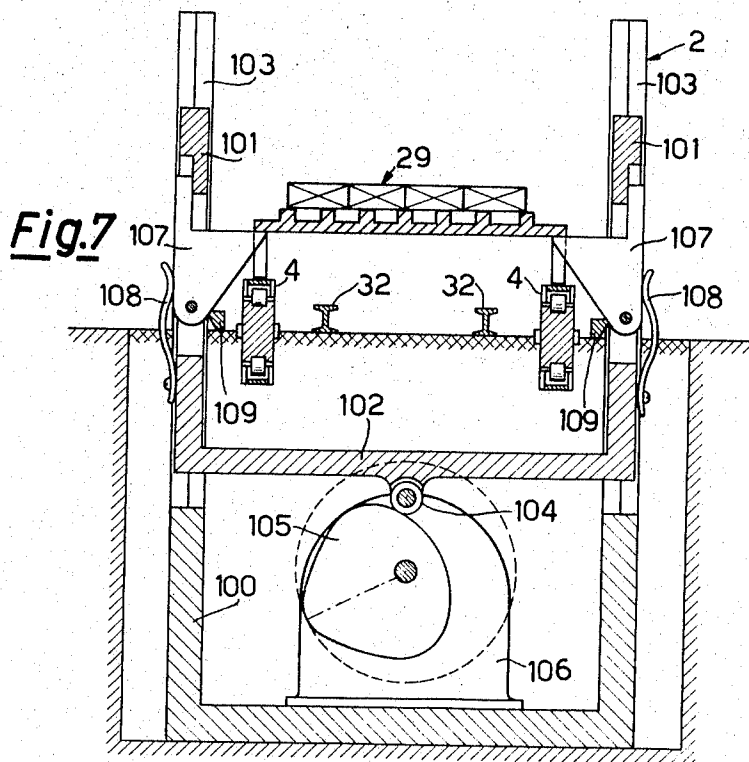
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Fig.9

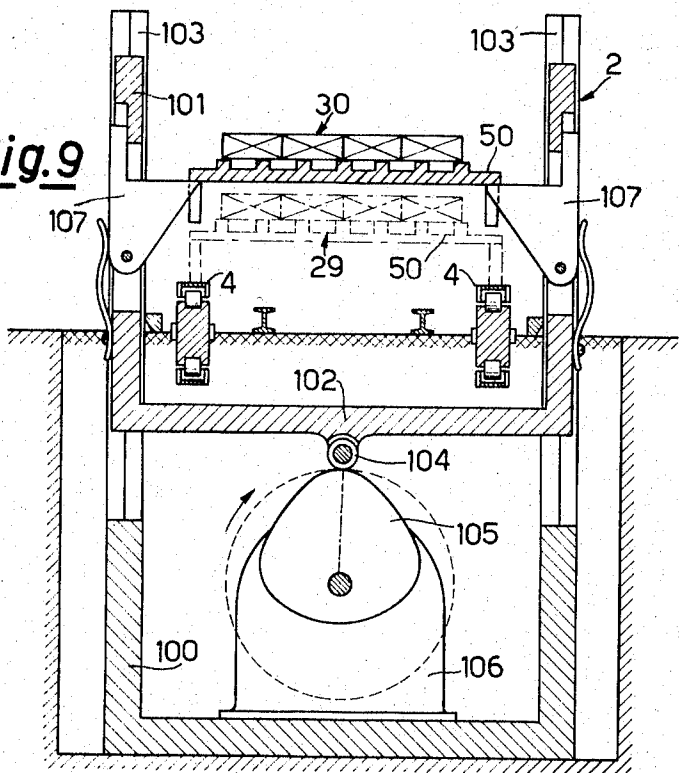
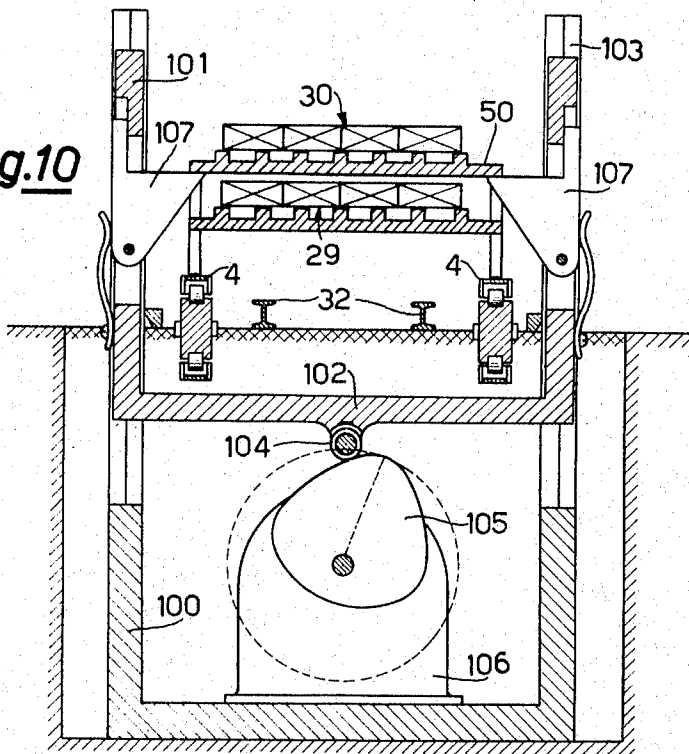


