

Sept. 3, 1935.

J. LUTON

2,013,278

METHOD FOR MAKING MOLDS

Filed July 25, 1933

3 Sheets-Sheet 1

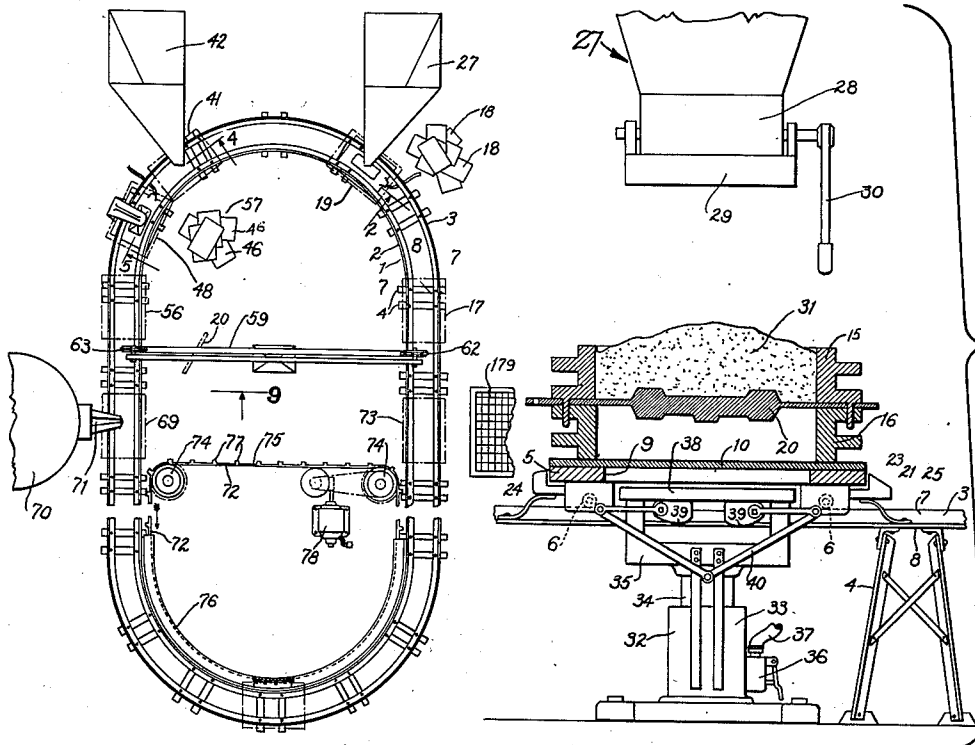


Fig 1

Fig 2.

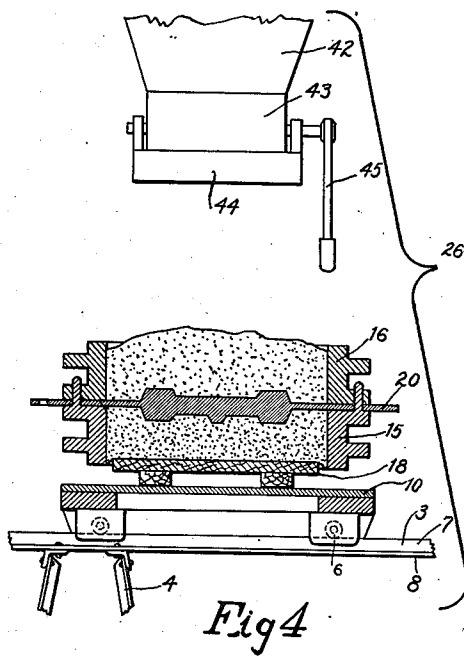


Fig 4

Fig 3.

