United States Patent

[11] 3,530,825

[72] Inventor Peter Antonissen, London, England
[21] Appl. No. 664,324
[22] Filed Aug. 30, 1967
Continuation-in-part of Ser. No. 641, 266; May 25, 1967, abandoned
[45] Patented Sept. 29, 1970
[73] Assignee Monsanto Chemicals Limited, of Monsanto House, London, England
[32] Priority June 7, 1966
[33] Great Britain
[31] 25,337/66

[54] **APPARATUS FOR PREPARING REFRACTORY SHELL MOLDS**
10 Claims, 13 Drawing Figs.

[52] U.S. Cl. **118/56,** 104/88, 118/58, 118/416, 118/425, 118/500, 214/1
[51] Int. Cl. **B05c 11/02**
[50] **Field of Search** .... 118/6, 52–57, 416, 423, 425, 426, 500, 503; 117/113, 114; 104/88; 214/302; 221/224, 236, 253; 269/(Inquired)

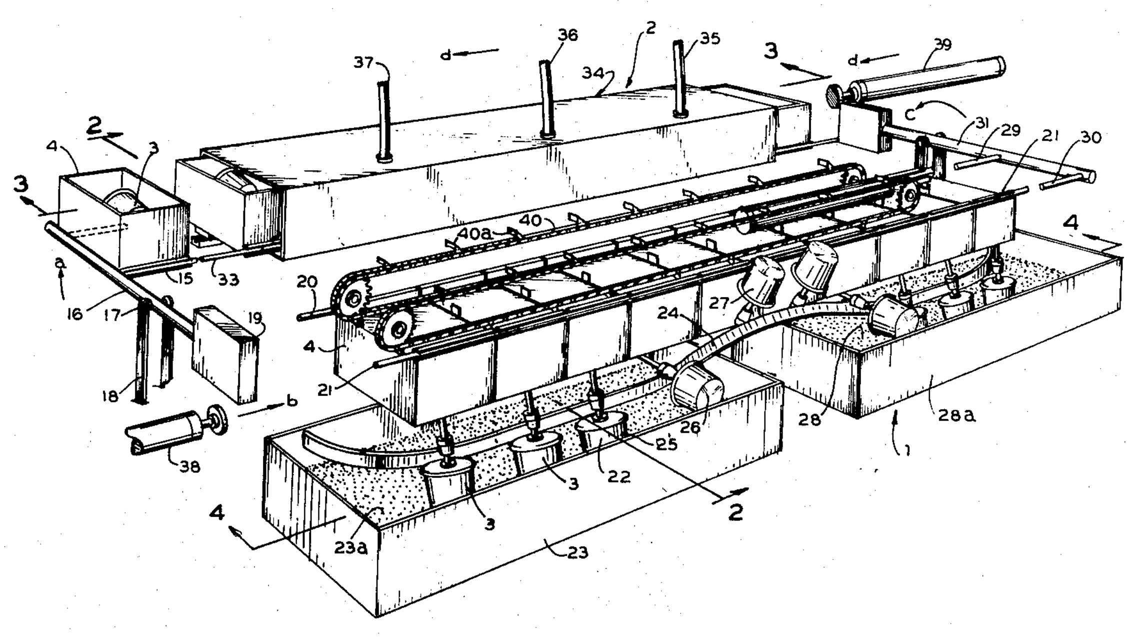
[56] **References Cited**

UNITED STATES PATENTS

433,300	7/1890	Monto	118/425
1,562,479	11/1925	Whitaker	118/56
1,585,880	5/1926	Schnell	118/56
1,868,545	7/1932	Slonneger	118/52
1,991,118	2/1935	Raiche	118/425X
2,155,995	4/1939	Robb	118/425X
2,387,300	10/1945	Ronci	118/52
2,574,686	11/1951	Brown	118/56X
2,755,205	7/1956	Robb et al.	118/56X
2,821,157	1/1958	Boyd	118/426X
2,821,158	1/1958	Brown et al.	118/56X
2,952,567	9/1960	Nordquist et al.	118/500X
3,112,834	12/1963	Dempster et al.	214/302
3,253,943	5/1966	Mayer et al.	118/423X
3,310,027	3/1967	Lindemann	118/52
3,384,048	5/1968	Kutcher	118/426X
3,396,696	8/1968	Becker	118/49

Primary Examiner—Morris Kaplan
Attorneys—Richard W. Sternberg, Roger R. Jones and James J. Mullen

ABSTRACT: The present invention, in part, relates to an apparatus for applying a coating of a slurry to a pattern and treating the slurry of the coating with a gaseous media such as ammonia in order to gel such slurry. Such apparatus comprises a container having an opening sufficiently large for a pattern to pass therethrough, such container being provided with mounting means incorporating a pivotal device for attaching a pattern to the container. Such mounting means allows the container when in a first position and when the opening of said container is in the upper most position to support the pattern within said container. When the container is in a second position with the opening in the lower position, the pattern is positioned outside of such container. There is also provided means for moving the container from the first position to the second position and a second means for applying a coating of a slurry to a pattern when the container is in the second position, and a third means for treating the slurry of the coating with such gas when the container is in the first position.



