Oct. 11, 1960 G. A. CONGER 2,955,332

APPARATUS FOR FORMING SHAPED ARTICLES SUCH AS FOUNDRY MOLDS AND CORES

Filed Sept. 2, 1958

3 Sheets-Sheet 1

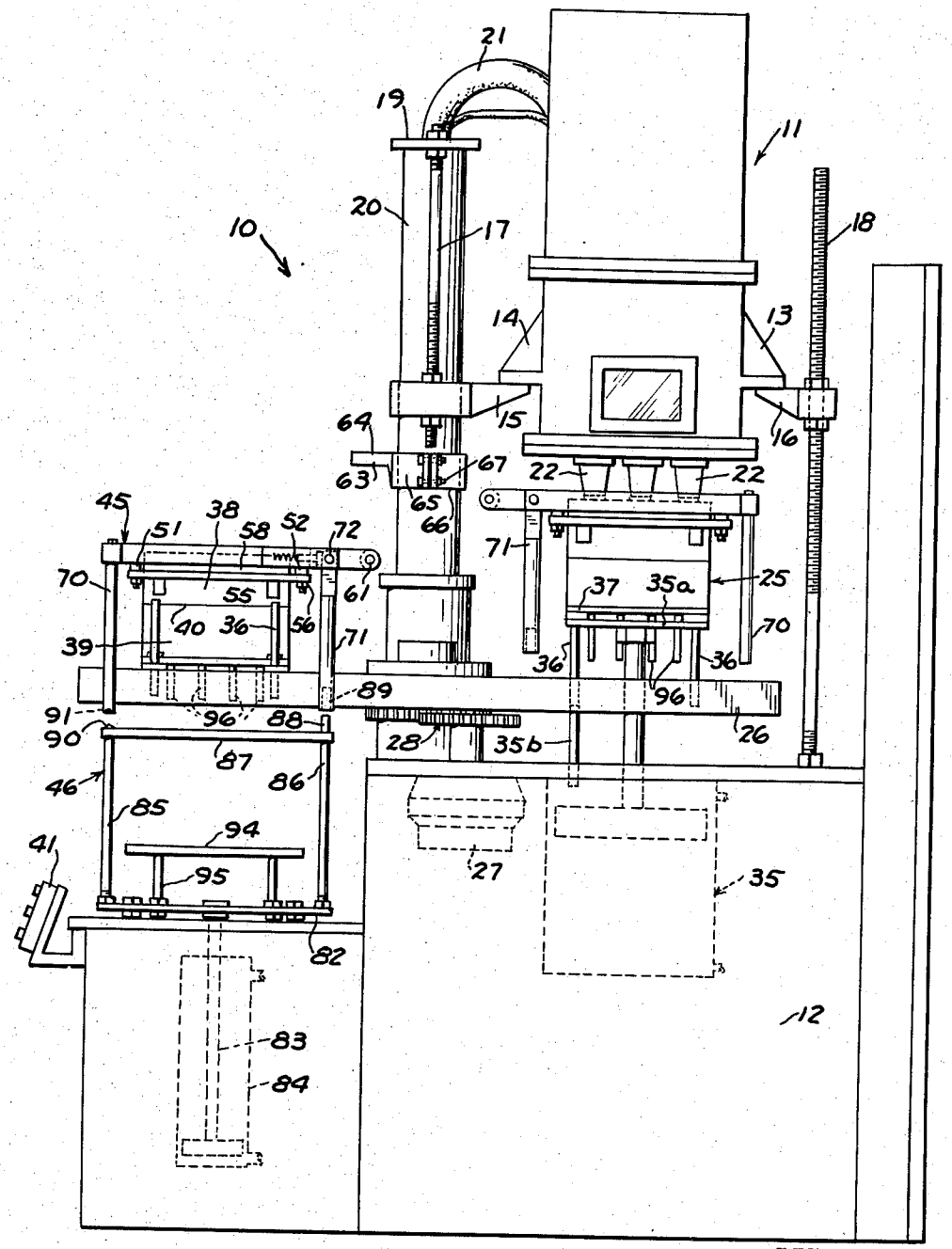


FIG. 1

