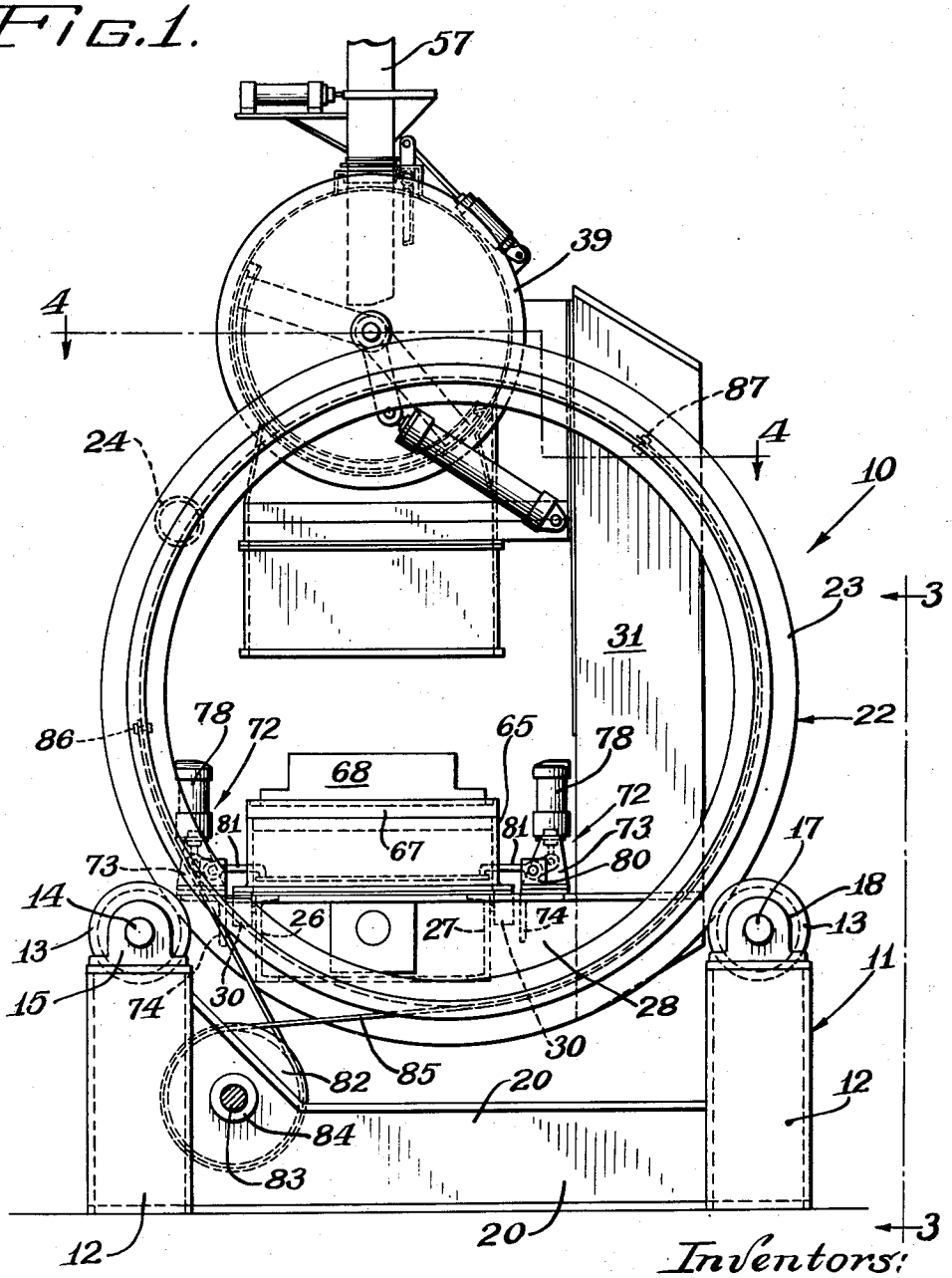
April 15, 1958 J. A. SHELBY ET AL 2,830,337

INVESTMENT MACHINE FOR MAKING SHELL MOLDS

Filed July 1, 1954 4 Sheets-Sheet 1

FIG. 1.