Patented Sept. 29, 1970

3,530,825

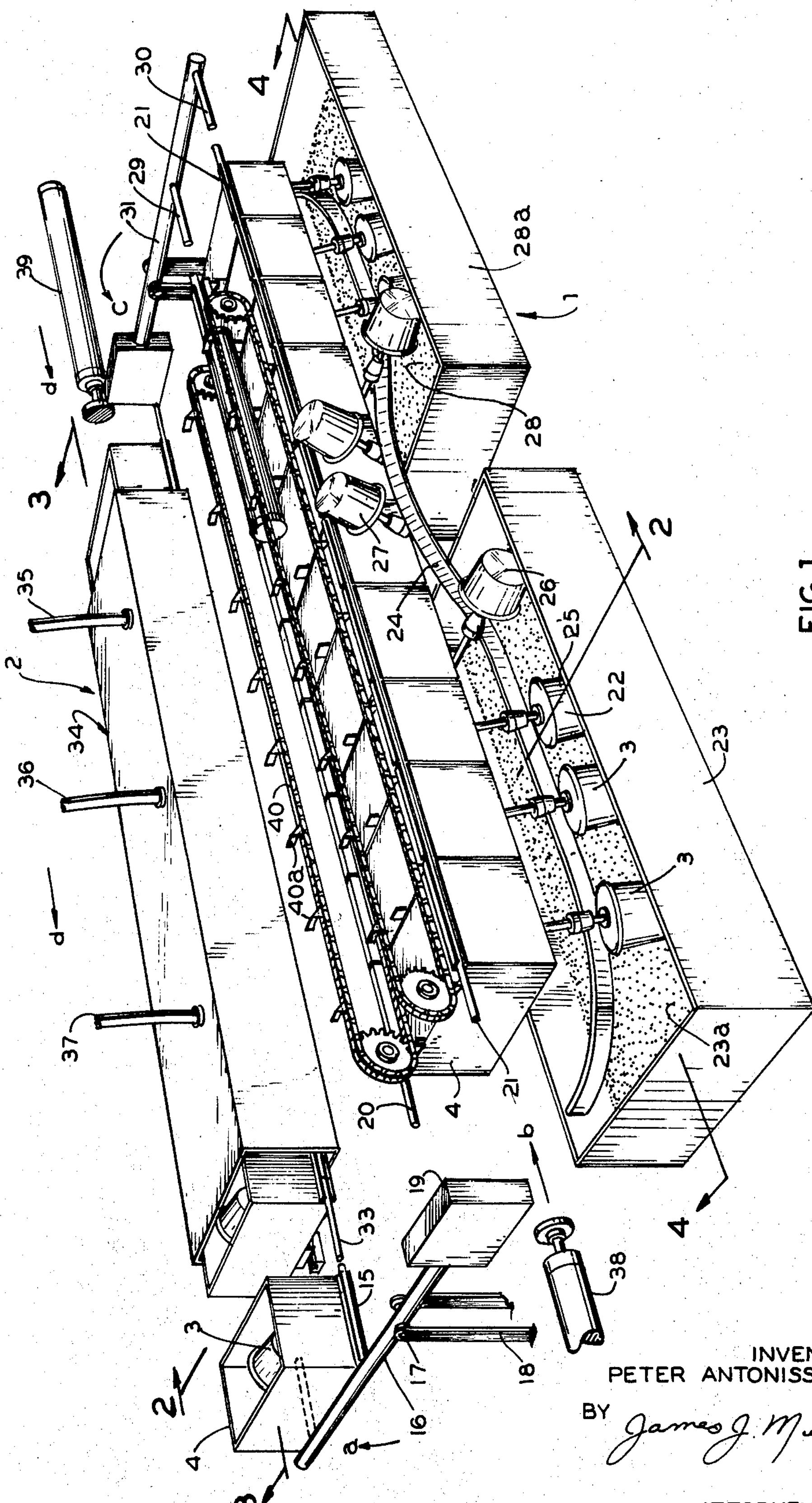


FIG.1

INVENTOR
PETER ANTONISSEN

BY James J. Mullen

ATTORNEY

Patented Sept. 29, 1970

3,530,825

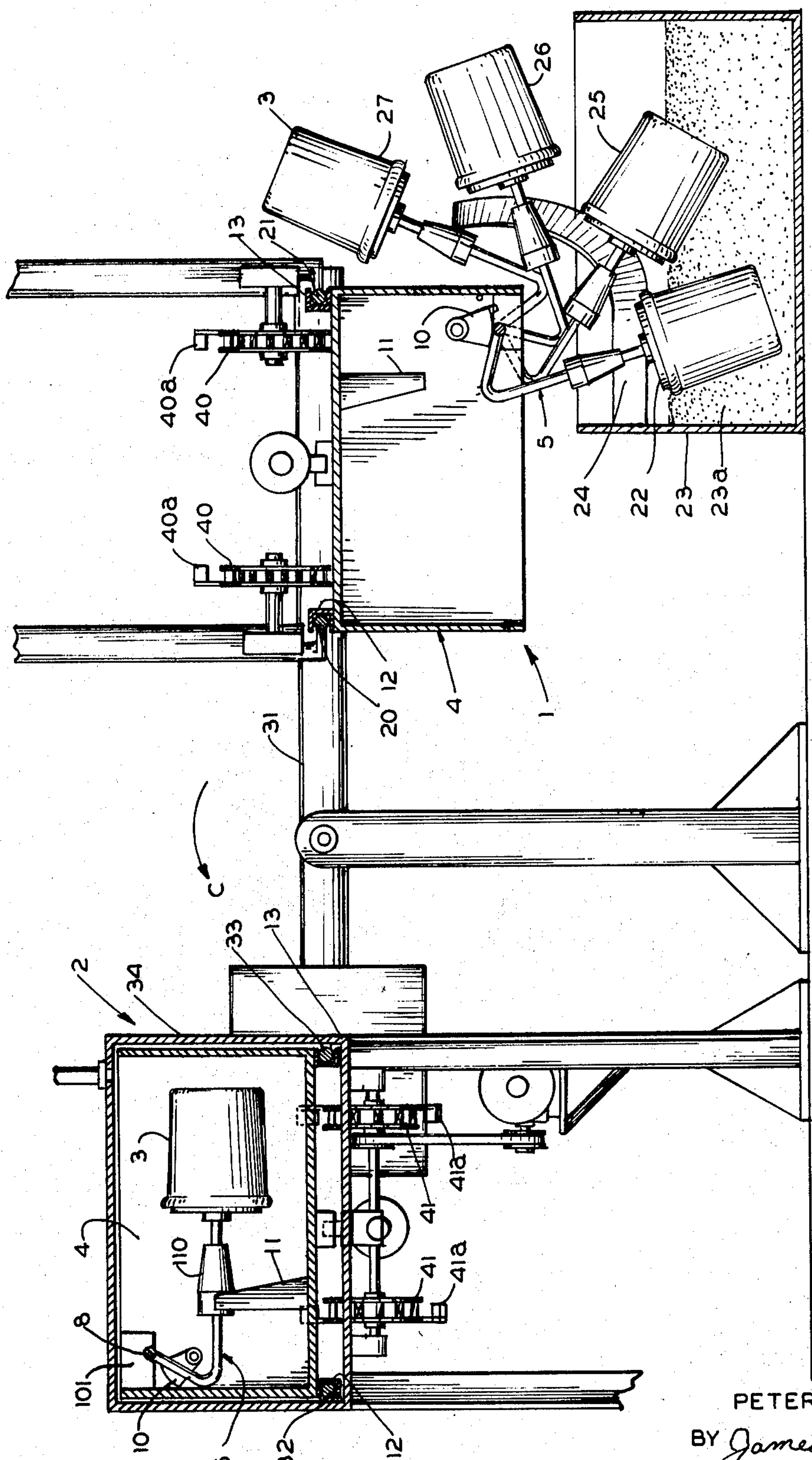


FIG.2

INVENTOR
PETER ANTONISSEN

BY James J. Mullen

ATTORNEY

Patented Sept. 29, 1970 **3,530,825**

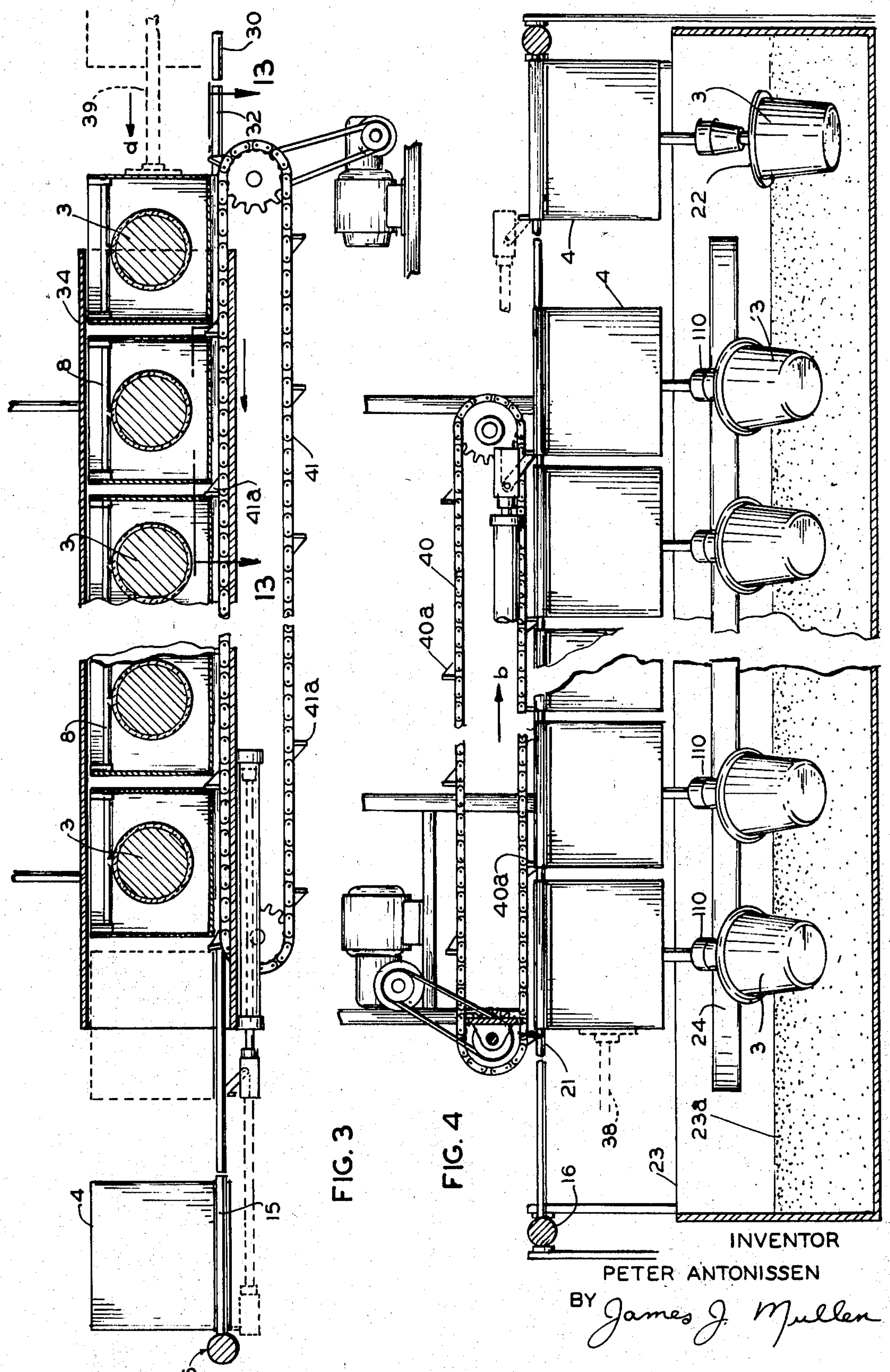


FIG. 3

FIG. 4

INVENTOR
PETER ANTONISSEN
BY James J. Mullen
ATTORNEY

Patented Sept. 29, 1970

3,530,825

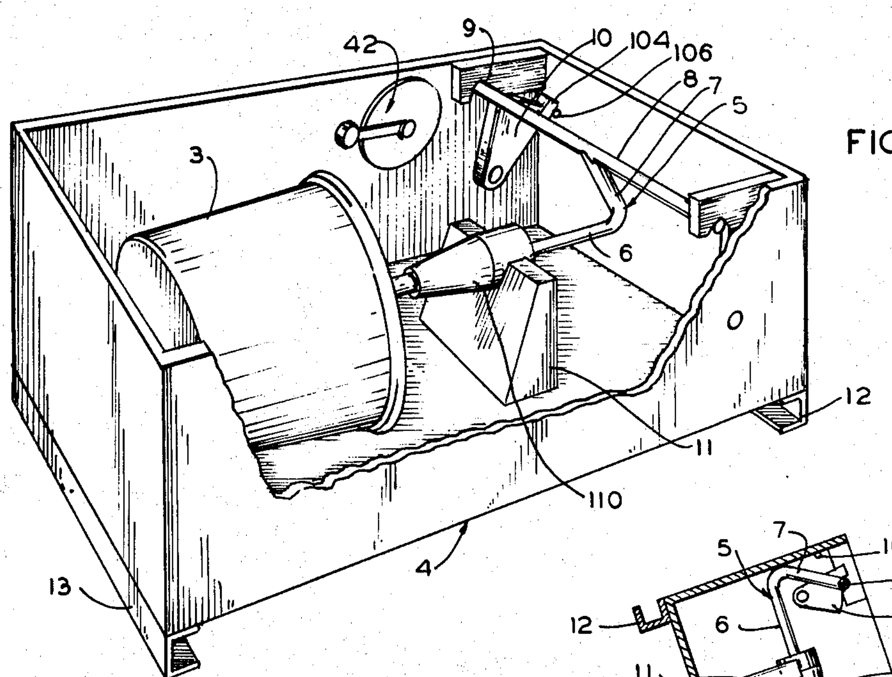


FIG. 5

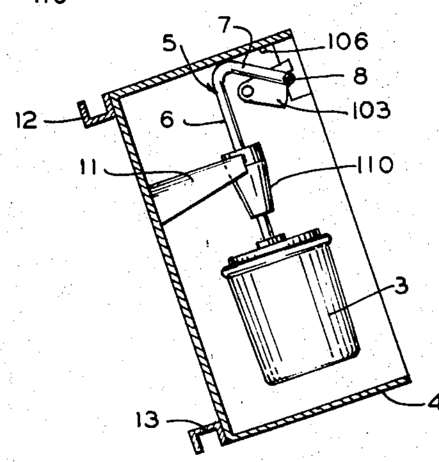


FIG. 6

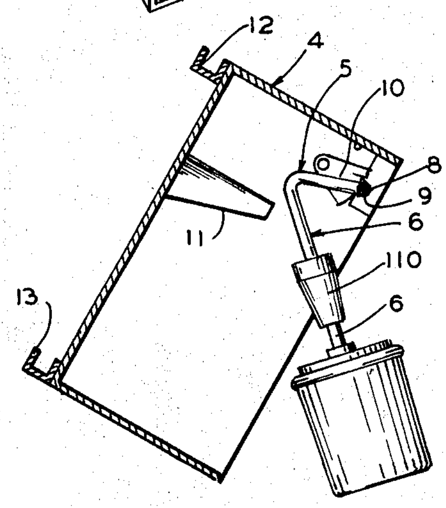


FIG. 7

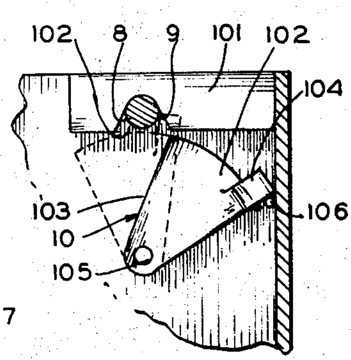


FIG. 8

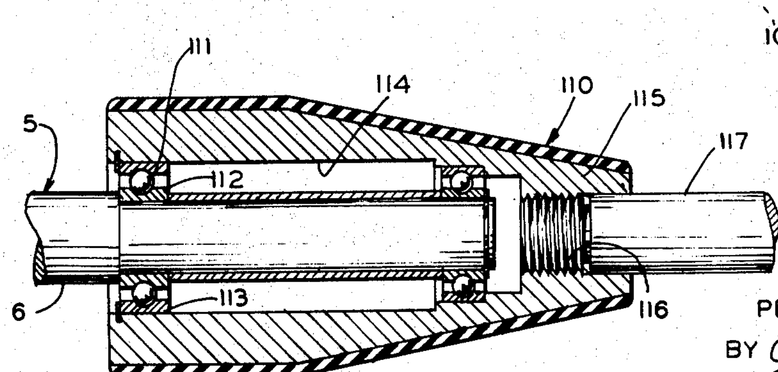


FIG. 9

INVENTOR
PETER ANTONISSEN
BY James J. Mullen

ATTORNEY

Patented Sept. 29, 1970 3,530,825

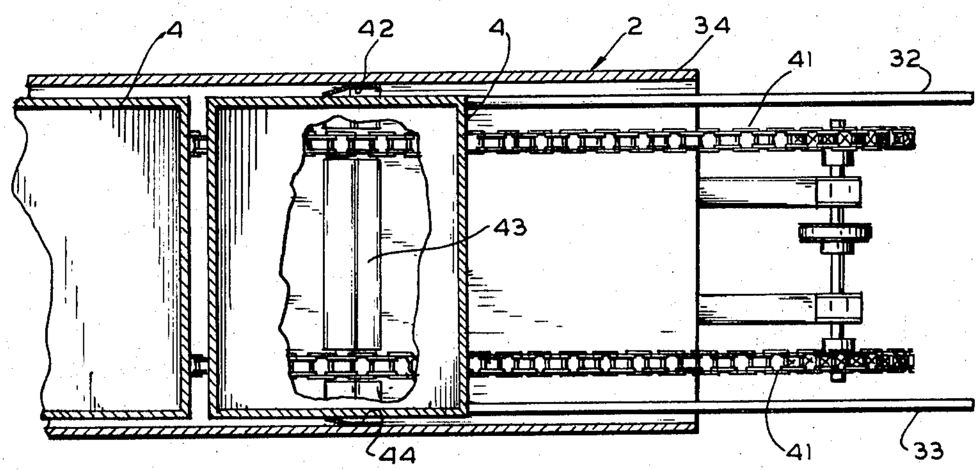


FIG. 13

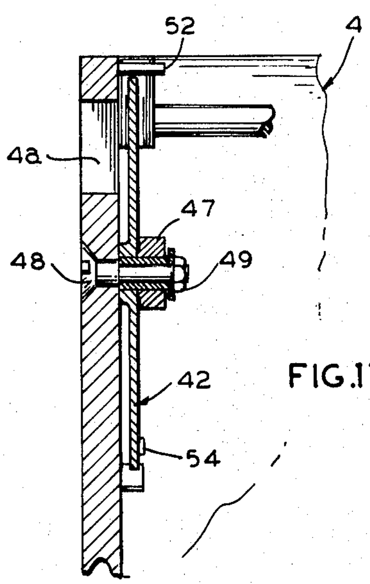


FIG. 11

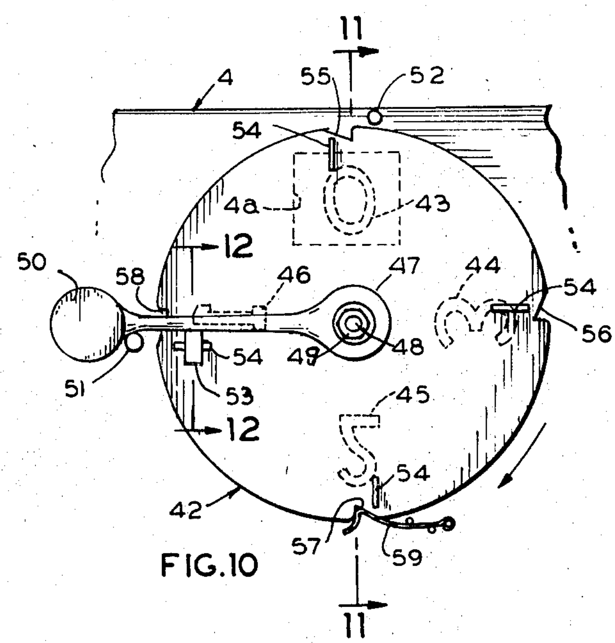


FIG. 10

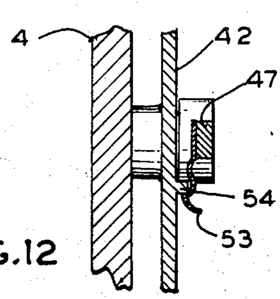


FIG. 12

INVENTOR
PETER ANTONISSEN
BY James J. Mullen
ATTORNEY

APPARATUS FOR PREPARING REFRACTORY SHELL MOLDS

This is a continuation-in-part of application Ser. No. 641,266, filed May 25, 1967 and now abandoned.

This invention relates to a new apparatus and process for coating a pattern with a refractory layer, for example in the production of refractory shell moulds.