Fig.10



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Fig.11

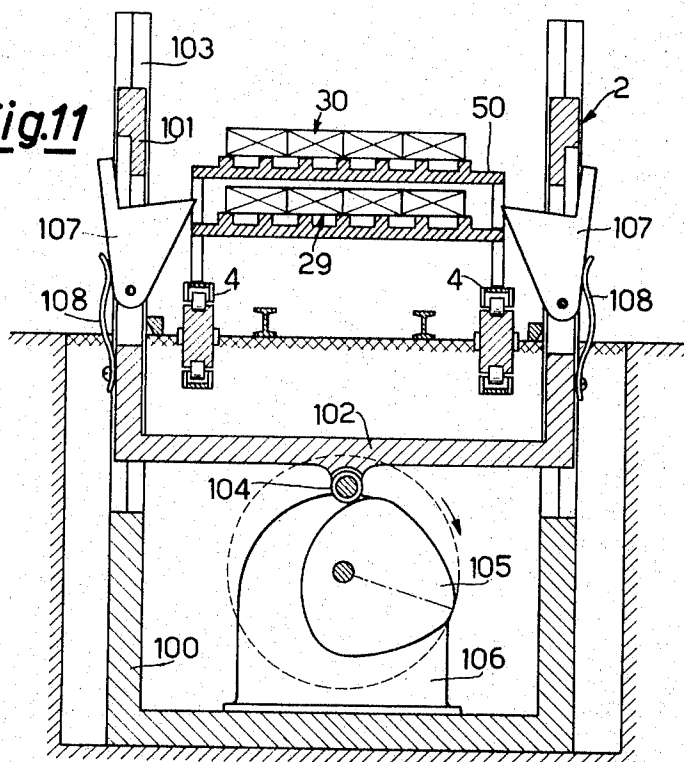
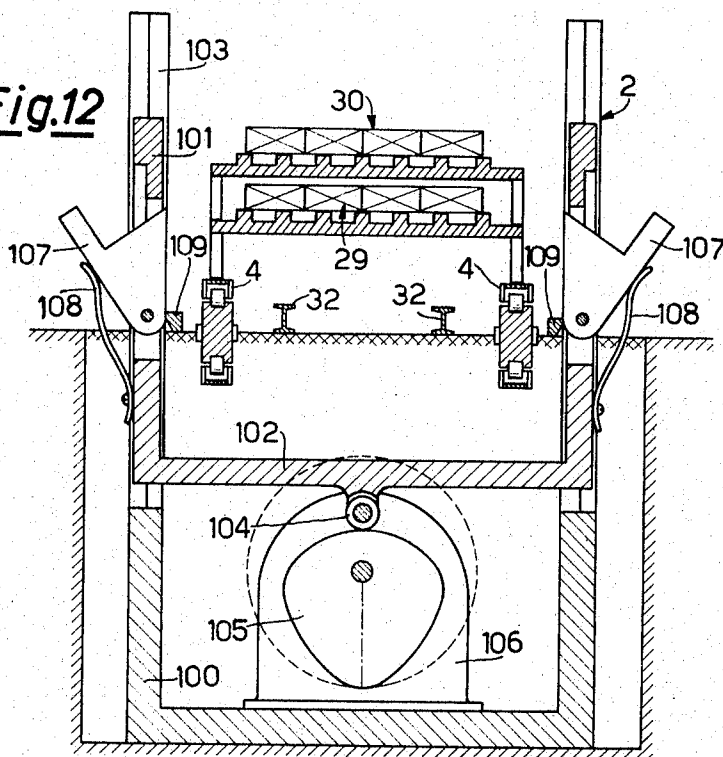


Fig.12



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Fig.13

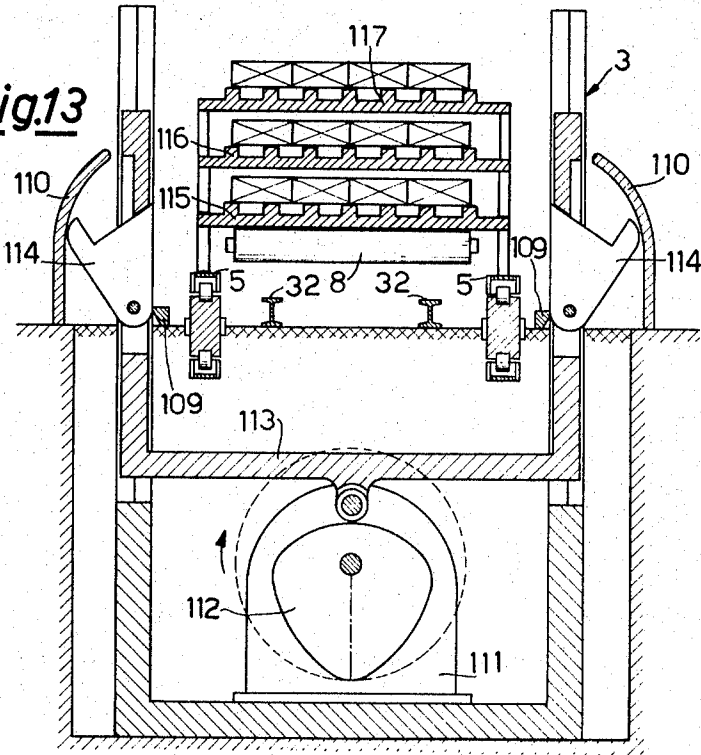
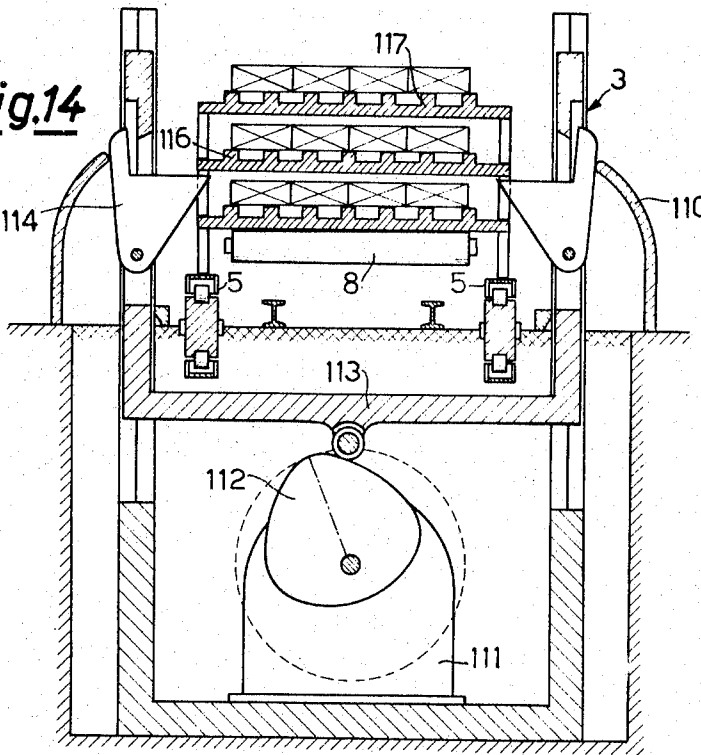