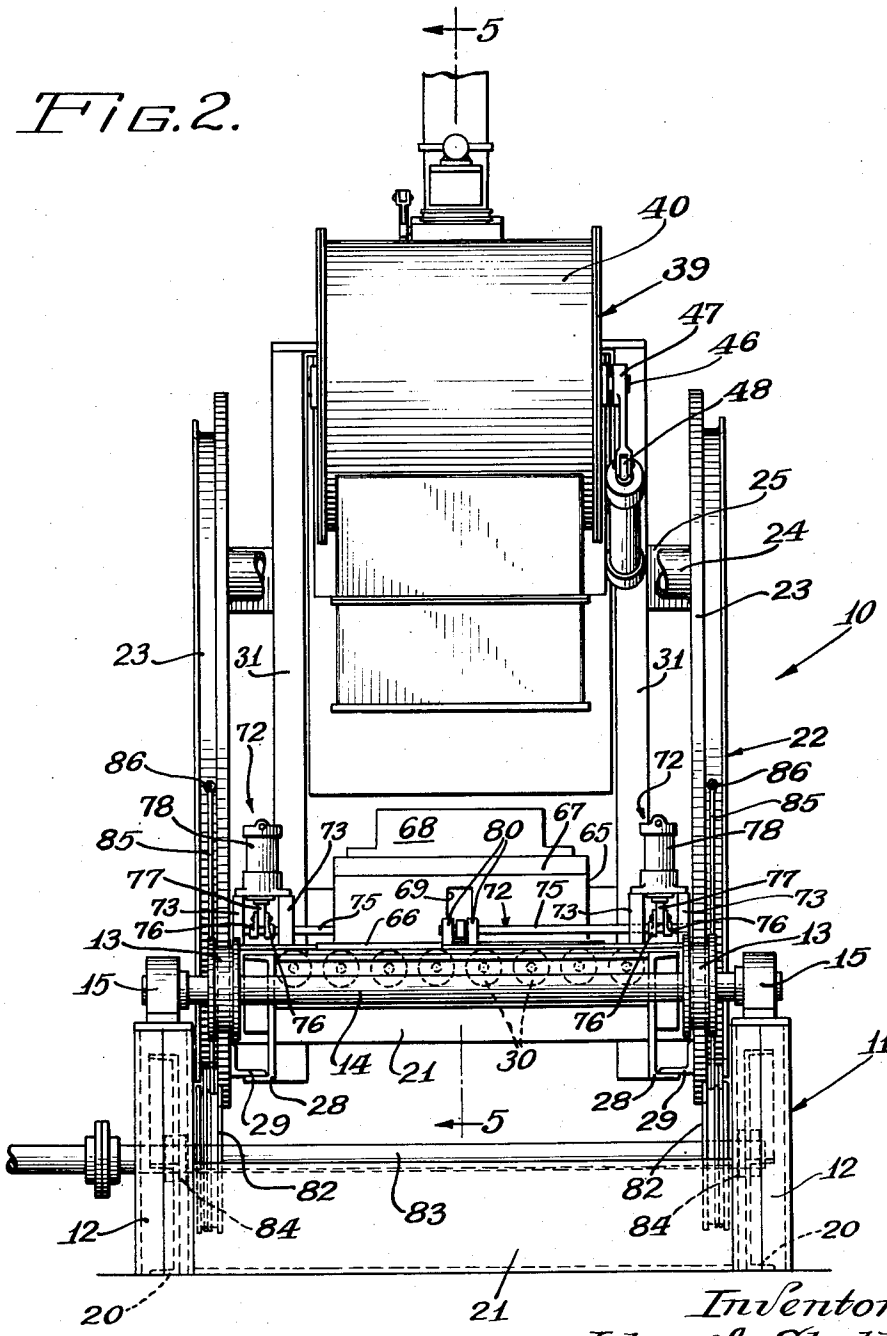
Inventors:
John A. Shelby
Allan F. Paton
Paul O. Pippel Atty.

April 15, 1958 J. A. SHELBY ET AL 2,830,337

INVESTMENT MACHINE FOR MAKING SHELL MOLDS

Filed July 1, 1954 4 Sheets-Sheet 2

FIG. 2.



Inventors:
John A. Shelby
Allan F. Paton
Paul O. Pippel Atty.

April 15, 1958 J. A. SHELBY ET AL 2,830,337

INVESTMENT MACHINE FOR MAKING SHELL MOLDS

Filed July 1, 1954 4 Sheets-Sheet 3

FIG. 3.