Refractory articles are often made by processes involving the use of a slurry containing a finely-divided refractory and a binding agent, for example one containing silica. For example in the "lost-wax" process for producing refractory shell moulds for use in metal casting, there is first prepared a fusible pattern of the shape that is desired in the final casting, and a relatively thin shell of refractory is formed round the pattern. The shell is formed by a series of operations which include coating the pattern with a layer of slurry that is covered with a "stucco" of refractory particles and then gelled. Gelation can be effected in various ways, for example the slurry will gel if it is merely allowed to dry out, but a preferred method is to bring about a more rapid gelation by the action of a gaseous gelling agent such as for instance carbon dioxide or ammonia. British Pat. Specifications 926,927, 966,792, and 1,004,278 all describe processes of this kind for the production of refractory shell moulds.

The present invention is concerned with a new apparatus for carrying out the coating and gelation operations.

The apparatus of the invention is one for applying a coating of a slurry to a pattern and then treating the slurry of the coating with a gas or vapour, comprising a box, cage or similar container having an opening sufficiently large for a pattern to pass through the opening, the container having mounting means incorporating a hinge, pivot or similar device for attaching a pattern to the container so that with the container in an attitude such that the opening is uppermost the pattern is supported within the container but with the container in an inverted attitude the pattern hangs outside