Fig.14



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Fig.15

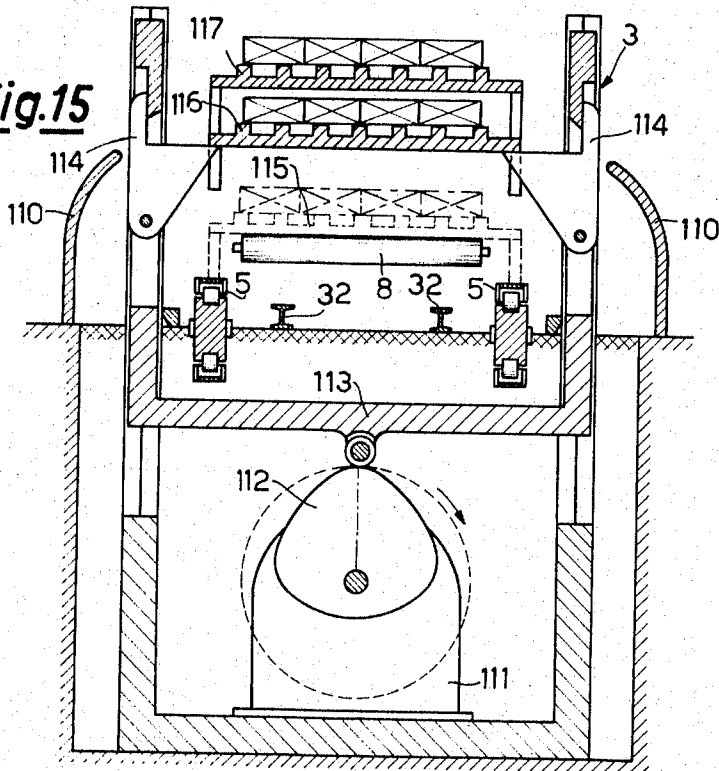
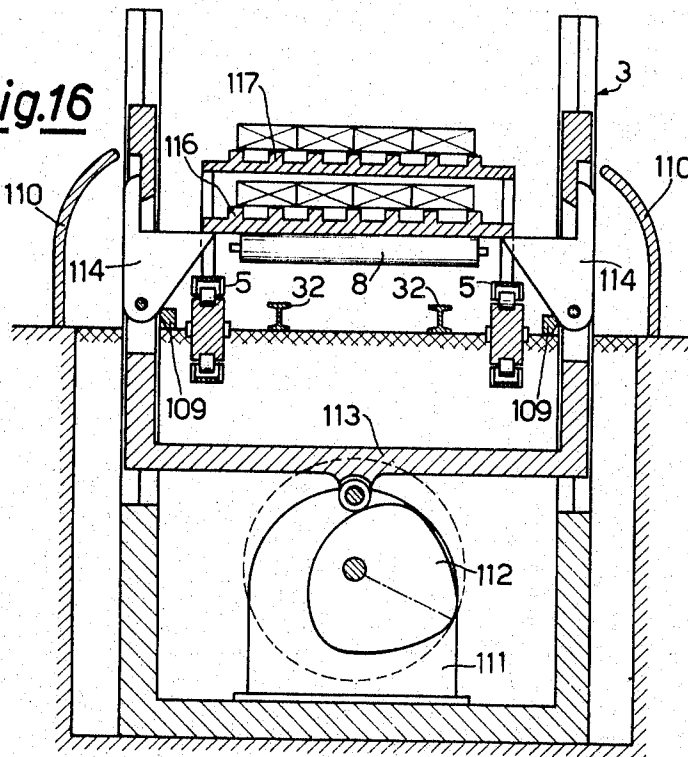


Fig.16



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STACKING MECHANISM

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Patent 699,878

15 Claims. (Cl. 214—6)

The present invention is related to an automatic mechanism for the production of bricks.

The present invention is related to a mechanism formed by a main mechanical assembly and by a system of sub-mechanisms cooperating therewith, adapted to arrange "green" shaped bricks on pallets as they come out of a shaping machine, to stack said pallets to convey said stacks groupwise towards a drying tunnel and, simultaneously and inversely, to withdraw the stacks groupwise from the drying tunnel and to forward them to the main assembly. The latter, after unstacking the stacks, removes the dried bricks from the pallets sending them towards a firing kiln whereas the empty aprons are recycled, the whole assembly being positively driven by one or more prime movers and controlled by electrical circuits capable of automating the operation.

The operation of the assembly according to the invention will become clear from the following description given with reference to the accompanying drawings, wherein:

FIG. 1 is a diagrammatical perspective view of an automatic system for the production of bricks.

FIGS. 2 and 2a are respective diagrammatical illustrations in end view and in side view of a brick-carrying pallet.

FIG. 3 is a plan view of a transfer mechanism.

FIG. 4 is a sectional view, along a vertical plane passing centrally through the mechanism shown in FIG. 3.

FIG. 5 is a perspective view of a pallet stacking mechanism.

FIGS. 6 through 12 are diagrammatical elevational views partly in section showing the operational stages of said stacking mechanism, and

FIGS. 13 to 16 are diagrammatic elevational views partly in section showing several operational stages of an unstacking mechanism.

In the disclosure to follow, for the sake of a clearer and more concise explanation, the several characteristic parts of the entire assembly will be separately listed, said parts to be particularly described and illustrated hereinafter in the disclosure and the drawings.