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3 Sheets-Sheet 2

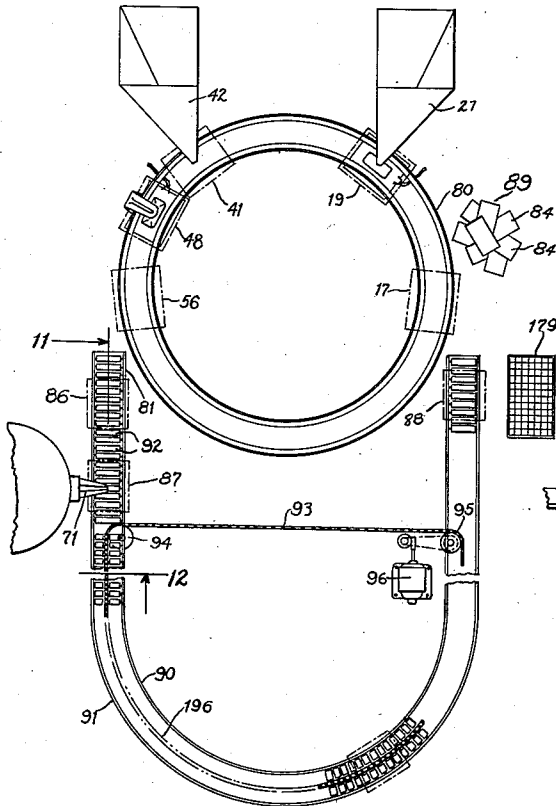


Fig 10

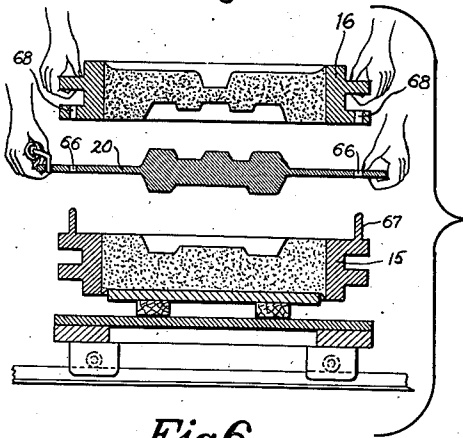


Fig 6

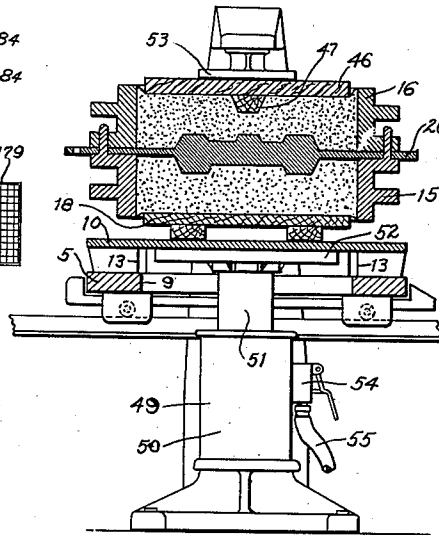


Fig 5

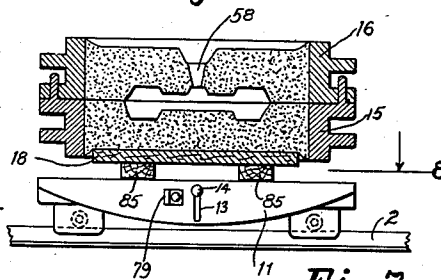


Fig 7

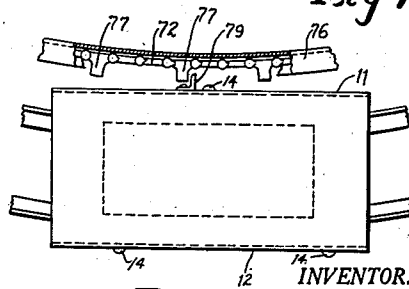


Fig 8. John Luton.