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3 Sheets-Sheet 2

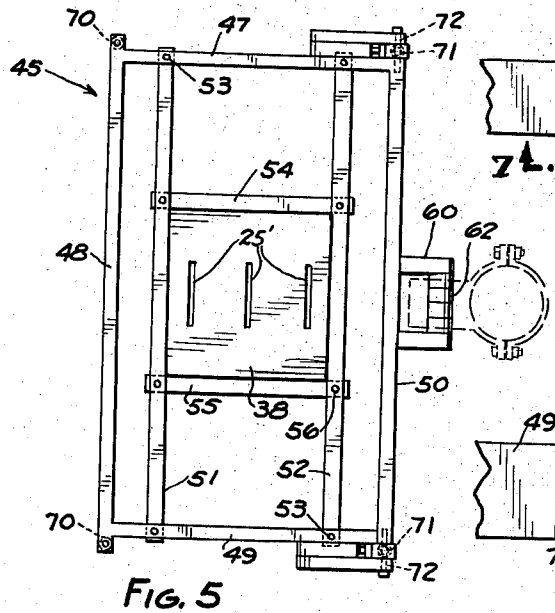


FIG. 5

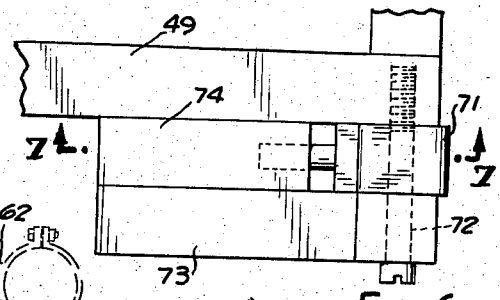


FIG. 6

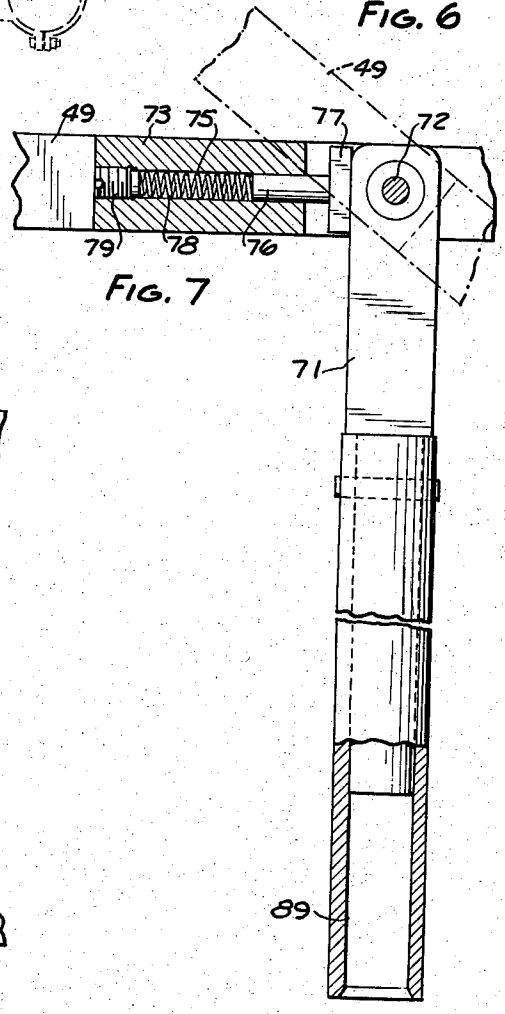


FIG. 7

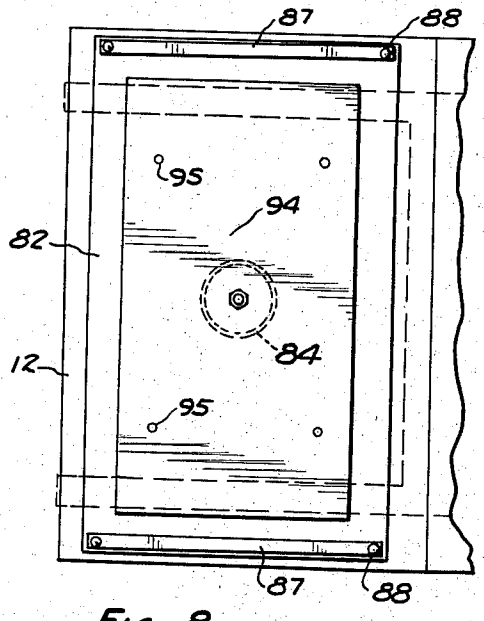