Said characteristic parts, which can be seen in FIG. 1, are as follows, namely:

A transfer mechanism 1 for loading upon pallets the green bricks or so called "greens" coming from a block-shaping machine and, simultaneously functioning to unload the dried "greens" from the pallets coming from the drying tunnel and also to recycle the thusly unloaded aprons towards the loading stage already described;

A stacking mechanism 2 fulfilling the function of stacking loaded pallets coming from the transfer mechanism;

An unstacking mechanism 3 which unloads the stacks of dried "greens" which are then intended to return to the transfer mechanism;

A twin-chain conveyor 4 which conveys the rows of stacks coming from the stacking mechanism;

A twin-chain conveyor 5, similar to 4 and having the reverse function of conveying the stacks towards the unstacking mechanism;

A lift-truck 6 having the function of supporting groups of stacks and carrying them onto the traveling platform 7, the latter fulfilling the task of displacing said truck transversely in front of the chains 4 and 5 and towards the drying tunnel chamber;

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A curvilinear conveyor 8 which has the function of conveying, one at a time, pallets with dried "greens" from the unstacking mechanism to the transfer mechanism;

A conveyor belt 9 conveying towards a kiln the dried greens coming from the transfer mechanism;

An electronic control keyboard 10 for the automatic control and check of circuits.

The general operation of the entire assembly will be now described in connection with FIG. 1, without delving into the mechanical details of the individual component parts: these latter will be described later.

From an extruder 22 a moisturized clay extrudate 24 is conveyed under a wire-cutter 23 which severs it into portions 25 of the desired length. The thusly formed "greens" pass over rollers, thrust by the extrudate, to reach the position indicated by 26 on the rollers 150 protruding from the apron 27. As soon as the "greens" have reached this position, a photocell (or any other automatic control member) sets the transfer mechanism or shifting assembly 1 to "go" and the latter actuates, with an upward motion, a fork 61 (cf. FIG. 3) which, passing with its prongs 62 between adjacent rollers 150 of the apron 27, lifts the "greens" therefrom and, with a simultaneously rotary motion through 90° (clockwise) brings them into the position indicated at 28 wherein the fork, is depressed with a motion inverse with respect to the prior one, to the prongs to pass in the interstices between the support straps 51 of a pallet of the kind shown in FIG. 2 which has arrived empty at the position 28 as carried by the transfer mechanism itself. Thus the "greens" are deposited on the pallet.

The transfer mechanism also expels a pallet located with "greens," bringing it to the position 29 in the stacking mechanism 2 which lifts it to the position 30, thus emptying the position 29 to be occupied by a second pallet carried by the transfer mechanism as the already described stage has been completed. Upon completion of the stacking the chain 4 causes the stack to make a step forward over a distance greater than the pallet's length.

As the stacking mechanism lifts this second pallet, the latter will lift the first pallet superposed thereover and in this way a stack will be formed in the stacking mechanism, always inserting a pallet underneath the preceding one.

When a group of aligned stacks has been formed on the chain 4, the traveling platform 7 is brought in correspondence with the chain 4 so as to allow the lift-truck 6 to proceed over the rails 32 (mounted between the chains 4) to slip a dolly 34 and a body 35 between the legs of the lowermost pallet and, after having lifted a group of pallets, to transfer said dolly to the traveling platform 7. Rolling on the rails 33, the traveling platform 7 places itself at the mouth of a chamber of a drying tunnel comprised between the walls 47, wherein the truck 6 discharges the stacks of pallets loaded with "greens."

Afterwards, the thusly emptied truck 6 returns to the traveling platform 7 which carries it to the mouth 46 of a drying tunnel chamber, still diagrammatically encompassed by the walls 47, and which contains dried "greens" on stacks of pallets. By a sequence of similar operations to the previous ones, a group of stacked pallets are taken and brought onto the traveling platform, which latter, being placed in front of the chain 5, permits the lifting truck to place the group of stacks of dried "greens" thereonto.

In FIG. 1 the arrows numbered 11-21, indicate the sequence and the direction of a complete cycle of operations performed by the lift-truck 6 and the traveling platform 7, starting from the removal of a group of stacks of pallets loaded with dried "greens."

The chain 5 transfers towards the unstacking mechanism 3 the stacks resting thereon and is stopped as the

first stack has arrived into the unstacking mechanism; the latter, as it becomes operative, lifts the pallet which immediately overlies the pallet placed at the lowermost level and resting on the chain 5 and lifts, solidly therewith, all of the overlying pallets. The lowermost pallet thus is freed and the curvilinear conveyor 8, after having slightly lifted it, brings it towards the transfer mechanism 1. The motion of the conveyor 8 and of the transfer mechanism feeder acts in such a way that the pallet is placed at 40 over a pair of arms 66 (cf. FIGS. 3 and 4), whereas, at the same time, in the final portion of the pallet's forward movement, the prongs 62 of the fork 61 slip between the strips 51 forming the resting surfaces of the "greens" on the pallet, subsequently lifting the dried "greens" to transfer them, thereafter, with a simultaneous clockwise 90-degree rotation, into the position 41.

Therein the fork, as it is depressed, causes its prongs to slip between the specially provided cantilevered driving rollers 151 journaled in the supporting piece 43 and lays down thereon the dried "greens" which are thrust by the same rollers onto the conveyor belt 9 (position 42) which advances them towards the kiln.

The transfer mechanism, by the previously outlined 90-degree rotation, in addition to carrying, by means of the prongs 62 of the fork 61, the "greens," carries also (through the arms 66 lying at a level lower than that of the rollers 150 and 151 and the conveyor 9 as well), the thusly unloaded pallet, from the position 40 to the position 41. A further 90-degree rotation in clockwise direction transfers the pallet from the position 41 to the position 26 whereat the already described "greens" loading stage takes place and an operative cycle is started afresh.

A pallet on which the "green" bricks are placed is illustrated in FIGS. 2 and 2A both in end and side view.

The pallet consists of a flat portion 50 wherefrom legs 52 downwardly protrude: the legs can be four in number and free, as indicated in FIG. 2, or they may also be fitted with transversal struts so as to stiffen them.

The pallet may have different shapes suitable to permit the superposition of the desired number thereof such that a free headroom for the "green" is left between each pallet and the next one above.

On the flat portion 50, are transverse and parallel arranged strips 51 on which the bricks are allowed to rest.

These strips have the twofold function of forming, with their uppermost face, a partial resting surface for the bricks so as to encourage the drying thereof and of creating inter-strip clearances 54 underneath the bricks so as to allow for the introduction therinto and the removal therefrom, in a vertical direction, of the prongs of a fork for transferring the bricks from other resting surfaces to the pallets, or vice-versa.