the container, means for moving the container from the first mentioned attitude to an inverted attitude or vice versa, means for applying a coating of a slurry to a pattern while the container is in an inverted attitude and means for treating the slurry of the coating with gas or vapour while the container is in the first mentioned attitude.

Normally, after a pattern is given each coating of slurry but before the coating is gelled by treatment with gas or vapour, it is given a coating of stucco material (refractory particles that are very often larger than those in the slurry), and accordingly the apparatus can also comprise means for applying a coating of stucco to a pattern when the container is in an inverted attitude.

Preferably the apparatus includes means for rotating the pattern after it has been coated with slurry about each of two axes inclined to each other at an angle of at least 30°, for instance about 90°, and preferably rotation can take place about the two axes simultaneously. Where there is a stucco-coating means it is preferable if the rotation can take place after a stucco-coating operation also.

Preferably the means for slurry- and stucco-coating comprises respectively a reservoir of slurry and a fluidised bed of stucco-particles into which a pattern can be dipped as it hangs outside its associated container. As alternatives, a pattern can be sprayed with slurry or passed beneath a "rain" of stucco particles.

The means for treating slurry of the coating with gas or vapour can conveniently comprise a tunnel, containing the gas or vapour, through which the container and coated pattern can be passed. With the pattern protected from mechanical damage within its container and with the relative ease of forming an appropriate seal between the tunnel and a container entering or leaving the tunnel, practical problems associated with such gas treatment of the delicate and awkwardly-shaped patterns are greatly reduced.

In the accompanying drawings, forming a part of this specification, and which like numerals are employed to designate like parts throughout the same,

FIG. 1 is a perspective view of the novel apparatus,

FIG. 2 is a cross section taken along lines 2–2 of FIG. 1,

FIG. 3 is a cross section taken along lines 3–3 shown in FIG. 1,

FIG. 4 is a cross section taken along lines 4–4 of FIG. 1 partially cut away,

FIG. 5 is a perspective view, partially broken away, of a box having a wax pattern mounted therein,

FIG. 6 is a sectional view of FIG. 5 showing said box in a tilted position,

FIG. 7 is a sectional view of FIG. 5 showing said box in an inverted attitude,

FIG. 8 is a partial cross section of FIG. 5 and shows a retainer latch mechanism,

FIG. 9 is an enlarged cross-sectional view of the sleeve bearing shown in FIGS. 5, 6 and 7,

FIG. 10 is an enlarged elevational view of FIG. 5 and shows a rotatable dial,

FIG. 11 is a cross-sectional view taken along lines 11–11 of FIG. 10,

FIG. 12 is an enlarged cross-sectional view taken along lines 12–12 of FIG. 10, and

FIG. 13 is an enlarged cross-sectional view taken along lines 13–13 of FIG. 3.