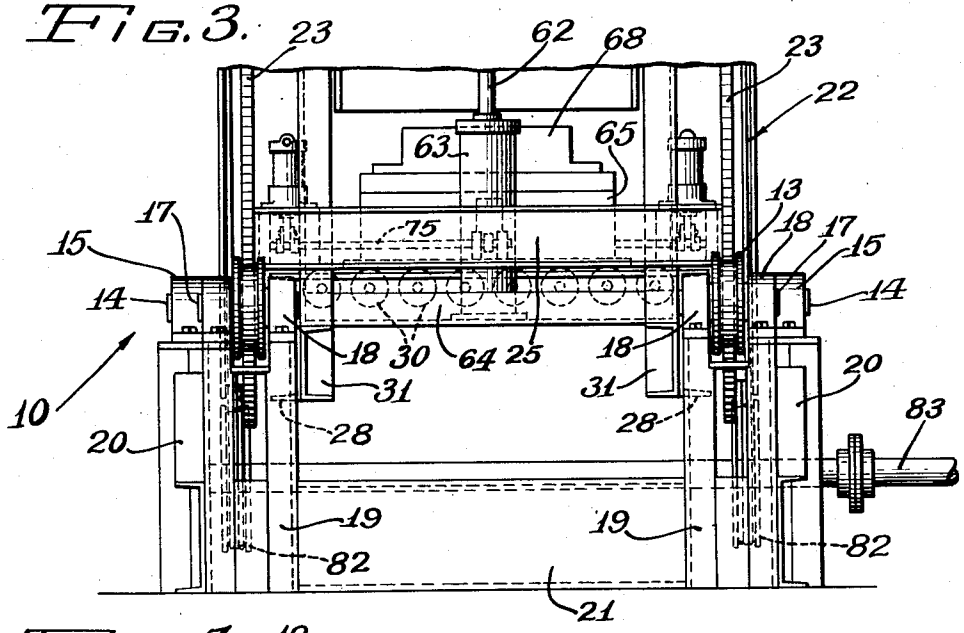
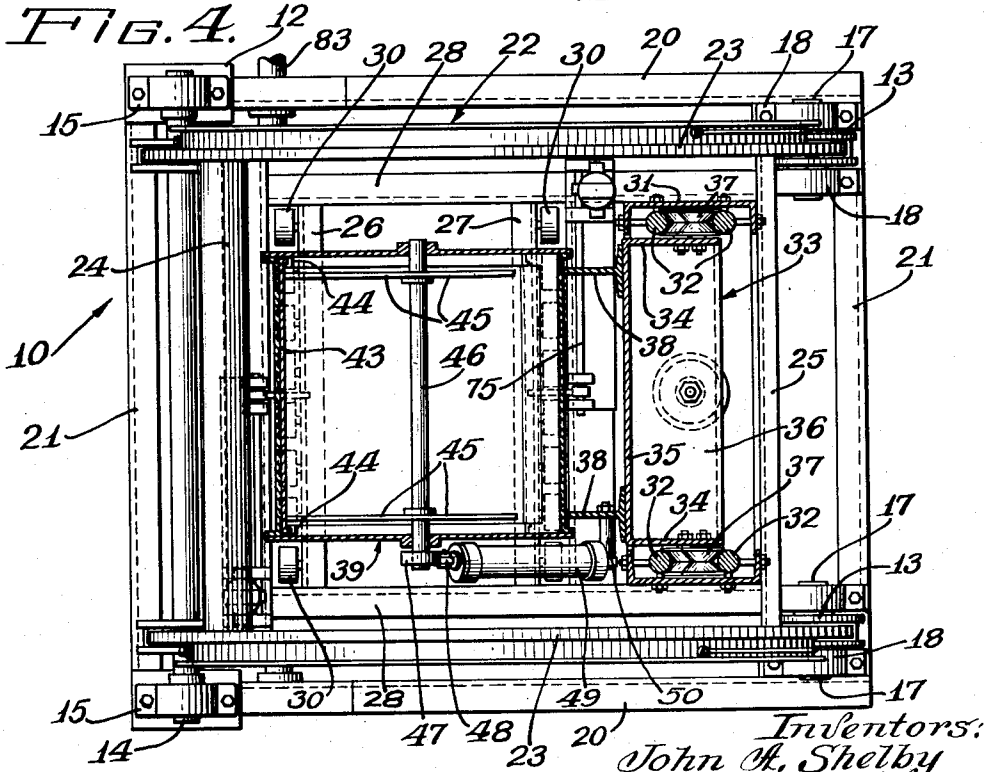


FIG. 4.



Inventors:
John A. Shelby
Allan F. Paton
Paul O. Pippel Atty.