The transfer mechanism 1, which can be seen in plan view in FIG. 3 and in cross-sectional view in FIG. 4, is formed by a lower, box-like fixed supporting structure 55 and by an upper fixed plate 56 connected to each other by a sturdy hollow shaft 57 which, consequently, is also fixed. The plate 55 can be seen in cross-sectional view in FIG. 4, whereas it has not been shown in FIG. 3 so as not to obstruct the view of the mechanical members therebeneath. Rotatably mounted about the shaft 57 is a body 58 which has the shape of a rectangular parallelepiped with a square base.

On each side of the rotatable body 58 is formed a dovetailed hollow 60 wherein the dovetailed end of one of the four forks 61 can be inserted: said forks are movable with respect to the body 58 only for vertical displacement within the dovetailed guide 60.

The displacement of each fork 61 along its respective guideway 60 is caused by a cylindrical cam face 64 fixedly protruding from the supporting structure 55 and on which every fork rests by means of a roller 63 carried by an arm 63' which protrudes downwardly from the fork.

Due to the profile of the cylindrical cam 64, during rotation of the body 78, the forks are lifted or depressed

and are kept at a constant level, high or low, according to the automation mechanisms which will be later described.

The rotation of the body is obtained by means of a reduction gear 68 mounted on the upper fixed plate 56 and which is fitted with a handle 65 which supports a roller 118, mounted on one of its ends, within one of four grooves 67 formed along the diagonals of the upper face of the rotatable body 58. The handle 65, rotating in a clockwise direction, starting from the position indicated in FIG. 5 inserts the roller 118 into one of the grooves 67 and drives the body 58 in rotation, also in a clockwise direction, about the shaft 57 until the latter is caused to complete a 90-degree rotation as the handle 65 has completed a 270-degree rotation, that is to say when it has taken the position indicated by the dotted line in FIG. 3.

During completion of the last 90-degree movement from 270° to 360°, the handle 65 causes the roller 118 to come out of the groove 67 and be inserted into the next groove 67 which has taken the place initially occupied by the preceding groove.

During this last 90° of rotation of the handle 65, the body 58 is not moved since the roller 118 is moved within the square empty space 69 existing between the four central ends of the grooves 67. The means for rotating the body is thus of the form of a Geneva-type mechanism.

The standstill state of the body 58 in its rest position as taken in this stage can be assured, for a full measure of safety, by a conventional locking pawl (not shown in the drawing), which, entering a specially provided hollow formed in the body 58 prevents any rotation thereof until such time as the handle 65, continuing with its rotation, removes the blockage formed by the locking pawl thus initiating the rotation of the body 58.

From the rotatable body 58 protrude four pairs of arms 66 which have the function of supporting the pallets placed thereon.

The position of these arms 66 and their level is such that the special configuration and size of both the pallets and their strips, of both the forks 61 and their prongs 62, and of the cylindrical cam 64 as well, produce to the result that, when the forks are in their depressed position, their prongs are inserted in the clearances between the strips 51 of the pallets at a level which is lower than that of the upperplane of said strips (FIG. 4.) Conversely, when the forks 61 are in their uplifted position, the prongs 62 thereof are placed at a higher level than the said strips.

The shifting mechanism further comprises two groups of rollers, 150 and 151, respectively, one projecting from the supporting member 27, the other one from the supporting member 43. Both these groups of rollers have a level which is located above the strips supported by the pallets, which latter rest upon the arms 66, and their sizes and location are such as to place the rollers on a plane which overlies the pallet strips when the rotatable body 58 is in the above indicated standstill position.

The highest-level position the forks are allowed to take by the agency of the cam 64 is such that the fork prongs are at a level slightly above the rollers.

The rollers 151 can rotate about their own axles and are driven in continuous rotation by the reduction gear 68a.

The group of idle rollers 150 is connected to plate 69 via the supporting piece 27, extending to a ring 71 about the cam 64, so that the plate 69 is rotatable for limiting angular movement. The ring 71 has its center coincident with the center of the transfer mechanism, so that the plate 69 can assume the position 70 shown in dotted lines in FIG. 3.

A recoil spring and a stop-member (not shown in the drawings), tend to maintain the group of rollers 150 in the position shown in solid lines in FIG. 3.

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The purpose of connecting the rollers 150 to a movable plate 69 is to allow the prongs 62 of the fork 61 to be disengaged from said rollers, since the lifting motion of said prongs is accompanied by a simultaneously, though slight, horizontal translational motion.

The transfer mechanism is completed by two devices one for expelling from said transfer mechanism the pallet placed onto the arms 66 oriented towards the stacking mechanism 2, the other for bringing onto the transfer mechanism the pallet coming from the curvilinear conveyor 8 by depositing said pallet on the pair of arms 66 placed in correspondence with said conveyor 8.

To simplify the disclosure the first of these devices will be called the "pallet-remover" and the second one the "pallet-feeder."

FIG. 4 shows in cross-sectional view the details of the pallet-feeder whereas FIG. 3 shows, in a diagrammatical plan view at 72, the pallet-remover and the pallet-feeder at 73.

A description of the constructional arrangement and the operability of the feeder will be given below, whereas a description of the pallet-remover will be dispensed with since it is similar, both as to its construction and operability, as the pallet-feeder.

The pallet-feeder is formed by a rectangular frame having grooves 74 in which two pair of rollers 83 are slidable; the rollers 83 extend from a carriage 81 which can thus be displaced from the position indicated in FIG. 4, i.e. beneath the pallet 40, to the position under the pallet 91 indicated in dotted lines in FIG. 3 and 4.

These two end positions and the movements therebetween are imparted to the carriage 81 by a face-cam 79 which acts via a roller 90 mounted at the end of a ball-crank lever 80 starting from the carriage 81, the latter being fitted with a recoil spring urging the carriage towards the center of the transfer mechanism.

The carriage 81 can take two positions in the vertical direction: a lowermost one and an uppermost one and this possibility is conferred thereto by a pallet receiving device 73 which is mounted on four bell-crank levers 75 (FIG. 4); these levers are pivotally mounted on the base-plate 55 with the two shafts 84 and 85 and are linked, to form an articulated quadrilateral, with two pitmans 76.