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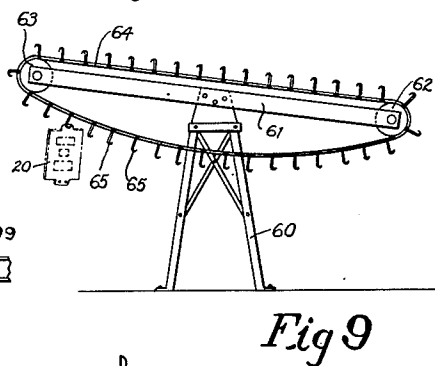
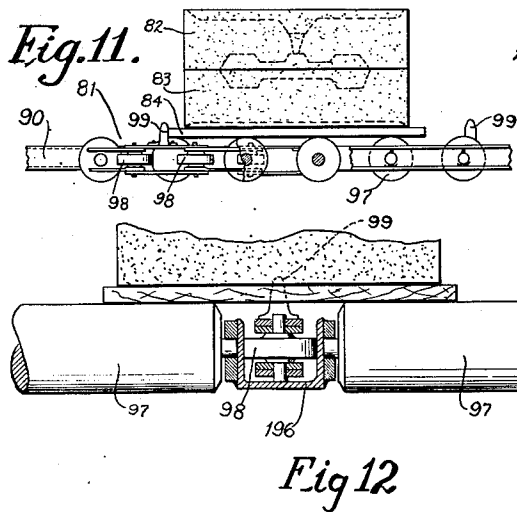
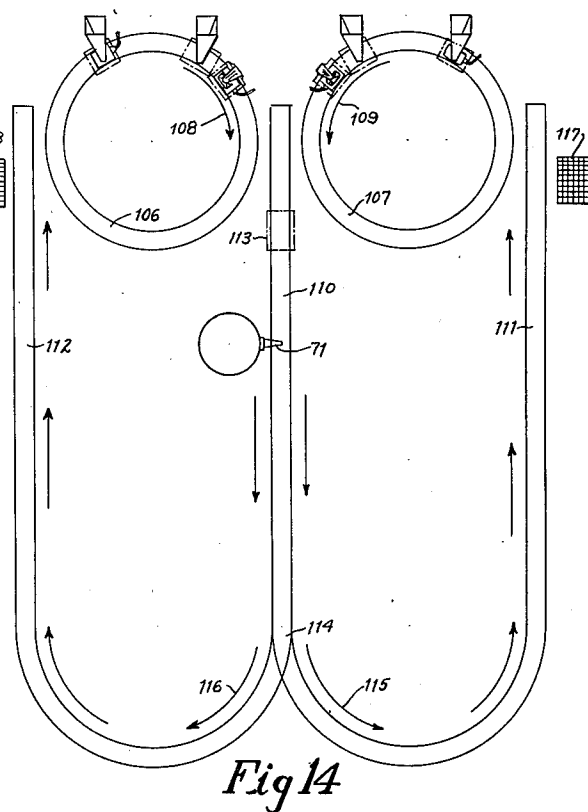
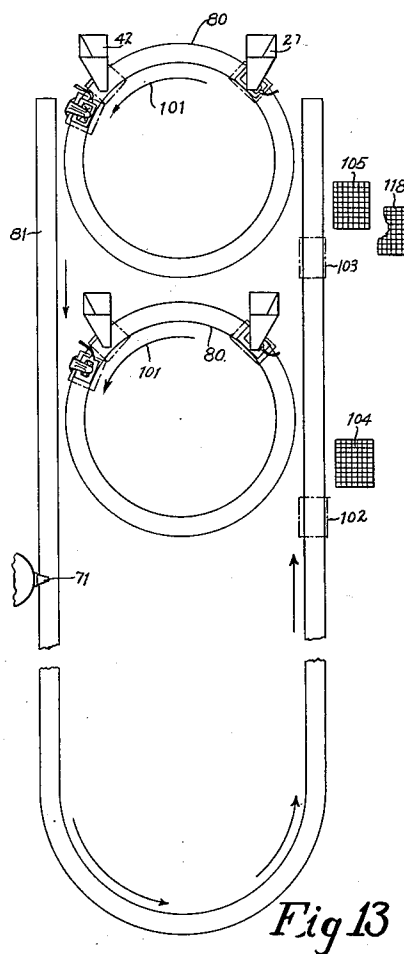
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## METHOD FOR MAKING MOLDS

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3 Sheets-Sheet 3



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## UNITED STATES PATENT OFFICE

2,013,278

## METHOD FOR MAKING MOLDS

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Cleveland, Ohio, a corporation of Ohio

Application July 25, 1933, Serial No. 682,138

3 Claims. (Cl. 22—193)

This invention relates to the art of founding and particularly to methods and apparatus for making molds of sand or the like and for casting the molds in metal.

It is one of the objects of this invention to provide an apparatus and method whereby a continuous process of producing molds and casting them in metal may be carried out with a saving in the time and/or in the labor cost thereof as compared with prior practice.

Another object is to provide an apparatus and method for producing molds and casting them in metal in which a division of labor may be effected, the necessary operations to produce a mold and casting it being divided up among a plurality of laborers instead of all being performed successively by a single laborer or groups of laborers.

Another object is to provide an apparatus and method for producing molds and casting them in metal wherein the molds may be produced by relatively unskilled labor or by labor less skilled than has heretofore been necessary.

Another object is to provide an apparatus and method for producing molds and casting them in metal and wherein the making of the molds may be carried on in a continuously repeating cycle of operations from a plurality of patterns.

Another object is to provide an improved method and apparatus for circulating molding flasks and patterns through a continuous cycle of mold-producing and mold-casting operations.

Other objects will be apparent to those skilled in the art to which my invention appertains.