FIG. 8

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3 Sheets-Sheet 3

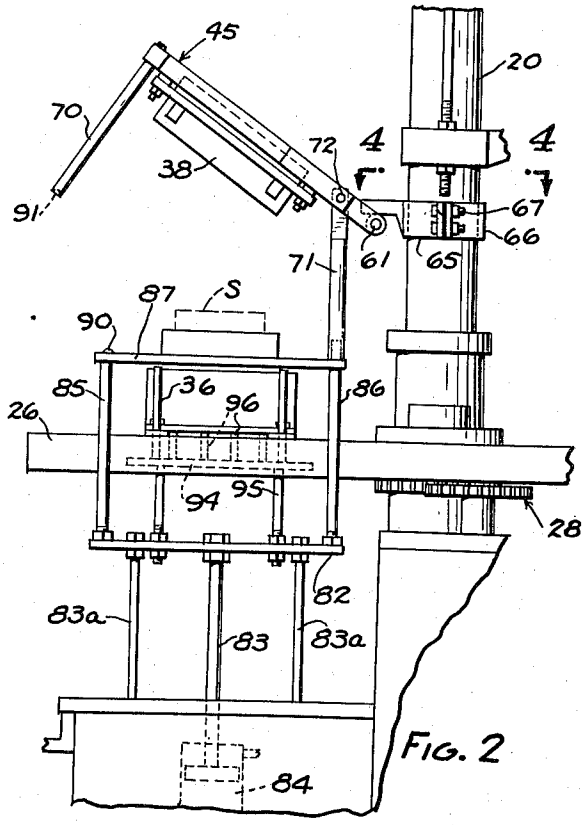


FIG. 2

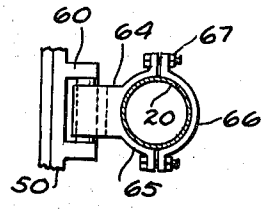
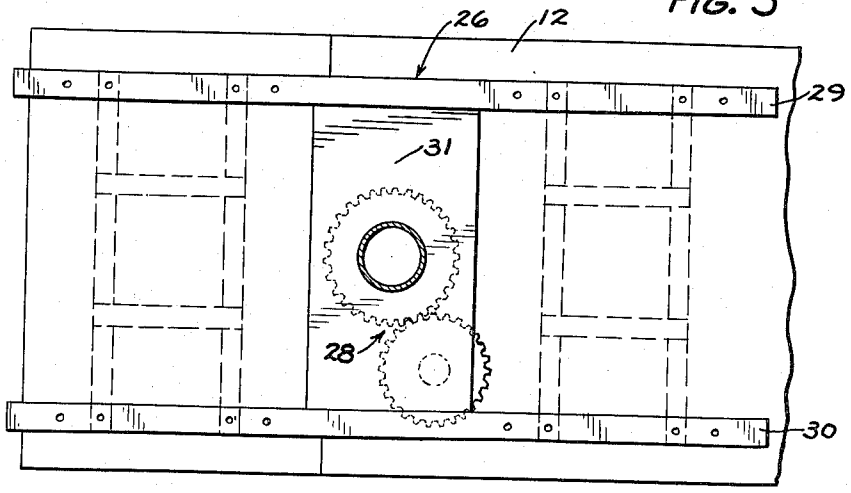