A stirrup connecting said pitmans 76, and having a roller 77 centrally mounted, permits a face-cam 78, mounted on the camshaft 79, to either lift or depress the device 73 and the carriage 81 therewith. The size of these component parts is such that in the lowermost position the carriage 81, as shown in FIG. 4, is in such a position as not to touch the lower ends of the legs of the pallet placed on the arms 66, or those of the pallet 91, either, which are at the same level, whereas the carriage 81, when it is lifted to its uppermost position, slightly lifts the pallet 91 from the conveyor 8 (FIG. 4) transferring it on the arms 66.

The two cams 78 and 79 are mounted solidly on a shaft 92 which passes through the hollow shaft 57 and, via the gears 98, 94 and 95 is driven to make the same number of revolutions as the crank 65 which transfers the drive to the rotatable body of the transfer mechanism. It is important to note that, while the cams 78 and 79 are always moving when the crank 65 is moving, the rotatable body 58 is moving, as has been seen in the foregoing, only during the first 270° of every revolution of said crank, whereas it is stationary when the crank 65 completes the last 90° of every revolution.

Beneath the cams 78 and 79 of FIG. 4 there are mounted similar cams 88 and 89 which, during their rotation, produce lowering and lifting movements and the to and for movements, respectively, of the pallet-remover.

As aforesaid, the pallet-remover is similar to the pallet-feeder but, instead of lifting the pallets by their legs, it lifts them by directly contacting them from below.

The sequence of said movements of the pallet-feeder is as follows: as the crank 65 starts its revolution thus

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beginning the rotation of the body 58, the carriage 81 is kept in the depressed position by the cam 78 whereas the cam 79 displaces it from the position diagrammatically shown in the drawing towards the position beneath the pallet 91: as the crank 65 passes through 270° the rotatable body 58 is stopped, whereas, while the rotation continues, the cam 78 lifts the carriage 81 which will lift from the curved conveyor 8 the pallet in the position 91 bringing it on the arms 66 in a position corresponding to the pallet shown in the drawing in the position at 40 by the instrumentality of a suitable centripetal spring (not shown) which acts on said carriage 81.

Near the end of the rotation, the cam 78 places in the lowermost position the carriage 81 which thus lays the pallet onto the arms 66 so that, on completion of a 360 degree revolution of the crank and of the cams, the carriage 81 is depressed enough as not to hinder the rotation of the pallet as the subsequent rotation stage of the system is started.

The whole operational sequence of the shifting, assembly will be now described with reference to FIGS. 3 and 4 and following the rotational sequence of one of the forks starting from the position indicated by 26 to the position indicated by 28, from 28 to 40, from 40 to 41 and from 41 to 26 again, thus following the four 90 degree rotations of a complete 360-degree revolution performed by the rotatable body 58.

The moistened clay extrudate 24 coming out of the extruder 22 is severed by the cutting wire 23 into portions 25 of the desired length which are the "green" bricks.

Said "greens" rest on rollers or on a rotatable platform and are thrust by the clay extrudate onto the idle rollers 150.

When the desired number of "greens" lies on the apron placed in the stay position 26, an electric control member or a photocell energizes the reducing gear 68 and the rotatable body 58 starts a 90-degree rotation in the clockwise direction.

Simultaneously the fork 61, due to the rotation, is lifted by the roller 63 which rolls over the cam 64 and thus the prongs 62 are lifted and penetrate between the rollers 150, entraining the latter through a short fraction of their rotational path, since said rollers are connected to the movable plate 69 which is displaced into the position 70 indicate in dotted lines to leave said rollers as soon as their level is exceeded due to lifting, thus lifting also, concurrently with the rollers, the "greens." These latter, towards the end of the 90-degree rotation of the rotatable body will be laid down, as the prongs of the fork are depressed into the inter-strip clearance 54 of a pallet. This completes the first 90-degree rotation corresponding to the first 270° of the crank 65.

From that time onwards, as aforesaid, the rotatable body 58 remains stationary whereas the cams 78 and 79, by completing the last 90-degree rotational path, remove the loaded pallet from the position 28 to the position 29 on the chain 4 where the stacking device stacks it on the following pallet as will be seen hereinafter. Once the pallet has been deposited at 29, the transfer operation is stopped and will be restarted, repeating an identical cycle, as soon as another group of "greens" comes to energize the photocell as has been described hereinbefore.

As soon as this occurs, the rotatable body will bring in front of the conveyor 8 the pair of arms 66 freed from the pallet during the preceding stage, when the relevant fork 61 is in the depressed position so that, as the rotation of the cams 78 and 79 proceeds, the feeder will provide as has been seen before, to remove a pallet loaded with dried "greens" from the conveyor 8 to deposit it onto the arms 66 of the rotatable body.

During this stage of passage of the pallet carrying the dried "greens" from the conveyor 8 to the shifting assembly, the height levels of the individual parts are such that the prongs 62 of the fork 61 enter the pallet's inter-strip clearances 54 so as not to touch the "greens" or

the pallet either whereas, at the end of the feeding stage, the individual parts take the positions indicated in FIG. 4.

Once the stage of feeding the pallet with the dried "greens" has been completed, which is simultaneously with the expulsion of another loaded pallet from the position 28 to the position 29 (FIG. 3, already described), the body 58 is stopped the second time until a third group of "greens" coming on the rollers 150 energizes the photocell anew starting the third 90-degree rotation of the rotatable body 58.

During this third stage which passes the pallet from the position 40 to the position 41, of FIG. 3, the fork, lifted by the agency of the cam 64, removes its prongs from the inter-strip clearances 54 of the pallet and lifts the dried "greens" lying thereon and, as it comes towards the end of its 90-degree rotation, still by the agency of the cam 64, be depressed causing its prongs 62 to enter between the rollers 151 and thus deposit the dried "greens" onto the rollers 151: these latter, continually driven in rotation, advance the dried "greens" onto the conveyor belt 9 which forwards said "greens" to the kiln.

After the third stoppage of the rotatable body 58, the fourth and last 90-degree rotation will be started: this is also due to the fact that a fourth group of "greens" come to the position 26.