My invention is fully disclosed in the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a plan view, in some respects diagrammatic, of an apparatus embodying my invention in one form;

Fig. 2 is a sectional view to an enlarged scale taken from the plane 2 of Fig. 1 and illustrating a flask jolting mechanism which I may employ;

Fig. 3 is a view similar to Fig. 2 illustrating certain parts thereof in different positions;

Fig. 4 is a sectional view to an enlarged scale taken from the plane 4 of Fig. 1;

Fig. 5 is a sectional view to an enlarged scale taken from the plane 5 of Fig. 1 and illustrating a squeezing operation which I may perform;

Fig. 6 is a view illustrating an operation of pattern removal which I may perform subsequent to operation of jolting and squeezing;

Fig. 7 is a sectional view illustrating a finished mold and carriage upon which it may travel during a casting operation;

Fig. 8 is a view taken from the plane 8 of Fig. 7 and rotated through 180°;

Fig. 9 is a view illustrating a pattern transfer mechanism which I may employ, the view being taken from the plane 9 of Fig. 1 and drawn to a slightly larger scale;

Fig. 10 is a view similar to Fig. 1 illustrating a modification;

Fig. 11 is a sectional view to an enlarged scale taken from the plane 11 of Fig. 10;

Fig. 12 is a sectional view to a still larger scale taken from the plane 12 of Fig. 10;

Fig. 13 is a diagrammatic view of a further modification generally similar to Fig. 10;

Fig. 14 is a diagrammatic view illustrating a still further modification of the form of Fig. 10.

This application is a continuation in part of the subject matter of my copending application, Serial No. 501,844, filed December 12, 1930, now matured into Patent No. 1,924,081, dated Aug. 22, 1933 for improvements in Methods and apparatus for making molds, and reference may be had thereto for a more complete description of parts briefly described herein.

Referring to the drawings, I have shown at 1 generally a trackway comprising inner and outer rails 2 and 3 which may be supported at a convenient height from the floor by a series of spaced trestles 4—4, one of which is fragmentarily illustrated in Fig. 2.

I provide a plurality of carriages adapted to support each a molding flask and pattern and to carry the same along the trackway 1 to a succession of stations at which successive mold-making operations may be performed; and then to carry the finished mold to a casting or pouring station and thence over a length of the trackway to permit chilling of the casting and thence back to the starting point where the casting is removed and the flask is started around the cycle another time to make another mold, etc.

One form of such carriage and trackway is illustrated and described in my above-mentioned copending application; and a preferred form is illustrated and described in my copending application, Serial No. 682,137, filed July 25, 1933 and reference may be had thereto for a more complete description.

It is believed to suffice herein to say that the carriage comprises a bed 5 provided with a plurality of wheels 6 adapted to run upon the vertically disposed flanges 7—7 of the rails, the horizontal flanges 8—8 of which rest upon and are secured to the trestles 4.

The bed 5 has an opening or perforation 9 55

therein upwardly through which heads of a jolting machine and a squeezing machine, to be described, may be projected. The bed is provided with a cover 10, preferably of sheet metal, covering the opening 9, resting upon the upper side of the bed, and having lateral depending flanges 11 and 12 provided with vertical slots 13 through which pins 14 are projected into the bed 5 and whereby the cover 10 may be retained in position on the bed 5 but may have vertical movement relative thereto.

For each of the carriages I provide a molding flask and a pattern. The flasks comprise a drag portion 15 and a cope portion 16. The complete carriage equipment is thus illustrated in Fig. 2 where it is shown in a particular position or station to be referred to.

The further description of the apparatus will follow in connection with a description of the operation of making a mold with the pattern and flask, removing the flask, pouring the mold, returning the flask to the pattern, removing the casting and then repeating this cycle.

The start of the progressive movement of the carriages may be considered as beginning when the carriage is in the position indicated in broken lines at 17, Fig. 1. At or adjacent the station 17 is provided a pile of follow boards 18—18 and one of these is associated with the flask and carriage. The carriage is then moved forward to the station indicated in broken lines at 19, the parts in this position being illustrated in Fig. 2, the flask parts 15 and 16 being assembled with a pattern 20.

At this station and at other subsequent stations where desired, I prefer to provide a device for predetermining the position of the carriage for the station and for automatically stopping it in that position when propelled thereto. A preferred form of such stop device is illustrated and fully described in my copending application, Serial No. 632,137, filed July 25, 1933, above referred to, and reference may be had thereto for a fuller description. It will suffice here to state that it comprises a bar 21 pivoted at an intermediate portion, for example as at 22, Fig. 3, and has stop shoulders 23 and 24 on opposite ends thereof adapted to engage adjacent end portions of the carriage bed 5. The approach end of the bar adjacent the shoulder 23 has an inclined surface 25. Springs 26—26 of the leaf type secured to the rail 3 may normally but yieldingly hold the bar in its generally horizontal position.