FIG. 4

FIG. 3



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APPARATUS FOR FORMING SHAPED ARTICLES SUCH AS FOUNDRY MOLDS AND CORES

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8 Claims. (Cl. 22—47)

This invention relates generally to apparatus for forming shaped articles such as molds and cores from foundry sand or the like wherein a sectional pattern is carried cyclically between a station where it is charged with sand and another station where the pattern is opened and the shaped article is removed therefrom.

A principal object of the invention is to provide a simple inexpensive improved structure for separating the pattern sections along a parting line to facilitate removal of the shaped articles at the unloading station and to facilitate reclosing the pattern sections for receiving another charge of sand in a subsequent molding cycle.

The invention generally contemplates securing to the upper pattern section a frame having depending sets of legs with the legs of one set being pivoted to the frame. An elevator engages the legs to raise the upper pattern section away from the lower pattern section and the elevator and pivoted set of legs have parts which interengage to form a rigid joint. A lever on the frame projects laterally of the pivoted legs and engages a stop to tilt the frame and upper pattern section after the pattern sections have been parted. The pattern sections re-engage along the parting line when the elevator is lowered and the joint between the elevator and legs then disconnects to enable the pattern to be transported away from the unloading station. One form of the invention is shown in the accompanying drawings.

Fig. 1 is a partly diagrammatic elevational view of molding apparatus utilizing the structure of this invention.

Fig. 2 is a fragmentary generally elevational view illustrating the apparatus of this invention in a position wherein the pattern is open.

Fig. 3 is a partly diagrammatic plan view of a reciprocating rotating conveyer with its central portion tion shown in section.

Fig. 4 is a sectional view on line 4—4 of Figure 2.

Fig. 5 is a plan view of a vertical carrier for the upper pattern section.

Fig. 6 is an enlarged fragmentary view illustrating structure at one of the pivoted legs of the carrier for the upper pattern section.

Fig. 7 is a fragmentary sectional view taken generally on line 7—7 of Figure 6 with parts illustrated in phantom.

Fig. 8 is a fragmentary plan view of the elevator for the upper pattern section carrier.

The molding apparatus **10** illustrated in Figure 1 includes a hopper **11** for containing foundry sand vertically adjustably mounted on a base **12** through lugs **13** and **14** resting on projecting portions **15** and **16** of collars secured by threaded means to upright posts **17** and **18**. Posts **17** are suspended from a cap **19** over the top of a large central cylindrical column **20** resting on the base and posts **18** are secured directly to the base. Hopper **11** is furnished with compressed air through a conduit **21** for forcing foundry sand through nozzles **22** in the base of the hopper into a pattern box **25** through openings **25'** therein. A conveyer **26** is journaled through suitable bearings around central column **20** and a motor

27 is operably connected to the conveyer through gearing **28** for rotating the conveyer preferably in a reciprocating manner for carrying pattern boxes **25** cyclically to the charging station beneath hopper **11** and to a mold removal station shown as being on the left side of the column as the drawings are viewed.

Conveyer **26** comprises a pair of beams **29** and **30** secured to a central portion **31** driven by gearing **28**. A fluid pressure motor **35** is operably connected to a table **35***a* vertically movable beneath hopper **11** for raising a pattern box **25** into charging engagement with sand nozzles **22** and for lowering the charged pattern or pattern box into engagement with conveyer **26**. A vertical guide rod **35***b* is attached to table **35***a* and slidably passes through an apertured portion of base **12** for guiding movement of the table. Vertical guide rods **36** are threaded into openings in conveyer beams **29** and **30** and slidably engage in openings provided in a base flange **37** on pattern box **25** for guiding vertical movement thereof and for positioning the pattern box on conveyer **26**.