April 15, 1958 J. A. SHELBY ET AL 2,830,337

INVESTMENT MACHINE FOR MAKING SHELL MOLDS

Filed July 1, 1954 4 Sheets-Sheet 4

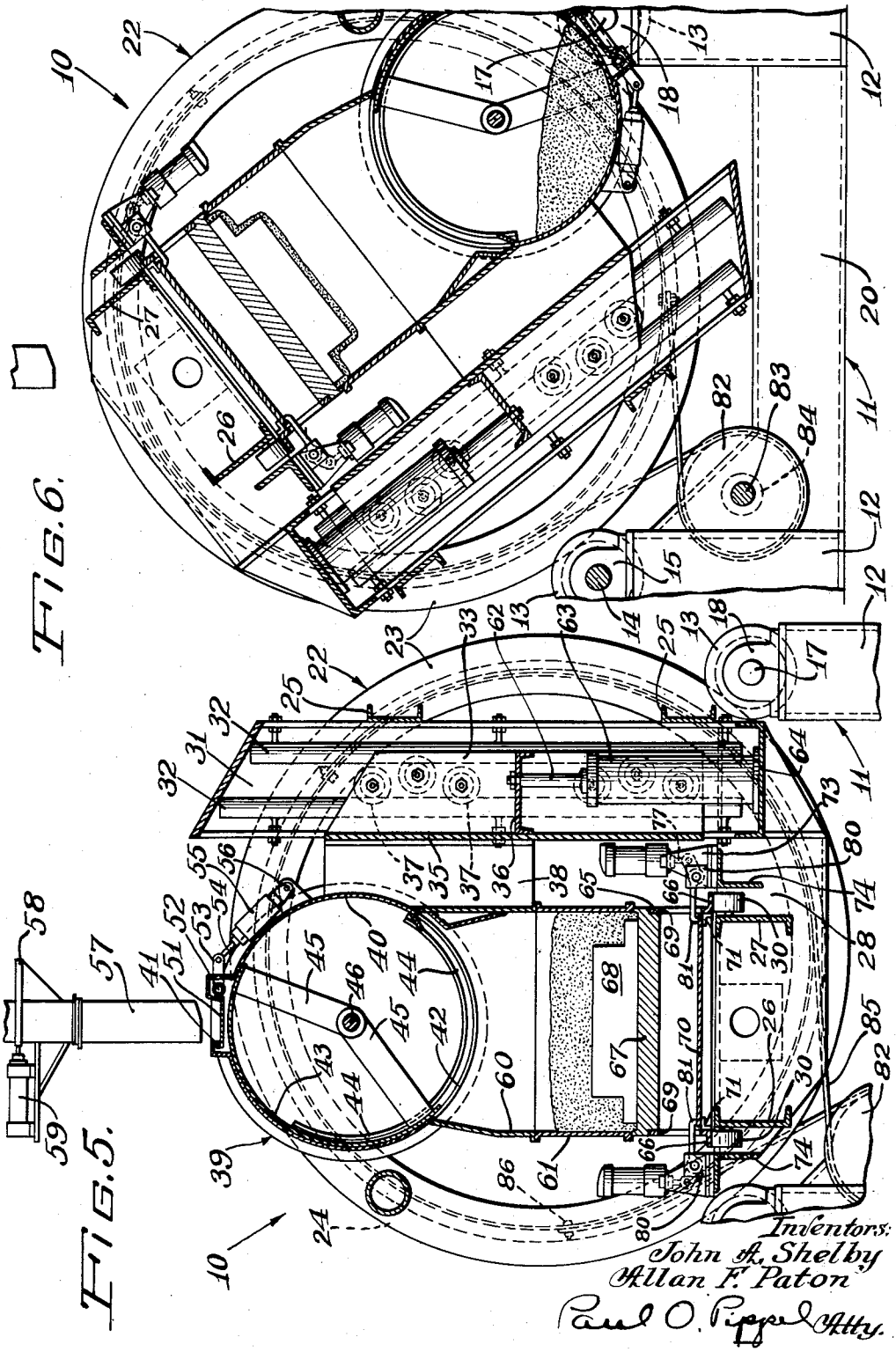


FIG. 6.

FIG. 5.

Inventors:
John A. Shelby
Allan F. Paton
Paul O. Pippel Atty.

United States Patent Office 2,830,337 Patented Apr. 15, 1958

2,830,337

INVESTMENT MACHINE FOR MAKING SHELL MOLDS

John A. Shelby and Allan F. Paton, Indianapolis, Ind., assignors to International Harvester Company, a corporation of New Jersey

Application July 1, 1954, Serial No. 440,793

11 Claims. (Cl. 22—9)

This invention relates to an improvement in an investment machine for manufacturing shell-type molds. More particularly it relates to an apparatus for investing a pattern with a relatively thin frangible shell in the mass production of shell molds.

In the foundry art of shell molding a metal pattern is generally heated and a sand and suitable binder mixture is delivered to the heated pattern whereupon a relatively thin frangible shell is formed. This shell is suitably cured by heating or baking and during the casting operation a pair of complementary shells are placed together in assembly whereupon casting material is poured into the cavity provided by the shell-type molds. Various devices for investing the pattern with the binder sand mixture have been devised. Most of these devices have performed satisfactorily but they have not been designed for high production of shell molds. It is a prime object of this invention therefore to provide an improved investment machine for manufacturing shell-type molds on a production basis.

It is still a further object of this invention to provide an improved investment apparatus adapted to be placed adjacent a plurality of conveyors which deliver a pattern to the investment machine whereupon the pattern is covered with a sand binder mixture while it is in a heated condition and whereupon it is discharged to one of the conveyors for conveyance to a baking oven for suitably curing the shell mold.

Still another object is to provide an improvement in a shell mold investment apparatus the improvement including means for releasably locking a pattern carrier on the platform of an investment machine, the carrier being locked during investing of the pattern with a sand mixture whereupon the locking means is releasable for releasing the pattern carrier so that it can be delivered to suitable conveying means adjacent the apparatus.

A still further object of the invention is to provide improved means for investing the heated pattern with a sand binder mixture including a device for rotating the pattern to an inverted position for discharging excess investment material from the pattern.

These and further objects will become more readily apparent from a reading of the specification in connection with the accompanying sheets of drawings.

In the drawings:

Figure 1 is a side view, in elevation, of an improved investment apparatus for manufacturing shell-type molds;

Figure 2 is a front view, in elevation, of the apparatus shown in Figure 1;

Figure 3 is an elevational view showing a portion of an investment machine taken substantially along the line 3—3 of Figure 1;

Figure 4 is a cross-sectional view taken substantially along the line 4—4 of Figure 1;

Figure 5 is a cross-sectional view through the investment apparatus taken substantially along the lines 5—5 of Figure 2; and,

Figure 6 is a sectional view similar to Figure 5 showing one operating position in the operating cycle of the investment apparatus.

An investment machine is generally designated by the reference character **10**. The machine **10** comprises a supporting structure **11** consisting of upright members **12** laterally spaced with respect to each other. Two upright members **12** are disposed in the front of the apparatus **10** and two upright members **12** are disposed at the rear of the apparatus **10**. Each of the upright members includes track rollers **13**. The track rollers **13**, which are positioned on the front upright members **12**, are suitably journalled on a shaft **14** which is carried in bearing members **15**. The track rollers **13** which are carried on the rear upright members **12** are suitably journalled on stub shafts **17** in turn journalled in bearing supports **18**. Each roller **13** of the rear upright members **12** is supported on two bearing supports **18** one of which is suitably supported on an upright member **19** as best indicated in Figure 3. The front and rear uprights **12** are securely connected together by means of a horizontally extending beam **20**. In addition the uprights **12** are suitably connected by means of supporting members **21** extending laterally relative to the beams **20**.