In this last quarter of a revolution of the body 58, will pass from the position 41 to the position 26 wherefrom it will start again due to the oncoming new group of "greens"; which by means of the photocell, will actuate the reducing gear 68 again, thus starting a new 360-degree cycle of the body 58, equal to the already described cycle.

In the foregoing description of a complete revolution of the body 58, there has been described the sequence of operative steps with reference to a single fork in every one of the successive quarters of a revolution traveled thereby, but it is obvious that for each 90-degree revolution, all the four described stages take place simultaneously and precisely one stage being performed for each of the four forks connected to the body 58.

In the light of that which has been said, for every 90-degree rotation of the body 58, there is simultaneously the loading of a pallet with wet "greens" and its advancement towards the stacking device, concurrently with the removal of a pallet with dried "greens" from the unstacking mechanism, and also its unloading and the transfer of the dried "greens" towards the firing kiln.

The operation of the stacking mechanism and of the unstacking mechanism will now be described.

The stacking mechanism 2 is formed by a U-shaped supporting structure 100 shown in FIGURES 5-12.

Every one of the sides of the supporting structure 100 is, in turn, U-shaped and has two vertical guides 103 having a concave V configuration: within each pair of U-shaped guides is slidably mounted a plate 101 which is solidly affixed to the other plate 101 by a strut 102. The two plates 101 and the strut 102 thus form a slide which can be vertically displaced between the guides 103.

This movement is imparted by the rotation of a cam 105 driven by a reducing gear 106 and which acts upon the slide via a roller 104 extending underneath the slide and acting on the cam 105.

This vertical movement has an amplitude which is slightly greater than the height of the pallet.

In each of the sides 101 of the slide there are formed two slots which have pivoted therein two pawls 107: on each of these a spring 108 is operative, which is affixed to the slide and tends to keep said pawls in the position as viewed in FIG. 7.

The stacking mechanism device is completed by two struts 109 affixed to the fixed structure 100 and adapted to make the pawls assume the position visible in FIG. 6 as the slide is in its lowermost position.

The operation of the stacking mechanism is explained hereinafter.

In FIG. 6 there is shown the rest position corresponding

to the position of the cam 105 with the cups directed downwardly, in which the slide is in its lowermost position and thus the pawls 107 are forced by the rods 109 to overcome the force of the springs 108 so as not to protrude inwardly of the stacking mechanism as can be seen in FIG. 6.

Starting from this rest configuration, the transfer mechanism deposits a pallet in position 29 onto the chain 4 (FIG. 3) within the stacking mechanism and, by a specially provided electric contact, starts the reducing gear 106 which starts the clockwise rotation of the cam 105: thus the slide (FIG. 7) is lifted and the pawls 107 are freed from the rods 109 and are thrust inwardly by the springs 108 so as to project beneath the pallet placed in the position 29 to lift the pallet (FIG. 7).

As the upward movement proceeds, the slide reaches the top, bringing the pallet to the position 30 of FIG. 9 wherein it is automatically stopped. In this top point of the stacking mechanism the pallet remains stationary until a new pallet (indicated in phantom in FIG. 9) is deposited by the transfer mechanism onto the chain 4.

As the second pallet is placed onto the chain, the reducing gear is started anew and the cam, assuming its clockwise rotation again, depresses the slide with the result that the pallet shown in position 30 is deposited on the pallet in position 29.

As the cam 105 continues its rotation and with the consequent continuation of the lowering movement of the slide, the pawls are first caused to move inwardly of the pallet (FIG. 11) and then at the end of the lowering stroke they are maintained in the position shown in FIG. 12.

Subsequently the cam 105 is not stopped but continues its rotation and the cycle depicted in FIGS. 7, 8 and 9 is repeated, the only difference being that, instead of one apron, the slide lifts two pallets.

Once the stack of pallets has been completed, the cam 105 is stopped with its cusp directed downward, so as to give time to the chain 4 to remove the stack so as to make room for the formation of a new stack.

By reiterating these cycles as many times as the pallets one desires to stack, a stack containing the desired number of pallets is obtained.

At this stage the stacking mechanism is automatically arrested in a position similar to that of FIG. 12 and, simultaneously, the chain 4 is started which, after advancing a desired distance, disengages the stacking mechanism from the stack and allows the starting of a new set of cycles identical to the previous ones to form a second stack and so forth. One of the features of the stacking mechanism is therefore that of forming a stack not superposing successively one pallet on the preceding one but placing every time the last pallet beneath the one occupying the same position previously.

The unstacking mechanism has a similar mode of operation.

It is constructed similar to the stacking mechanism with the difference that the pawls are springless and are urged to project inwardly by specially provided guides 110 which can be seen in FIGS. 13 to 16.

It operates as follows:

In FIG. 16 the unstacking mechanism is shown in the rest position i.e. with the slide stationary in its lowermost position and with the pawls urged by the rods 109 to free the inside of the unstacking mechanism so as to permit the introduction into the mechanism, by the agency of the chain 5, of a stack coming from the drying tunnel.

The introduction of a stack causes, by means of a specially provided electric automatic control, the starting of a reducing gear 111 and thus also of a cam 112: the latter, by rotating in the clockwise direction, causes the slide 113 to be lifted, which results in the contact of the pawls with their tips 114 against the guides 110. The pawls are thrust inwardly so as to enter between the lowest

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pallet 115 and the overlying pallet 116 thereover, as indicated by FIG. 14.

As the upward motion of the slide proceeds, the pawls lift the pallets 116, 117 and any other pallets superposed on 117, and the configuration depicted in FIG. 15 is obtained, i.e. the pallet 115 is freed and rests upon the chain 5 wherefrom it is taken by the curved conveyor 8 which slightly lifts it from the chain 5 and conveys it in front of the transfer mechanism.

As soon as the lowermost pallet has thus been removed from the unstacking mechanism, the slide 113 begins its descent and places upon the chain 5 the pallet 116 and the superimposed pallet 117 together with any other pallets superposed thereon.

As the downward movement continues, the pawls contact the rods 109 and are compelled to take a position similar to that of FIGURE 13, and a new cycle can be started.