In operation, when the carriage is moved along to the station at which it is to be stopped, a leading portion of the bed 5 rides over the inclined surface 25, rocking the bar clockwise as viewed in the drawings, the said end portion of the bed proceeding until it engages the stop portion 24 whereupon the stop portion 23 rises under the impulsion of a spring and prevents backward movement of the bed. The bed is thus trapped in a predetermined position at the station. To move it on to the next station, the bar 21 may be rocked manually counter-clockwise to free the stop portion 24 from the corresponding end of the bed.

Immediately above the flask at the station 19 is a hopper 27 having a discharge spout 28. Molding sand is supplied to the hopper from conditioning apparatus and by conveyor means not shown but well known in the art. The spout 28 is closed by a gate 29 operable by a hand lever 30.

The operator at the station 19 operates the lever 30 and discharges sand from the spout into the drag flask 15 as at 31 upon the pattern 20. He

then places the follow board 18 thereon as indicated in Fig. 3. At the station 19 is also provided a jolting machine, indicated generally at 32. The machine comprises a cylinder 33, piston 34 and jolting head 35, and operable valve means generally indicated at 36 communicating with a source of compressed air 37 whereby the head 35 may be jolted with the well known movement in founding practice.

The elements providing the jolting movement constitute no essential part of my invention and may be such as are well known in the art.

The jolting head 35 has a supplemental head 38 which may be raised and lowered relative to the head 35 by a mechanism comprising lobed cams 39—39 rotatably mounted on the head 35 and operable by a mechanism indicated generally at 40 to move them from a retracted position illustrated in Fig. 2 to an extended position illustrated in Fig. 3 to elevate the supplemental head 38. In the elevated position of Fig. 3, the supplemental head 38 is rigidly supported upon the head 35. As the supplemental head 38 rises, it moves upwardly through the opening 9 in the carriage bed 5, picks up the cover 10 and the flask parts and pattern thereon and elevates them above the bed. The jolting mechanism 32 is then operated to jolt the head 35 and the supplemental head 38 therewith; and the jolting movement is communicated to the flask and jolts it in a well known manner.

The mechanism above referred to is more completely described in my copending application, Serial No. 501,844, filed December 12, 1930, and reference may be had thereto.

It will be observed that by this means the shocks of jolting the flask are not transmitted to the carriage nor to the trackway nor to the wheels 6 thereof and thus anti-friction bearings may be provided in the wheels without the rapid deterioration which otherwise would occur.

After the completion of the jolting operation, the supplemental head 38 is lowered and the cover 10 and the flask board thereon is again transferred to the carriage and it is moved on to the next station indicated at 41, where the parts appear as viewed in Fig. 4. Either at this station or prior to the arrival of the carriage thereto, the operator picks up the two parts of the flask and turns them upsidetown on the carriage bed, and with the follow board 18 resting directly on the cover 10. Immediately above the flask at the station 41 is another hopper 42 having a spout 43 and a gate 44 controlled by a lever 45.

An operator at the station 41 now operates the handle 45 to drop sand from the hopper 42 into the cope portion 16 of the flask. A small supply of sprue mold boards 46—46 is disposed adjacent the station 41 and the operator now takes one of these boards and places it on the sand in the cope flask as illustrated in Fig. 5, the board having a sprue mold pattern portion 47 on the underside thereof. The carriage is then moved by an operator to a squeezing station indicated at 48 at which is located a machine known in the founding art as a squeezer, and Fig. 5 illustrates the flask and squeezer at this station.

The squeezer, shown generally at 49, may be of any suitable or known construction and its exact construction constitutes no essential part of the present invention. As is common to such squeezers, it comprises a cylinder 50, a piston 51 and a squeezing head 52 elevatable by the pis-

ton and a stationary upper squeezing head 53. The movement of the head 52 is controlled by a valve 54 communicating with a supply of compressed air 55. Upon operating the valve 54, the head 52 is elevated and squeezes the mold between the heads 52 and 53, in a well known manner.