The supporting structure **11** supports a rotatable frame **22**. The rotatable frame **22** comprises a pair of laterally spaced and parallel circular track members **23**. The track members **23** are connected at their forward portions by means of a lateral brace **24** and are suitably connected at rear portions by means of upper and lower channel beams **25**.

A platform is provided on a rotatable frame **22**, this platform including channel members **26** and **27** positioned in parallel relation as best shown in Figure 4. The channels **26** and **27** are suitably connected to beams **28**, which as best shown in Figure 2, are connected to the track members **23** by means of angle members **29**. A plurality of conveyor rollers **30** are suitably pivotally connected to the channels **26** and **27** to provide a roller conveyor.

The rotatable frame **22** also supports a plurality of longitudinally extending, or normally upright, track frame members **31**. The upright track members **31** have each suitably connected thereto parallel vertically extending upright rods **32** defining a suitable vertically extending track means. A bracket structure generally designated at **33** is best shown in Figures 4, 5 and 6. The bracket structure **33** includes side plates **34** suitably connected by means of an end plate **35** which is also connected to a bottom plate **36**. A plurality of rollers **37** are suitably journalled on the side plates **34**, the rollers **37** being positioned to roll on the tracks formed by the upright rods **32**. A pair of laterally spaced and parallel T-beams **38** suitably support an investment material drum or hopper generally designated by the reference character **39**.

The drum or hopper **39** comprises a circular housing **40** having an inlet opening **41** and an outlet opening **42**. An arcuate closure gate **43** is positioned within the drum **39** for suitably opening and closing the outlet **42**. A pair of laterally spaced track members **44** are positioned immediately adjacent the outlet opening **42**. The track members **44** serve to provide guides for the arcuate closure gate **43**. A pair of arms **45** are connected to the gate **43**, these arms being rigidly connected to a shaft **46**. As best shown in Figure 4 a shaft **46** is pivoted on the drum **39** and is connected to a crank arm **47** which in turn is connected to a piston arm **48**. The piston arm **48** is reciprocably positioned within a cylinder or fluid extensible device **49** which is pivotally connected, as indicated at **50**, in Figure 4, to one of the T-beams **38**.

An inlet closure gate **51** is positioned over the inlet opening **41** as best shown in Figures 5 and 6. The closure gate **51** is connected to a pivot pin **52** pivotally connected to the drum **39**, the said pin **52**, in turn being connected to an arm **53** adapted to rotate the closure gate **51** on the said pivot pin **52**. The arm **53** is connected to a piston rod **54** reciprocably positioned within a fluid extensible device **55**. The extensible device **55** is connected as indicated at **56** to the drum **39**.

As best shown in Figures 1 and 5 a supply chute **57** is positioned above the inlet opening **41**. The supply chute **57** includes a valve member **58** adapted to suitably control the discharge of material from the chute **57** by means of a fluid extensible device **59**. The chute or hood **60** is connected to the material drum **39**, and an extension **61** in turn connected to the chute **60**. The drum **39** is adapted to be vertically moved on the upright track members **31** by means of a piston rod **62** which is connected to the channel bottom member or plate **36**. The piston rod **62** in turn is reciprocably positioned with respect to a fluid extensible device **63** suitably positioned on a transversely extending beam **64** which is connected to the track members **31**.

A pattern box or carrier unit **65** is positioned on the conveyor rollers **30**. The carrier **65** includes a flange **66** which engages and is supported on the conveyor rollers **30**. A pattern support **67** is mounted on the carrier **65** and in turn supports a pattern **68**. As best shown in Figures 2, 5 and 6, the carrier 65 is provided with oppositely disposed access openings **69**. A stripper plate **70** is vertically movable within the carrier **65** and is maintained therein by means of substantially parallel angle supports **71** suitably connected to the carrier **65**.

Means for maintaining the carrier **65** within the investment machine **10** is provided in the form of releasable holders generally designated at **72**. The releasable holders **72** are suitably supported by means of brackets **73** on angle members **74** connected to beams **28** (best shown in Figure 5). One of the releasable holders **72** is positioned on opposite sides of the pattern carrier **65**. Each holder **72** includes a laterally extending shaft **75** which is mounted for rotation on the brackets **73**. A crank arm **76** is attached to each shaft **75** the crank arm being movable by a piston **77** on a fluid extensible cylinder **78**. As best shown in Figures 2 and 5, ears **80** extend upwardly from the angle **74** these ears also supporting the shaft **75**. A finger **81** is connected to each laterally extending shaft **75**, the fingers extending through the openings **69** as best shown in Figures 5 and 6. The fingers **81** are adapted to engage the upper edge of the stripper plate **70** and to maintain the same in lowered relation relative to the angle **71**. This in effect locks the carrier **65** in position for the investment operation.

A pair of pulleys **82** are connected for rotation with a shaft **83** which is suitably journalled on bearing members **84** suitably supported on the transversely spaced horizontal beams **20**. A pair of cables **85** are wound around the pulleys **82** and are connected to the circular track members **23** as best indicated at **86** and **87**.