Referring now more specifically to the novel apparatus (FIG. 1) of the present invention, it will be noted such apparatus comprises two main sections, the first 1 being devoted to slurry- and stucco-coating operations and the second section 2 being devoted to gelation of the slurry by the action of ammonia gas or any NH_3-containing gas such as an ammonia-air mixture. Each pattern 3 or assembly of patterns, also referred to herein as a cylinder, is mounted within an open-topped box 4 by means of a generally L-shaped mounting arm 5, the pattern being affixed to the end of the longer portion 6 of the arm and the shorter portion 7 being fixed to a T-piece 8 pivoted at its ends to the sides of the box at two pivot points 9; note FIGS. 5 through 8. A retainer latch mechanism 10, FIG. 8 and described hereinafter in detail, is provided so that the T-piece, arm and pattern assembly can be easily removed or clipped into place. The T-piece, arm and pattern can thus pivot about the pivot points 9 but the assembly is prevented from touching the bottom of the box by engagement of the mounting arm with a fixed support 11. The mounting arm 5 has a sleeve bearing 110, FIG. 9, in its longer portion 6 so that the end of the arm and the pattern can rotate about the axis of this portion of the arm. More specifically and referring to FIG. 9, the mounting arm portion 6 extends into the interior of sleeve bearing 110 and thus permits rotation thereabout by means of bearings 111 positioned between collars 112 and 113. Collar 112 is attached to mounting arm portion 6 and collar 113 is attached to the interior wall 114 of sleeve bearing 110. In the uppermost area 115 of the truncated conical portion of the sleeve bearing 110, there is provided a threaded bore 116 which permits the pattern or cylinder arm 117 to be detachably, rigidly affixed to said sleeve bearing 110.

Along two opposite bottom edges of the box 4 are fixed two lengths of U-channel section 12 and 13 (note FIGS. 5, 6 and 7) which are engageable with two rods 14 and 15 extending horizontally from near one end of a pivoted transfer arm 16, note FIG. 1. The transfer arm 16, which is pivoted at 17 to a fixed support 18 and has fixed to its end remote from the rods 14 and 15 a counterpoise weight 19, is arranged so that starting from the position shown in FIG. 1 rotation through 180° in a vertical plane in the direction of the arrow *a* brings a box 4 supported on the rods 14 and 15 in an inverted position to the start of the coating section 1 with its U-channel sections 12 and 13 aligned with a pair of parallel horizontal suspension rails 20 and 21. A hydraulic or pneumatic mechanism 38, partially shown in FIG. 1, is provided so that a succession of boxes can be made to slide on to and along the suspension rails in the direction of the arrow *b*.

With the box in the inverted position, the pattern 3, as a result of pivotal movement about the points 9, hangs down beneath the open box as shown at 22. A tank 23 of slurry 23*a* is so placed that with the assembly hanging in this position at the start of the rails it dips into the slurry. As the box slides along the suspension rails **20** and **21**, the rotatable end of the mounting arm **5**, *i.e.* the sleeve bearing **110**, comes into engagement with a guide rail **24** which is shaped so that the assembly, *i.e.* **3** and **5**, is lifted sideways and upwards about the pivot points **9** and at the same time the rotatable part of the mounting arm **5**, *i.e.* the sleeve bearing **110**, rolls along the guide rail so that the pattern **3** is rotated about the axis of the longer portion **6** of the mounting arm. A succession of positions of the pattern is shown at **25**, **26** and **27**. The guide rail **24** is so shaped that after the pattern **3** has been lifted through nearly 180°, the continued movement of the box **4** along the rails causes the pattern **3** to be gradually lowered (while still being rotated about the axis of the mounting arm **5**), so that it **3** hangs down in a fluidised bed of stucco **28** contained in vessel **28***a*. As the box **4** moves further along the rails **20** and **21** the pattern **3** is then lifted, lowered and simultaneously rotated as before by action of the guide rail **24**.

Eventually when a box **4** arrives at the ends of the suspension rails **20** and **21**, its U-channel sections **12** and **13** engage with two horizontal rods **29** and **30** attached to a pivoted and counterbalanced transfer arm **31** similar to that **16** described hereinbefore. Pivotal movement of the transfer arm **31** in the direction of the arrow *c* reinverts the box (so that the pattern is now supported within it) and brings the U-channel sections **12** and **13** into alignment with a pair of horizontal parallel rails **32** and **33** leading into a tunnel **34**, note FIGS. **1** and **2**. A ram mechanism **39** is provided to push a succession of boxes in the direction of the arrow *d* through the tunnel **34** into which a gas such as, for instance, ammonia can be injected through an inlet **35** and exhausted at two outlets **36** and **37**.

Flexible seals **42**, **43**, and **44**, FIG. **13**, at each end of the tunnel **34** and at the bottom thereof minimise the leakage of gas, and it is also advantageous in this respect to operate with the pressure within the tunnel **34** slightly below atmospheric pressure.

When a box **4** reaches the end of the tunnel **34**, it can be removed from the apparatus or put through the apparatus again so that the pattern undergoes a further sequence of coating and hardening operations.