It will be observed that the head 52 upon rising, passes upwardly through the opening 9 in the bed 5 and engages the cover 10 and raises it and the flask supported thereon free from the carriage proper whereby the squeezing operation is performed without transmitting any of the squeezing pressure to the trackway or to the carriage. After the squeezing operation is complete, the valve 54 is operated to lower the head 52 to its normal position.

When in its lower position, the head 52, and likewise the head 38 of the jolter mechanism above described, are out of the path of the movement of any of the parts of the carriage whereby the carriage may be moved thereover in coming to or departing from the station. To this end, these heads preferably operate upwardly between the rails 2 and 3 of the trackway.

After the squeezing operation above described, the carriage and flask are moved on to the station indicated at 55 in Fig. 1. There the sprue follow board 46 is removed and returned to the pile from which it was taken, indicated generally at 57; and the mold is disassembled as illustrated generally in Fig. 6, to remove the pattern 20 therefrom, and the two parts of the flask are re-assembled as shown in Fig. 7. During these operations the rest of the sprue mold 58 may be produced in a well known manner for pouring later.

The pattern removed from the mold is now put upon a transfer mechanism illustrated generally at 59, Fig. 1, and shown separately in Fig. 9, to transfer the pattern back to the station 17 from which it started. Any suitable transfer mechanism may be employed. That shown in the drawings comprises a central column 60 carrying at its upper end an inclined head or frame 61 having rotatable belt pulleys 62 and 63 at its opposite ends. A belt 64 runs over the pulleys and is provided with a longitudinal series of hook devices 65—65 adapted to be engaged with one or another of the perforations 66 in the pattern match-plate by which it is aligned with its flask portions 15 and 16 in the usual manner, for example by means of pins 67 on one of the flask members projecting through the perforations 66 and into corresponding perforations 68 in the other flask member.

The higher pulley of the two, namely 63, is disposed over or adjacent the station 56 and the pattern 20, supported thereon, will move by gravity downwardly substantially to the station 17 over which the pulley 62 is disposed.

The mold is now complete and appears as illustrated in Fig. 7 and is then moved by an operator from the station 56 to a pouring station 69 where molten metal from a cupola 70 is poured into the mold through the sprue mold 58 from a spout 71. The cupola 70 and spout 71 may be of well known construction and form no essential part of my invention. The carriage containing the mold and molten metal is now moved forwardly along the trackway until it is picked up by a driving chain 72 by which it is continuously moved along the trackway until it reaches the next station, indicated in broken lines at 73 in Fig. 1.

The exact construction of the propelling chain 72 constitutes no essential part of my invention. One form, however, is illustrated in Figs. 1 and

8. The chain is looped over a pair of spaced sprocket wheels 74—74, extends from one to the other in a straight flight 75 and the return flight runs in a curved channel 76 which disposes it parallel to adjacent portions of the trackway between the stations 69 and 73. The chain is provided with spaced prongs 77 and is propelled by a motor 78 which continuously drives the chain by driving the pulley 74 by suitable transmission mechanism.

The carriages, preferably the covers thereof, are each provided with a lug 79 adapted to be engaged by one or another of the prongs 77 whereby the carriage may be propelled by the chain around the trackway with a continuous movement.

The length of the trackway between the stations 69 and 73 is proportioned so that the metal will solidify sufficiently to be removed from the mold. At the station 73, therefore, the flask is opened up, the casting and sand shaken out, and the two flask portions are returned to the carriage, and the carriage is moved on to the station 17 where a pattern is assembled with it and it is ready to proceed a second time around the cycle.

To facilitate breaking up the sand and separating the casting therefrom, a grate 179 of known construction and operated in the known manner may be provided.

It will be observed that there are more flasks in the system than patterns, those flasks in the system between the stations 69 and 73 being without patterns; so that the pattern is not returned to the same flask from which it was disassembled after the making of the mold and therefore the patterns may be made interchangeable with the flasks.

As will now be apparent, any suitable number of operators may be stationed on the inside or on the outside of the trackway and that the various operations performed may be sub-divided among them; and that the flask patterns move continuously through the cycle being used over and over again, and may be described as circulating through the mold-making and casting system without cessation. As each operator performs but a single operation, all the operations of making the mold and casting it may be formed with the maximum of economy.

Any suitable apparatus may be employed to convey sand from the shaking out grate 179 through a conditioning apparatus and back to the sand hoppers 42 and 27. Such apparatus being well known in the art, the exact details of construction thereof form no essential part of my invention, and my invention comprehends any such apparatus as an element thereof.

After the complete apparatus has been started up and the first flask has returned all the way from the starting point back thereto again, each flask will have associated with it a follow board 18 and no more such boards need be supplied to the system from the pile above referred to adjacent the station 19.