In general operation of the apparatus an empty pattern is mounted on the left hand portion of conveyer **26**. The conveyer is rotated 180 degrees until the pattern is beneath hopper **11**. The pattern is then elevated to receive a charge of sand from nozzles **22** and is again lowered. Conveyer **26** is then rotated 180 degrees in the opposite direction to return the charged pattern to its original station. The pattern is preferably provided with electric heating elements (not shown) which bake and cure the sand in the pattern. The conveyer is reciprocally rotated so that the electric conduits for the pattern (not shown) can be directly connected into the patterns without the use of slip rings. When the pattern has been returned to its original station its cope or upper section **38** is elevated away from its drag or lower section **39**, the two sections separating along a generally horizontally extending parting line **40**. The shaped article is removed from the pattern, the pattern sections are reengaged with each other and the cycle is repeated. It will be understood that in the apparatus illustrated, two patterns are in the cycle described, one being mounted on each arm of conveyer **26**. Suitable mechanical and electrical means may be provided for automatically carrying out the cycle and a control panel **41** may be provided for the operating mechanism.

The present invention is specifically concerned with the apparatus for opening pattern **25** after an article has been shaped therein and reclosing the pattern after the article has been removed.

This apparatus includes a carrier **45** for upper pattern section **38** and an elevator **46** for raising and lowering the carrier. Carrier **45** includes a generally rigid frame composed of members **47—50** which is secured to upper pattern section **38** through beams **51** and **52** bolted to frame members **47** and **49** as at **53** in turn having cross beams **54** and **55** bolted thereto as at **56**. Cross beams **54** and **55** supportingly engage a flange **58** on upper pattern section **38**. A bifurcate lever **60** projects laterally of frame member **50** and a pin **61** extending between the lever portions supports one or more rollers **62** for engaging the under surface **63** of a stop member **64** vertically adjustably secured on central column **20**. To facilitate this vertical adjustment, stop **64** comprises a projection on one of two semi-circular collar members **65** and **66** bolted together around the collar by bolts **67**.

Two sets of legs depend from the corners of the frame portion of carrier **45**, the pair of legs **70** remote from central column **20** being rigid with the frame and the pair of legs **71** adjacent the column being pivotally mounted on the frame through pivots **72**. Each pivot is supported by a portion of the frame and a pivot support member **73** secured to the outer face of each frame mem-

ber 47 and 49 through a spacing element 74 (Figs. 6 and 7). This provides a space between the pivot support 73 and the frame member for receiving the upper end of pivoted leg 71. Spacer 74 has a bore 75 (Fig. 7) with a plunger stem 76 operably disposed therein, the plunger head 77 engaging a side face of leg 71 adjacent its upper end. The plunger is urged by a spring 78 into engagement with a side of the leg and a screw 79 is provided behind spring 78 to regulate the stress in the spring. Plunger head 77 and the flat face of leg 71 co-operate to retain leg 71 against unintentional swinging movement.

Elevator 46 includes a base 82 secured to the piston rod 83 of a fluid pressure motor 84 arranged to raise and lower the elevator in a generally vertical direction. Guide rods 83*a* attached to base 82 pass slidably through apertured portions of base 12 for guiding movement of the elevator (Fig. 2). Elevator 46 also includes four upstanding corner posts vertically aligned with corner legs 70 and 71 of carrier 45. The pair of posts 85 underlying outer carrier legs 70 and corner posts 86 underlying pivoted legs 71 are interconnected by rails 87 for purposes of rigidity and also for supporting carrier legs 70 and 71. Posts 86 have extensions 88 projecting above rails 87 and forming pins for telescoping engagement within longitudinal sockets 89 in the lower ends of pivoted carrier legs 71. Outer elevator posts 85 have relatively small taper projections 90 engageable in complementary recesses 91 in the bottom ends of legs 70.

Elevator 46 also includes a table 94 supported on base 82 through posts 95 for engaging conventional core stripping pins 96 depending below lower pattern section 39.