The latch mechanism indicated generally by the numeral **10** in FIGS. **2** and **5** is shown in an enlarged view in FIG. **8**. Each pivot point **9** is provided by a plate **101** recessed at **102** so as to provide a suitable pivoting surface for the T-piece **8**. In FIG. **6** the arm **5** with sleeve bearing **110** is shown resting on the support **11** which acts as a fulcrum so that the T-piece **8** is forced upwards against the recess **102**. A sector-shaped latch **103** having a radial projection **104** is pivotally mounted at **105** on the side of the box **4**, and with the box **4** in the position shown in FIG. **8** the latch rests with the projection resting against a stop **106**. As the box **4** is tilted by pivotal movement of the transfer arm **16** the latch **103** falls forward so that the projection **104** rests against the T-piece **8** as shown in FIGS. **6** and **7**, thus holding the T-piece in engagement with the recess **102** in the plate **101**. The latch **103** remains in engagement with the T-piece **8** throughout subsequent movements of the mounting arm **5** shown, for example, in FIG. **7**, but as the pivotal movement of the transfer arm **31** reinverts the box **4**, the latch **103** reverts to the position shown in FIG. **5** permitting removal and replacement of the mounting arm **5** and pattern **3**. This particular kind of latching mechanism is a preferred embodiment of the invention. In another embodiment, the T-piece could be permanently hinged to the container with the mounting arm being removably fitted to it by, for instance, a bayonet or similar clip.

Many other variations can be made on the apparatus described in the foregoing paragraphs. For instance although a rotary movement is applied to the pattern **3** as a result of the mounting arm **5** itself rolling along the guide rail, the rail can contact a friction roller, such as a wheel, fixed to the arm. If the roller is a frustoconical one (like that shown in detail at **110** in FIG. **9**) and the guide rail **24** is shaped so that the point of contact moves towards and then away from the apex of the cone, the rotary movement is accelerated and decelerated relatively smoothly. When a wheel is used, the rotatable portion of the mounting arm can be driven, for example by means of a motor or preferably a compressed air turbine, or the guide rail **24** can have associated with it a driven belt which engages with a roller on the mounting arm.

Hydraulic or pneumatic rams **38** and **39** have been mentioned as a suitable means for moving a succession of boxes along suspension rails **20**, **21**, **32** and **33**, but an endless roller chain such as that shown in FIG. **13** can be employed for this purpose if desired in order to achieve a more uniform motion. More specifically and with reference to FIGS. **2**, **3** and **13**, it will be noted that the endless roller chain also referred to in the art as an endless conveyor comprises two chains, **41** which are spaced apart from each other having flights **41***a* thereon which function as projections to engage and push the box through said tunnel. A pair of similar chains **40** containing flights **40***a* are also shown in FIGS. **2** and **4**. If these types of endless conveyors are utilized, the hydraulic or the pneumatic rams are only partially used, *i.e.* only to remove the box from the transfer arm and place said box unto said endless conveyor **40** or **41**. However, these rams are preferred for moving the box through the tunnel **34**. A series of rollers can be employed if one so desires in place of rails **32** and **33** within tunnel **34** so as to facilitate movement of the boxes on through.

The apparatus can be operated in tandem with a similar apparatus so that a pattern is subjected to a succession of coating and hardening steps; such an arrangement is desirable where slurries of differing compositions are employed in the production of successive layers of refactory, and for example it often happens that the first coating of a shell mould is desirably of different composition from the remainder of a shell. However, where successive coatings are similar, it is usually more convenient to recycle a pattern through a single apparatus until the required number of coatings have been built up. For example, each box can bear a rotatable dial which is automatically advanced by a chosen fraction of a complete revolution each time the box completes a cycle, the dial co-operating with a sensing mechanism which causes removal of the box and substitution of one containing an uncoated pattern whenever the dial has completed an amount of rotation corresponding to the required number of coating and hardening operations for the pattern loaded into that particular box.

Referring more specifically to the subject matter set forth immediately above the FIGS. **5** and **10** through **12**, there is disclosed a rotatable dial **42** having the numerals **0** (**43**), **3** (**44**), **2** (**45**) and **1** (**46**) thereon (in dotted lines) at 90° angular positions from each other.

Immediately adjacent said dial **42** is a pendulum **47** held at one end thereof by means of bolt **48** and nut **49**. At the opposite end of said pendulum, there is located a pendulum weight **50** which rests on stop pin **51**, which in turn is attached to the interior wall of the box. When the box is tilted, the weight or counterbalance **50** causes the dial **42** to rotate clockwise 90°. After this 90° turn, the weight **50** is prevented from further rotation by means of stop pin **52** which is also located on the interior wall of the box. The dial **42** per se is caused to rotate the 90° distance due to catch **53** in pendulum **47** and which engages nipples **54** which are located on said dial at 90° angular positions from each other. In other words, as pendulum **47** rotates from stop pin **51** to stop pin **52**, catch **53** engages nipples **54** and thus causes the dial **42** to move. The dial **42** is prevented from rotating counterclockwise by means of a series of slots **55**, **56**, **57**, and **58** which individually engage spring lock **59** as dial **42** rotates.

Some form of air lock involving two gates is advantageously employed in place of or in addition to the flexible seals **42**, **43**, and **44** at the entrance and exit of the tunnel. The gates could be automatically opened and closed by the arrival of a box, there being some form of over-riding control to prevent both gates being opened together. Such an arrangement is particularly useful where the container is in the form of a cage rather than a box.

It is not essential that the box should have solid sides and bottom and in fact an open-work cage can be substituted.