The investment machine is, during its operation, situated in close proximity to roller conveyors, not shown, which extend from a preheating furnace to the investment machine, and then to a heating and curing furnace. In operation the carrier **65**, which contains the pattern **68**, is delivered to the conveyor rollers **30**. At this stage of the operation, the apparatus is in the position shown in Figures 1 and 2, the carrier has moved into position and the extensible devices **78** are effective to rotate the shaft **75** in such a manner that the fingers **81** engage the upper edge of the stripper plate **70** to securely maintain the pattern carrier and pattern **65** in position immediately underneath the chute extension **61**. As indicated in Figure 1, the drum **39** is in a filling position with reference to the supply chute **57**. The inlet closure gate **51** is opened during the upward movement of the drum **39** and the valve **58** is effective to permit the discharge of a resin binder mixture to the interior of the drum **40**. Material is now delivered to the drum until it reaches a level position immediately below the lowermost point of the chute **57**. The drum **39** is then lowered relative to the chute **57** and the inlet closure gate **51** closes to suitably close the inlet opening of the drum. The drum is now moved downwardly until the extension **61** completely surrounds the pattern and provides in effect a closed chamber within the extension **61** in the chute **60**. The gate **43**, which has been closed until this time, is now opened by means of cylinder **49**. Material from the drum now drops down upon the pattern **68**. The pattern **68** has been heated and the material consisting primarily of a binder and sand mixture forms a thin layer on top of the heated pattern **68**. After the pattern **68** has been invested with the material it is desired to immediately remove the excess from the pattern and return the same to the drum **39**. At this point the rotating frame **22** is rotated by means of the cables **85** (and a suitable power unit not shown which is connected to the shaft **83**) thereby causing the units mounted thereon to rotate to the position shown in Figure 6. In this position the closure gate **43** of the drum is open and any excess sand and binder mixture which is placed on the pattern is returned by gravity to the drum. The gate **43** now closes and the rotatable frame **22** returns to its normal position shown in Figure 5 whereupon the drum **39** can again be moved upwardly in filling position with respect to the supply chute **57**. The release holders **72** are now released so that the carrier can be moved from the rollers **30** to one of the adjacent conveyors (not shown) which will deliver the carrier and pattern to a suitable curing oven.

To summarize the operation it can be stated that the drum moves up into position for receiving a binder sand mixture from the chute **57**. Thereupon the drum is lowered until the extension **61** is disposed in substantially sealed relation around the pattern **68**. The gate **43** is now opened and material descends onto the pattern **68** whereupon the pattern frame and pattern are rotated so that any excess sand is returned to the drum. After return of the excess material to the drum the outlet gate is again closed and the drum is moved to its filling position. The releasable holders are released so that the carrier can depart from the conveyor rollers **30** to another conveyor for delivery to the curing oven.

The apparatus shown can easily produce, on a large quantity basis, shell molds as the patterns are delivered from the preheating oven. The unit can be quickly rotated to a position where any excess binder sand mixture is returned to the hopper. By the novel arrangement shown, a pattern carrier may be utilized, the pattern carrier being suitable to support the pattern in position during various operations before and after it has been placed in the investment machine. By suitably connecting the device to a switch control unit, complete automatic operation can readily be procured. Thus it can be seen that the objects of the invention have been fully achieved and that a mass production shell mold investment apparatus has been provided. It must be understood that changes may be made in the invention without departing from the spirit of the invention or the scope thereof as defined in the appended claims.

What is claimed is:

1. An investment machine for investing a pattern with a mold material comprising; a supporting structure, a plurality of bearing rollers mounted on said supporting structure, a rotatable frame including a pair of laterally spaced and aligned circular track members, said track members being rotatably supported on said bearing rollers, a pair of longitudinally extending track members mounted on said frame, a bracket movably mounted on said longitudinal track members, a drum supported on said bracket, said drum having an inlet opening and an outlet opening, an inlet closure gate for said inlet opening, an outlet closure gate for said outlet opening, a hood connected to said drum and in communication with said outlet opening, a supply chute positioned above said inlet opening, a platform carried by said frame, conveyor means on said platform, a pattern carrier movable on said conveyor to a position beneath said hood, said carrier comprising a box frame having a stripper plate enclosed therein for relative reciprocating movement relative to

a pattern carried on said carrier, first fluid pressure extensible means adapted to engage said stripper plate for locking said carrier in position on said conveyor, second fluid pressure extensible means connected to said frame and to said bracket for moving said drum to a position whereby said chute extends through said inlet opening for supplying material to said drum, said second extensible means being adapted to move said drum to a second position whereby said hood is in engagement with said carrier over a pattern carried therein and said drum is moved away from said chute, means connected to said inlet closure gate for closing the same in the second position of said drum, means connected to said outlet closure gate for opening said gate during the second position of said drum whereby material within said drum is deposited on the pattern, and means for rotating said frame with the drum in said second position whereby excess material on the pattern is returned to said drum by gravity.