In operation it may be assumed that pattern box 25 has received a charge of foundry sand from hopper 11 in the manner described and that conveyer 26 has been actuated to transport the pattern to the unloading station at the left hand side of Fig. 1. The sand has been heated and cured within the pattern and the pattern is ready to be unloaded. Elevator 46 is in the lower position of Fig. 1 and upper pattern section 38 is still engaged against lower pattern section 39 along parting line 40. To open pattern 25 fluid under pressure is introduced to motor 84 for elevating the piston and piston rod 83. This movement raises elevator base 82 and carries posts 85 and 86 upwardly. Pins 88 telescopingly engage within sockets 89 in pivoted legs 71 and tapered projections 90 engage within recesses 91 in legs 70. Carrier legs 70 and 71 bottom against rails 87.

Upon continued upward movement of the elevator, carrier 45 is moved upwardly and upper pattern section 38 separates from the lower pattern section. Carrier 45 and upper pattern section continue in their upward path of movement until rollers 62 engage the under surface 63 of stop 64. Upon continued upward movement of elevator 46 and carrier 45 the frame portion of carrier 45 together with upper pattern section 38 are levered about pivots 72 at the upper ends of legs 71 by co-operation of lever 60 and stop 64. This tilts the carrier frame and upper pattern section to the position illustrated in Fig. 2 where by suitable controls upward movement of the elevator is discontinued.

It will be noted that interengaging pins 88 and sockets 89 provide a rigid joint between the elevator and carrier facilitating the tilting movement. Also the relatively small size of taper projections 90 and recesses 91 enable carrier legs 79 to swing away from engagement with rails 87. During tilting movement of the carrier frame, rollers 62 roll on stop surface 63 in a lateral direction to provide minimal resistance to the tilting movement. During this upward movement table 94 engages depending core stripping pins 96 and forces them upwardly into lower pattern section 39 in a conventional manner for stripping the shaped article S out of the lower pattern section. The shaped article may then be removed from the lower pattern section.

After shaped article S has been removed from the pattern the pressure in fluid motor 84 is reversed or exhausted to lower piston rod 83 and elevator 46. In the initial downward movement of the elevator, legs 71 move straight downwardly and the carrier frame and attached top pattern section tilt down to a generally horizontal position in which the lower ends of legs 70 re-engage rails 87. Upon continued downward movement of the elevator the entire carrier and upper pattern section move vertically downward until upper pattern section 38 engages lower pattern section 39 on parting line 40. The lower pattern section forms a stop restraining further downward movement of upper pattern section and carrier 45 but elevator 46 continues its downward movement until pins 88 have withdrawn from sockets 89 to disconnect the joint between the elevator and carrier. At the bottom of this downward movement pins 88 are spaced below carrier 26 which is then free to swing for carrying the unloaded pattern to a position beneath hopper 11 for recharging with foundry sand. This swinging movement carries another loaded pattern 25 above elevator 46 and the unloading procedure may be repeated.

One of the principal advantages of the mold unloading apparatus is that the tilting movement provides maximum working space facilitating unloading of the lower pattern section and maintenance of the pattern sections while at the same time requiring only a moderate length of travel for elevator 82. Moreover, the pin and socket joint between the elevator and carrier legs 71 is very simple and inexpensive and the co-operating stop and lever parts 60—67 are also simple inexpensive and virtually foolproof. The co-operating parts of the apparatus have minimal tendency toward malfunctioning caused by dirt, wear and the like.