In a preferred embodiment of the present invention, there is provided an apparatus for applying a coating of a slurry to a pattern and treating the slurry coating with a gaseous media, comprising a series of containers each of which have an opening sufficiently large for a pattern to pass through such an opening. Each of such containers is adapted with means for mounting the pattern and which means comprises a L-shaped mounting arm, to one portion of which is affixed the pattern and the other portion being fixed to the tail of a T-piece pivoted at its ends to the size of the container. A pair of counterbalanced transfer arms are so adapted whereby one transfer arm inverts the aforementioned container in one instance and the other such transfer arm is so adapted to receive the inverted container and return said container to its original position in a second instance. A longitudinally extending, gas treating tunnel is provided for gelling the coated patterns. Such tunnel includes a single gas inlet means and a pair of gas outlet means, the two of which outlet means are positioned at the opposite ends of said tunnel for exhausting said gas. This tunnel is also provided with a pair of suspension rails which permit said containers to be held thereon, and an endless conveyor traversing substantially the full length of said tunnel whereby when said container is placed on said conveyor, such container is moved from one end of the tunnel to the other. In the coating operation section, there is provided a second pair of suspension rails and a second endless conveyor associated therewith and located substantially parallel and adjacent to said tunnel. A pair of receivers are positioned substantially beneath said second pair of suspension rails, such receivers being interconnected therebetween by means of a single guide rail which extends substantially the full length of both receivers. The preferred apparatus also includes a pair of rams, one of which is positioned in front of the entrance of the abovedescribed tunnel and adjacent to the second aforementioned transfer arm so that when said transfer arm inverts said container to its original position with the opening uppermost and aligns said container with the entrance of said tunnel, the first mentioned ram forces said container from the second aforementioned transfer arm and onto the endless conveyor of said tunnel. The second ram is positioned at the opposite end of said tunnel but in front of the above-described second pair of suspension rails and associated endless conveyor, and adjacent the above-described first transfer arm so that when said container emerges from the exit end of said tunnel, it is received by said first transfer arm, the first transfer arm inverts the container, and the second ram forces the container from the first transfer arm onto the second aforementioned pair of suspension rails. The second aforementioned endless conveyor thus moves the inverted container with its pattern hanging therefrom, *i.e.* the pattern is out of the container and beneath it, the full length of said second pair of suspension rails and finally onto the second aforementioned transfer arm.

I claim:

1. An apparatus for applying a coating of a slurry to a pattern and treating the slurry of the coating with a gaseous media, comprising at least one container having an opening sufficiently large for a pattern to pass through such opening, said container being adapted with mounting means for attaching such pattern to the container so that with the container in an attitude such that the opening is uppermost, the pattern is supported within the container but with the container in an inverted attitude, the pattern hangs outside the container; a first means for moving the container from the first mentioned attitude to an inverted attitude and then back to the first mentioned attitude; a second means for applying a coating of a slurry to a pattern while the container is in an inverted attitude; and a third means for treating the slurry of the coating with said gaseous media while the container is in the first mentioned attitude.

2. An apparatus as set forth in claim **1** where said second means includes means for rotating the pattern after it has been coated with slurry about each of two axes inclined to each other at an angle of at least 30° and for rotating the slurry coated pattern after a stucco-coating has been applied thereto.

3. An apparatus as set forth in claim **2** wherein said second means includes a reservoir of slurry and a vessel having a fluidised bed of stucco particles into which said pattern can be dipped as it hangs outside its associated container.

4. An apparatus as set forth in claim **3** wherein said third means includes a tunnel, containing said gaseous media, through which the container and coated pattern can be passed.

5. An apparatus as set forth in claim **4** wherein the means for mounting the pattern comprises a generally L-shaped mounting arm, to one portion of which is affixed the pattern and the other portion being fixed to the tail of a T-piece pivoted at its ends to the sides of the container.

6. An apparatus as set forth in claim **5** wherein the mounting means also includes a retainer latch mechanism so that the T-piece, arm and pattern can be detachably removed or clipped into place in the container.

7. An apparatus as set forth in claim **6** wherein the end of the mounting arm to which the pattern is detachably affixed, includes a sleeve bearing friction roller which permits the pattern to rotate 360° with respect to the remainder of the arm; and said second means includes a guide rail so that the said roller can be rotated by rolling along such guide rail so shaped that the pattern is lifted sideways and upwards about the pivot points and at the same time the friction roller of the mounting arm rolls along the guide rail so that the pattern is rotated about the axis of the first portion of the mounting arm.

8. An apparatus as set forth in claim **7** wherein the roller is frustoconical and the guide rail is shaped so that the point of contact moves towards and then away from the apex of the cone so as to afford a relatively smooth acceleration and deceleration of the rotary movement.

9. An apparatus as set forth in claim **8** wherein the container is adapted with a rotatable dial which is automatically advanced by a quarter of a complete revolution each time the container completes a cycle.

10. An apparatus for applying a coating of a slurry to a pattern and treating the slurry coating with a gaseous media, comprising (**1**) a series of containers each of which have an opening sufficiently large for a pattern to pass through such an opening, said container being adapted with means for mounting the pattern and which means comprises an L-shaped mounting arm, to one portion of which is affixed the pattern and the other portion being fixed to the tail of a T-piece pivoted at its ends to the size of the container; (**2**) a pair of counter balanced transfer arms one of which is so adapted as to invert the aforementioned container in one instance and the other such transfer arm is so adapted to receive the inverted container and return said container to its original position in a second instance; (**3**) a longitudinally extending, gas treating tunnel including a single gas inlet means and a pair of gas outlet means, the two of which outlet means are positioned at the opposite ends of said tunnel for exhausting said gas, said tunnel being provided with a pair of suspension rails which permit said containers to be held thereon, and an endless conveyor traversing substantially the full length of said tunnel whereby when said container is placed on said conveyor, such container is moved from one end of the tunnel to the other; (**4**) a second pair of suspension rails and a second endless conveyor associated therewith and located substantially parallel and adjacent to said tunnel; (**5**) a pair of receivers positioned substantially beneath said second pair of suspension rails, such receivers being interconnected therebetween by means of a single guide rail which extends substantially the full length of both receivers; and (**6**) a pair of rams, one of which is positioned in front of the entrance of the abovedescribed tunnel and adjacent to the second aforementioned transfer arm so that when said transfer arm inverts said container to its original position with the opening uppermost and aligns said container with the entrance of said tunnel, the first mentioned

ram forces said container from the second aforementioned transfer arm and onto the endless conveyor of said tunnel; the second ram is positioned at the opposite end of said tunnel but in front of the above-described second pair of suspension rails and associated endless conveyor, and adjacent the above-described first transfer arm so that when said container emerges from the exit end of said tunnel, it is received by said first transfer arm, the first transfer arm inverts the container, and the second ram forces said container from the first transfer arm onto the second aforementioned pair of suspension rails, said second aforementioned endless conveyor thus moving the inverted container with its pattern hanging therefrom the full length of said second pair of suspension rails and finally onto the second aforementioned transfer arm.