The exact number of patterns and flasks which may circulate continuously through the system illustrated in Fig. 10, will be determined largely by the number of stations starting with the station 17 and around through the station 56 back to the station 17. For the most economical use of the apparatus there should be one flask and pattern at each station or moving from one station to the next at all times. The number of flasks in circulation will be equal to the number

of patterns plus those flasks which have been poured and are on the cooling portion of the trackway, which number is of course determined by the length of trackway necessary to solidify the casting.

In the form of my invention in Fig. 10, the minimum number of flasks may be employed.

At 80 is illustrated a trackway generally similar to the trackway 1 of Fig. 1 but circular in form. Hoppers 27 and 42, a starting station 17, a drag filling and jolting station 19, a cope filling station 41 and a squeezing station 48 and a disassembling station 56 are provided, all as in the form of Fig. 1.

At the station 56, however, the flask is removed from the mold, and the mold supported upon a board, is picked up and removed from the trackway 80 and laid upon a conveyor 81. In Fig. 11 the cope portion of the mold is illustrated at 82, the drag portion at 83, and the board at 84, resting upon the conveyor illustrated generally at 81. It will be apparent, therefore, that the flasks employed must be of the form known as snap flasks and the drag follow board 84 must preferably be of a form without cleats or lugs such as the lugs 85, Fig. 7, which were used in the other form. After the follow board 84 with the mold thereon is placed upon the conveyor 81, the two parts of the snap flask together with the pattern which has been removed from the mold, are placed upon the carriage and moved from the station 56 around the circular trackway to the starting point 17. Otherwise, the operations of forming the mold may be the same as those described for the form of Fig. 1.

The conveyor 81 is generally of U-shape, and the mold is placed thereon, for example at a station 86 at or adjacent the end of the U leg and adjacent the station 56 so that it will be convenient for an operator to lift the mold from the circular trackway and place it on the U-shaped conveyor. The mold is then propelled along the conveyor by hand to a pouring station 87 where molten metal may flow from a spout 71 to fill the mold. The mold is then picked up by an automatic propelling means and propelled on the conveyor around the closed end to the other leg of the U where it may be moved manually to a break-up station indicated at 88.

At the station 88 the mold and casting may be broken apart in connection with a shake-out grate 179 and the follow board 84 may be passed over to one of the flasks at the station 17 and be re-introduced into the circulation thereof. If desired, the follow boards 84 may be dropped into a pile indicated generally at 89 from which they may be transferred to the flasks going around the circular trackway 80. Obviously, there will be more follow boards 84 than there are flasks and patterns inasmuch as some of them will be slowly moving along the U-shaped conveyor 81.

The sprue mold board may be introduced into the system and out again at the stations 41 and 56 as described for the form of Fig. 1.

The conveyor mechanism 81 may be of any suitable construction and the details thereof constitute no essential part of my invention. In the form illustrated, the conveyor comprises a pair of laterally spaced channels 90 and 91 supported in any suitable manner and in which the opposite ends of rollers 92 are rotatably supported.

For automatically conveying the mold around the closed end of the U, which portion may be of any suitable length to give the necessary time

for the molten metal to solidify, the following means may be provided. A chain 93 runs over a pair of sprockets 94 and 95, the sprocket 95 being driven by a motor 96. The chain 93 extends in a straight flight from the sprockets 95 and 94 and thence around the closed end of the U-shaped conveyor runs in a channel 196. In this portion of the conveyor the rollers are in two parts, 97-97, rotatably supported at one end in the channels 90 and 91 and at their inner ends on the channel 196. The channel 196 is bent to conform to the shape of the channels 90 and 91. The chain 93 may be provided with spaced rollers 98 to facilitate its movement through the channel 196 and may be provided with longitudinally spaced prongs 99 extending upwardly therefrom and out of the channel 196 and above the rollers 97-97.

By this construction, when the mold is moved from the station 87, the board 84 thereof may be engaged by one of the prongs 99 as illustrated in Figs. 11 and 12, and thence may be propelled around the conveyor to or adjacent the station 88 where it may be moved from the chain and prongs manually. Guiding side rails 100, Fig. 12, may be provided if desired to insure that the mold may not leave the rollers of the conveyor.