2. An investment machine for investing a pattern with a mold material, comprising; a supporting structure, a rotatable frame including a pair of laterally spaced and aligned circular track members, said track members being rotatably supported on said supporting structure, a pair of longitudinally extending track members mounted on said frame, a bracket movably mounted on said longitudinal track members, a drum supported on said bracket, said drum having an inlet opening and an outlet opening, an inlet closure gate for said inlet opening, an outlet closure gate for said outlet opening, a hood connected to said drum and in communication with said outlet opening, a supply chute positioned above said inlet opening, a platform carried by said frame, conveyor means on said platform, a pattern carrier movable on said conveyor to a position beneath said hood, said carrier comprising a box frame having a stripper plate enclosed therein for relative reciprocating movement relative to a pattern carried on said carrier, first fluid pressure extensible means adapted to engage said stripper plate for locking said carrier in position on said conveyor, second fluid pressure extensible means connected to said frame and to said bracket for moving said drum to a position whereby said chute extends through said inlet opening for supplying material to said drum, said second extensible means being adapted to move said drum to a second position whereby said hood is in engagement with said carrier over a pattern carried therein and said drum is moved away from said chute, means connected to said inlet closure gate for closing the same in the second position of said drum, means connected to said outlet closure gate for opening said gate during the second position of said drum whereby material within said drum is deposited on the pattern, and means for rotating said frame with the drum in said second position whereby excess material on the pattern is returned to said drum by gravity.

3. An investment machine for investing a pattern with a mold material, comprising; a supporting structure, a rotatable frame including a pair of first track members, said first track members being supported for rotation on said support, a pair of second track members mounted on said frame, a drum supported on said second track members, said drum having an inlet opening and an outlet opening, an inlet closure gate for said inlet opening, an outlet closure gate for said outlet opening, a hood connected to said drum and in communication with said outlet opening, a supply chute positioned above said inlet opening, a platform carried by said frame, a pattern carrier on said platform beneath said hood, said carrier being adapted to support a pattern, first fluid pressure extensible means adapted to engage said carrier for locking said carrier in position on said platform, second fluid pressure extensible means connected to said frame for moving said drum to a position whereby said chute extends through said inlet opening for supplying material to said drum, said second extensible means being adapted

to move said drum to a second position whereby said hood is over a pattern carried on said carrier, means connected to said inlet closure gate for closing the same in the second position of said drum, means connected to said outlet closure gate for opening said gate during the second position of said drum and material within said drum is deposited on the pattern, and means for rotating said frame with the drum in said second position whereby excess material on the pattern is returned to said drum by gravity.

4. An investment machine for investing a pattern with a mold material, comprising; a supporting structure, a rotatable frame including a pair of laterally spaced first track members, said first track members being rotatably supported on said supporting structure, a pair of second track members mounted on said frame, a bracket movably mounted on said second track members, a drum supported on said bracket, said drum having an inlet opening and an outlet opening, an inlet closure gate for said inlet opening, an outlet closure gate for said outlet opening, a hood connected to said drum and in communication with said outlet opening, a supply chute positioned above said inlet opening, a platform carried by said frame, a pattern carrier on said platform, said carrier comprising a box frame having a stripper plate connected thereto for relative reciprocating movement relative to a pattern carried on said carrier, first fluid pressure extensible means adapted to engage said stripper plate for locking said carrier in position on said conveyor, second fluid pressure extensible means connected to said frame and to said bracket for moving said drum to a position whereby said chute extends through said inlet opening for supplying material to said drum, said second extensible means being adapted to move said drum to a second position whereby said hood is over a pattern carried on said carrier, means connected to said inlet closure gate for closing the same in the second position of said drum, means connected to said outlet closure gate for opening said gate during the second position of said drum whereby material within said drum is deposited on the pattern, and means for rotating said frame with the drum in said second position whereby excess material on the pattern is returned to said drum by gravity.

5. An investment machine for investing a pattern with a mold material, comprising; a supporting structure, a frame rotatably supported on said supporting structure, a pair of track members mounted on said frame, a drum supported on said track members, said drum having an inlet opening and an outlet opening, a hood connected to said drum and in communication with said outlet opening, a supply chute positioned above said inlet opening, a platform carried by said frame, a pattern carrier on said platform beneath said hood, said carrier being adapted to carry a pattern below said hool, first fluid pressure extensible means adapted to engage said carrier for locking said carrier in position on said platform, second fluid pressure extensible means connected to said frame for moving said drum to a position whereby said chute extends through said inlet opening for supplying material to said drum, said second extensible means being adapted to move said drum to a second position whereby said hood is over a pattern carried on said carrier, closure means for closing the inlet opening in the second position of said drum, closure means adapted to open said outlet opening during the second position of said drum whereby material within said drum is deposited on the pattern, and means for rotating said frame with the drum in said second position whereby excess material on the pattern is returned to said drum by gravity.

6. An investment machine for investing a pattern with a mold material, comprising; a supporting structure, a frame supported on said support, a drum supported on said frame, said drum having an inlet opening and an outlet opening, a hood connected to said drum and in

communication with said outlet opening, a supply chute positioned above said inlet opening, a platform carried by said frame, conveyor means on said platform, a pattern carrier movable on said conveyor to a position beneath said hood, said carrier being adapted to support a pattern beneath said hood, means for locking said carrier in position on said conveyor, fluid pressure extensible means connected to said frame for moving said drum to a position whereby said chute extends through said inlet opening for supplying material to said drum, said extensible means being adapted to move said drum to a second position whereby said hood is over a pattern carried on said carrier, means for closing the inlet opening in the second position of said drum, means for opening said outlet opening during the second position of said drum whereby material within said drum is deposited on the pattern, and means for moving said frame with the drum in said second position whereby excess material on the pattern is returned to said drum by gravity.