I claim:

1. Apparatus for forming shaped articles such as foundry molds and cores from sand or the like comprising, a pattern having sections which are separable from each other along a parting line, support means supporting one of said sections, frame means having a portion secured to the other section and pivoted means thereon, frame actuating means mounted for advancing movement and return movement relative to said frame means, said pivoted means and actuating means having parts which interengage to form a generally rigid joint therebetween responsive to advancement of said actuating means toward said frame means, said actuating means being operable through said joint to move said frame means upon advancing movement thereof for separating said pattern sections and carrying said portion of said frame means and other pattern section in a path of movement, said frame means having lever means projecting laterally of the pivot of said pivoted means and transversely of said path of movement, means forming a stop in the path of movement of said lever means against which said lever means is engageable, said lever means and stop cooperating upon continued movement of said pivoted element in said path of movement to tilt said portion of said frame means and said other pattern section relative to said one pattern section, whereby to facilitate removal of a shaped article from said pattern, said actuating means in said return movement thereof returning said frame means to reengage said pattern sections, said one pattern section forming a stop restraining return movement of said frame means when said pattern sections are engaged, said joint being detachable by continued return movement of said actuating means.

2. The combination defined in claim 1, wherein said pivoted means and actuating means have telescoping parts which interengage upon advancing movement of said actuating means to form a generally rigid pin and socket type joint, said joint being detachable by said continued return movement of said actuating means as described.

3. Apparatus for forming shaped articles such as foundry molds and cores from sand or the like comprising, a pattern having sections which are separable from

each other along a parting line, support means supporting one of said sections, frame means having a portion secured to the other section and pivoted means thereon, frame actuating means mounted for advancing movement and return movement relative to said frame means, said pivoted means and actuating means having parts which interengage to form a generally rigid joint therebetween responsive to advancement of said actuating means toward said frame means, said actuating means being operable through said joint to move said frame means upon advancing movement thereof for separating said pattern sections and carrying said portions of said frame means and said other pattern section in a path of movement, said frame means having lever means projecting laterally of the pivot of said pivoted means and transversely of said path of movement, means forming a stop in the path of movement of said lever means and having a surface, said lever means having roller means thereon engageable against said surface, said lever means and stop cooperating upon continued movement of said pivoted means in said path of movement to tilt said portion of said frame means and said other pattern section relative to said one pattern section, whereby to facilitate removal of a shaped article from said pattern, said roller means rolling on said surface in a direction transverse to said path of movement upon said continued movement of said pivoted means to facilitate the tilting of said frame and other pattern section, said actuating means in said return movement thereof returning said frame means to reengage said pattern sections with said roller means rolling on said surface to facilitate return tilting movement of said portion of said frame and said other pattern section, said one pattern section forming a stop restraining return movement of said frame means when said pattern sections are engaged, said joint being detachable by continued return movement of said actuating means.

4. Apparatus for forming shaped articles such as foundry molds and cores from sand or the like comprising, a pattern having sections which are separable from each other along a parting line, support means supporting one of said sections, frame means having a portion secured to the other section and including a plurality of elements extending in a direction transverse to the general direction of said parting line, at least one of said elements being mounted through a pivot on said portion of said frame means, frame actuating means mounted for movement toward and away from said elements for engaging and disengaging the same, the pivoted element and said actuating means having parts which cooperate to form a generally rigid joint therebetween responsive to interengagement of said elements and actuating means, said actuating means being operable through said joint to move said frame means when engaged therewith for separating said pattern sections and carrying said frame and other pattern section in a path of movement, said frame means having lever means projecting laterally of said pivot and transversely of said path of movement, means forming a stop in the path of movement of said lever means against which said lever means is engageable, said lever means and stop cooperating upon continued movement of said pivot element in said path of movement to tilt said other portion of said frame and said other pattern section relative to said one pattern section, whereby to facilitate removal of a shaped article from said pattern, said actuating means being returnable for returning said frame means to reengage said pattern sections, said one pattern section forming a stop restraining return movement of said frame means when said pattern sections are engaged, said joint being detachable by continued movement of said actuating means from said elements.