When the unstacking mechanism has laid on the chain 5 the last pallet of a stack, and when the conveyor 8 has removed it from the chain, a new stack takes the unstacking position by advancement by the chain 5 and the whole sequence is repeated as already described.

To obtain automatic operation of the entire cycle a conventional electric contact or photocell implementation can be provided, which controls suitable telecontrolled switches.

Also the unstacking mechanism has the feature, akin to that of the stacking mechanism, of removing the lowermost pallet from the stack and proceeding up to the top one.

Both in the foregoing disclosure and in the drawings a mechanical embodiment has been described which is not to be construed as limiting in any way since numerous modifications and variations will be apparent to those skilled in the art without departing from the scope and spirit of the invention.

What is claimed is:

1. Apparatus for the automatic handling of articles comprising a transfer mechanism at a transfer station operative simultaneously to load articles for treatment onto pallets and to unload treated articles from pallets, a stacking mechanism at a stacking station which acts to stack loaded pallets ejected in succession from the transfer station for treatment, an unstacking mechanism at an unstacking station which acts to unstack loaded pallets after treatment in a treatment zone for reception in succession at the transfer station, and conveyor means arranged to feed articles for treatment to the transfer station, to convey stacks of loaded pallets from the stacking station to the treatment zone, to convey stacks of loaded pallets from such treatment zone to the unstacking station, and to remove from the transfer station the treated articles unloaded from pallets, said transfer mechanism comprising a rotatable body which carries a plurality of article-supporting means vertically displaceable relative to the body and a plurality of pallet-supporting means, said article-supporting means being arranged at a loading position to load articles for treatment onto a pallet carried by a respective pallet-supporting means and simultaneously at an unloading position to unload treated articles from a pallet carried by a respective pallet-supporting means.

2. Apparatus according to claim 1 comprising annular cam means fixed coaxially relative to the body for displacing the plurality of article-supporting means vertically relative to the rotatable body during rotation of the body.

3. Apparatus according to claim 2 wherein each article-supporting means comprises a pronged fork, a set of spaced parallel idle rollers carried in cantilever fashion on a support at the loading position for receiving the articles for treatment, the rollers being spaced to allow passage therebetween of the fork prongs, the fork prongs being movable from a level beneath the rollers upwardly between the rollers to lift the articles therefrom upon

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rotation of the rotatable body and thence to pass downwards into clearance spaces of a pallet carried by a respective pallet-supporting means so as to deposit the articles on the pallet.

4. Apparatus according to claim 3 wherein said roller support is displaceable through a limited arc about the axis of rotation of the rotatable body to accommodate entrainment of the rollers by the prongs during an initial degree of rotation of said body.

5. Apparatus according to claim 4 wherein the fork prongs extend in cantilever fashion from the rotatable body and lie in the clearance spaces of a pallet during ejection of a loaded pallet from, or reception of a loaded pallet at, the transfer station.

6. Apparatus according to claim 5 comprising a set of spaced parallel driven rollers carried in cantilever fashion on a support at the unloading position, the rollers being spaced to allow passage therebetween of the fork prongs, the fork prongs carrying treated articles lifted from a pallet loaded with treated articles and movable from a level above such roller assembly down between the rollers to deposit treated articles thereon for removal from the transfer station.

7. Apparatus according to claim 1 comprising a drive means for driving the rotatable body including a Geneva-type drive mechanism to index the body intermittently through a number of equal stages of a revolution, and a pallet-supporting means and an article-supporting means corresponding to each rest position of the body.

8. Apparatus according to claim 7 wherein the rotatable body is indexed intermittently through four 90° stages of a single 360° revolution of the body.

9. Apparatus according to claim 7 wherein the transfer mechanism comprises a device acting automatically to eject pallets loaded with articles for treatment in succession to the stacking station, and a device acting automatically to receive pallets loaded with treated articles in succession from the unstacking station.

10. Apparatus according to claim 9 comprising cam means, said drive means driving the pallet-ejecting and pallet-receiving devices each by way of said cam means so that such devices operate to eject or receive a pallet during rest periods of the body.

11. Apparatus according to claim 10 wherein the pallet-ejecting and pallet-receiving devices each comprise a pallet carriage roller-mounted on a frame for horizontal movement relative thereto and radially of the axis of rotation of the rotatable body, a bell-crank lever means supporting the frame for vertical movement, further cam means for controlling the horizontal and vertical movement in the case of the ejecting device to lift a loaded pallet from a respective pallet-supporting means of the body and transfer and deposit same at the stacking station, and in the case of the receiving device to lift a loaded pallet from a conveyor from the unstacking station and transfer and deposit same on a respective pallet-supporting means of the body.

12. Apparatus according to claim 1 wherein the stacking mechanism comprises driven cam means, a slide mounted for vertical reciprocating movement by said driven cam means over an end of a horizontal conveyor and including pawl means which acts during upward movement of the slide to successively engage and lift clear loaded pallets ejected onto such conveyor for reception therebelow of a succeeding loaded pallet, to form a stack of a desired number of loaded pallets, the stack to be then rested on the conveyor for removal from the stacking station.

13. Apparatus according to claim 12 comprising spring means urging the pawl means into a pallet-engaging position and fixed deflector means for forcing the pawl means to a pallet-disengaging position as the slide is brought to a lowermost rest position.

14. Apparatus according to claim 13 wherein the unstacking mechanism comprises driving cam means, a

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slide mounted for vertical reciprocating movement by said driven cam means over an end of a horizontal conveyor and including pawl means, fixed guide means which forces the pawl means during upward movement of the slide to engage between a lowest pallet and an immediately overlying pallet of a stack of loaded pallets resting on the conveyor and thence lift clear such overlying pallet and any superposed pallets of the stack, so as to free said lowest pallet for removal to the transfer station, fixed deflector means for forcing the pawl means to a pallet-disengaging position as the slide is brought to a lowermost position.

15. Apparatus according to claim 14 wherein each of said conveyors is a parallel chain conveyor for cooperating with a lift truck means to convey the stacks of loaded pallets from the stacking station to the treatment zone

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and to convey the stacks of loaded pallets from the treatment zone to the unstacking station, the conveyors extending parallel and the lift truck means transverse to the ends of the conveyors remote from the stacking and unstacking stations.

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