7. An investment machine for investing a pattern with a mold material, comprising; a supporting structure, a frame rotatably supported on said support, a drum supported on said frame, said drum having an inlet opening and an outlet opening, a hood connected to said drum and in communication with said outlet opening, a supply chute positioned above said inlet opening, a platform carried by said frame, a pattern carrier supported on said platform beneath said hood, said carrier being adapted to support a pattern beneath said hood, first actuating means connected to said frame for moving said drum to a position whereby said chute extends through said inlet opening for supplying material to said drum, said first actuating means being adapted to move said drum to a second position whereby said hood is positioned over a pattern carried on said carrier, means connected to said inlet opening for closing the same in the second position of said drum, means connected to said outlet opening for opening the same during the second position of said drum whereby material within said drum is deposited on the pattern, and second actuating means for rotating said frame with the drum in said second position whereby excess material on the pattern is returned to said drum by gravity.

8. An apparatus for investing a pattern with a mold material comprising; a support, a frame including a pair of circular track members rotatably carried by said support, a conveyor carried by said frame, a pattern carrier supported on said conveyor, said carrier having a pattern supported thereon, a second frame supported on said first frame, a drum on said second frame, said drum having an inlet opening and an outlet opening, a supply chute positioned in proximity to said inlet opening, a hood connected to said drum and adapted to communicate with said outlet opening, actuating means connected to said second frame for raising the same and said drum on the track members into a first position whereby said chute extends through said inlet opening into said drum, said actuating means being adapted to move said drum to a second position remote from said chute whereby said outlet opening and hood is disposed over said pattern and material is directed through said outlet opening over said pattern, inlet closure means adapted to close said inlet opening during the second position, means to open said outlet opening during said second position, and means connected to said first frame for rotating the same relative to said support whereby excess material on said pattern returns by gravity to said drum through said outlet opening.

9. An apparatus for investing a pattern with a mold material comprising; a support, a frame including a pair of circular track members rotatably carried by said support; a conveyor carried by said frame, a pattern carrier supported on said conveyor, said carrier having a pattern supported thereon, a second frame supported on said first frame, a drum on said second frame, said drum having an inlet opening and an outlet opening, a supply chute positioned in proximity to said inlet opening, actuating means connected to said second frame for moving the same and said drum on the track members into a first position whereby said chute extends through said inlet opening into said drum, said actuating means being adapted to move said drum to a second position remote from said chute whereby said outlet opening is disposed over said pattern and material is directed through said outlet opening over said pattern, inlet closure means adapted to close said inlet opening during the second position, means to open said outlet opening during said second position, and means connected to said first frame for rotating the same relative to said support whereby excess material on said pattern returns by gravity to said drum through said outlet opening.

10. An apparatus for investing a pattern with a mold material comprising; a support, a frame including a pair of circular track members carried by said support, a platform carried by said frame for rotation about a horizontal axis, a pattern carrier supported on said platform, said carrier having a pattern supported thereon, a second frame supported on said first frame, a drum on said second frame, said drum having an inlet opening and an outlet opening, a supply chute positioned in proximity to said inlet opening, actuating means connected to said second frame for moving the same and said drum on the track members into a first position whereby said chute extends through said inlet opening into said drum, said actuating means being adapted to move said drum to a second position remote from said chute whereby said outlet opening is disposed over said pattern and material is directed through said outlet opening over said pattern, inlet closure means adapted to close said inlet opening during the second position, means to open said outlet opening during said second position, and means connected to said first frame for rotating the same relative to said support whereby excess material on said pattern returns by gravity to said drum through said outlet opening.

11. An apparatus for investing a pattern with a mold material comprising; a support, a frame carried by said support for rotation about a horizontal axis, a conveyor carried by said frame, a pattern carrier supported on said conveyor, said carrier having a pattern supported thereon, a second fame supported on said first frame, a drum on said second frame, said drum having an inlet opening and an outlet opening, a supply chute positioned in proximity to said inlet opening, a hood connected to said drum and adapted to communicate with said outlet opening, actuating means connected to said second frame for raising the same and said drum into a first position whereby said chute extends through said inlet opening into said drum, said actuation means being adapted to move said drum to a second position remote from said chute whereby said hood is disposed over said pattern and material is directed through said outlet opening over said pattern, inlet closure means adapted to close said inlet opening during the second position, means to open said outlet opening during said second position, and means connected to said first frame for rotating the same relative to said support whereby excess material on said pattern returns by gravity to said drum through said outlet opening.

References Cited in the file of this patent

UNITED STATES PATENTS

2,317,574	Williams	Apr. 27, 1943
2,659,944	Valyi	Nov. 24, 1953
2,724,158	Davis et al.	Nov. 22, 1955

OTHER REFERENCES

Foundry, November 1952, page 265.
Fortune, July 1952, pages 104–106, 140 and 143.