Where greater productive capacity with the minimum of floor space is desired, the form of Fig. 10 may be modified as illustrated in Fig. 13 or 14. In Fig. 13, the two circular trackways 80-80 are provided with suitable stations therearound and apparatus at the stations as described in connection with the trackway 80 of Fig. 10. The direction of movement around the trackway may be that indicated by the arrows 101. The molds may be lifted from the trackway 80 when finished thereon and transferred to the conveyor 81, passing the pouring spout 71. The molds upon reaching either the station 102 or the station 103 may be broken up on the grates 104 and 105, respectively, the follow boards being returned to carriages on the trackways 80-80.

Thus while duplicating the circular trackways 80 and the apparatus thereon for making the molds, the U-shaped conveyor 81 need not be duplicated but the legs thereof may be extended slightly in length.

In Fig. 14, another floor plan is provided. In this form two circular trackways 106 and 107 are provided, the circulation thereon being in opposite directions as indicated by the arrows 108 and 109. Two U-shaped conveyors are provided having a common leg 110 and individual legs 111 and 112. Molds finished on the circular trackways 106 and 107 are transferred to the common conveyor leg 110, for example at the station 113, and cast a common pouring spout 71. At 114, the conveyor divides by any suitable switching mechanism and some of the molds may be directed in the direction of the arrow 115 and others in the direction of the arrow 116 whence they are conveyed to the legs 111 and 112 of the conveyor and ultimately broken up upon the grates 117 and 118.

The forms of my invention illustrated in Figs. 10, 13 and 14 effect a return to the circulating system of only the follow boards upon which the molds are transported while being poured and cooled; and have the advantage that the cooling conveyor, being doubled back upon itself in U-form, covers the minimum length of floor space. Obviously the method of these forms may be practiced with a cooling conveyor of rectilinear

form and the follow boards discharged at the end of the line may be transported by other means back to the station 17 or its equivalent on the circular trackway.

- 5 The two hoppers of the form of Fig. 1 or of Fig. 10 may be fed by sand from a common hopper, and the four hoppers of the forms of Figs. 13 and 14 may be fed from a common hopper to simplify the apparatus supplying the sand to the system. Any suitable construction of sand handling apparatus for this purpose may be used. One form is illustrated and described in my copending application, Serial No. 682,137, filed July 25, 1933, and reference may be had thereto for a description thereof.

My invention is not limited to the exact details of construction shown and described. Many changes and modifications may be made therein within the scope and spirit of my invention without sacrificing its advantages.

I claim:

1. The method of making castings which includes moving a plurality of molding units each including a pattern and a plurality of flask elements through a succession of stations from a starting point, performing on each unit different mold-making operations at the different stations including removing the pattern from the flask elements and leaving a completed mold, returning the pattern on a closed path of movement to the starting point, continuing movement of the mold and a flask element on a branch path of movement, pouring molten metal into the mold, moving the poured mold and said flask element over a cooling portion of the branch path of movement, causing the metal to solidify, continuing movement of the mold and flask element to the starting point, breaking up the mold and removing the casting, the molds and said flask elements being moved at the same predetermined rate over the cooling portion of the branch path and the patterns and flask elements moving independently on the closed path and on other portions of the branch path.

2. The method of making castings which includes moving a plurality of flasks and patterns

through a succession of stations from a starting point, performing on each flask and pattern different mold-making operations at the different stations including removing the pattern from the flask and leaving a mold therein, returning the pattern on a closed path of movement to the starting point, continuing movement of the mold and flask on a branch path of movement, pouring molten metal into the mold, moving the poured mold and flask over a cooling portion of the branch path of movement, causing the metal to solidify, continuing movement of the mold and flask to the starting point, breaking up the mold and removing the casting, the flasks being moved at the same predetermined rate over the cooling portion of the branch path and the patterns and flasks moving independently on the closed path and on other portions of the branch path.

3. The method of making castings which includes moving a plurality of patterns and snap-flasks including a mold supporting element through a succession of stations from a starting point, performing on each flask different mold-making operations at the different stations including removing the patterns from the flasks and removing the flasks from the mold leaving the mold on the mold supporting element, returning the patterns and flask on a closed path of movement to the starting point, continuing movement of the mold and mold supporting element on a branch path of movement, pouring molten metal in the mold, moving the poured mold and supporting element over a cooling portion of the branch path of movement, causing the metal to solidify, continuing movement of the mold and supporting element to the starting point, breaking up the mold and removing the casting, the mold and mold supporting element being moved at the same predetermined rate over the cooling portion of the branch path and the mold and supporting element moving independently on other portions of the branch path and the flasks and associated patterns moving independently on the closed path.

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