5. Apparatus for forming shaped articles such as foundry molds and cores from sand and the like comprising, a pattern having an upper section and a lower section which are separable from each other along a

generally horizontal parting line, means forming a carrier secured to the upper section, leg means mounted on said carrier through a pivot and extending downwardly thereof, means forming an elevator mounted for movement in a vertical direction toward and away from said leg means, said leg means and elevator having parts which interengage to form a generally rigid joint therebetween responsive to movement of said elevator toward said leg means, said elevator being operable through said joint to elevate said carrier when said joint is connected for elevating said upper pattern section away from said lower pattern section in a path of movement, said carrier including means forming a lever projecting laterally of the pivot of said leg means and transversely of said path of movement, means forming a stop in the path of movement of said lever against which said lever is engageable, said lever and stop cooperating upon continued upward movement of said leg means to tilt said upper pattern section relative to the lower pattern section, whereby to facilitate removal of a shaped article from said pattern, said elevator being movable for returning said upper pattern section into engagement with said lower pattern section, said lower pattern section forming a stop restraining movement of said upper pattern section and carrier when said pattern sections are engaged, said joint being detachable by continued movement of said elevator away from said leg means.

6. Apparatus for forming shaped articles such as foundry molds and cores from sand and the like comprising, a pattern having an upper section and a lower section which are separable from each other along a generally horizontal parting line, means forming a support for said lower pattern section, a carrier which includes a frame portion secured to said upper pattern section and a plurality of sets of legs extending downwardly from said frame portion, one of said sets of legs being pivotally mounted on said frame portion, an elevator mounted for movement in a vertical direction toward and away from said legs for engaging and disengaging the same, the pivotally mounted legs and said elevator having parts which cooperate to form a generally rigid joint therebetween responsive to interengagement of said legs and elevator, said elevator being operable through said joint to elevate said carrier for elevating said upper pattern section away from said lower pattern section in a path of movement, said carrier including means forming a lever projecting laterally of said pivoted legs and transversely of said path of movement, a stop in the path of movement of said lever against which said lever is engageable, said lever and stop cooperating upon continued movement of said pivoted legs in said path of movement to tilt said frame portion and upper pattern section relative to said lower pattern section, whereby to facilitate removal of a shaped article from said pattern, said elevator being lowerable for returning said upper pattern section into engagement with said lower pattern section, said lower pattern section forming a stop restraining continued movement of said carrier when said pattern sections are engaged, said joint being detachable by continued downward movement of said elevator away from said legs.

7. The combination set forth in claim 6 wherein said frame portion secured to said upper pattern section is generally centrally located, said legs extending downwardly of portions of said frame disposed outwardly of the central portion, said legs being spaced outwardly of the outer walls of said pattern when said sections thereof are engaged on said parting line.

8. Apparatus for molding shaped articles such as foundry molds and cores from sand or the like comprising, a pattern having an upper section and a lower section which are separable along a generally horizontal parting line, a conveyor upon which the lower pattern section is supported, said conveyor being movable in a generally horizontal direction to transport said pattern

to and from a station for unloading said pattern of shaped articles formed therein, a carrier secured to said upper pattern section and including pivoted leg means which depend in a generally vertical direction, an elevator at said station movable in a vertical direction toward and away from said leg means, said elevator and leg means having parts which are interengageable responsive to upward movement of said elevator when said pattern is at said station, said parts when interengaged forming a generally rigid joint, said elevator being operable through said joint and carrier to elevate said upper pattern section away from said lower said pattern section in a path of movement, said carrier including means forming a lever projecting laterally of the pivot of said leg means and transversely of said path of movement, means forming a stop in the path of movement of said lever against which said lever is engageable, said lever and stop cooperating upon contiued movement of said leg means in said path of movement to tilt said portion of said carrier and said upper pattern section relative to

said lower pattern section, whereby to facilitate removal of said pattern from a shaped article, said elevator being lowerable for returning said upper pattern section into engagement with said lower pattern section, said lower pattern section forming a stop restraining downward movement of said carrier when said pattern sections are engaged, said joint being detachable by continued downward movement of said elevator away from said leg means whereby to facilitate horizontal mold-conveying movement of said conveyor.

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