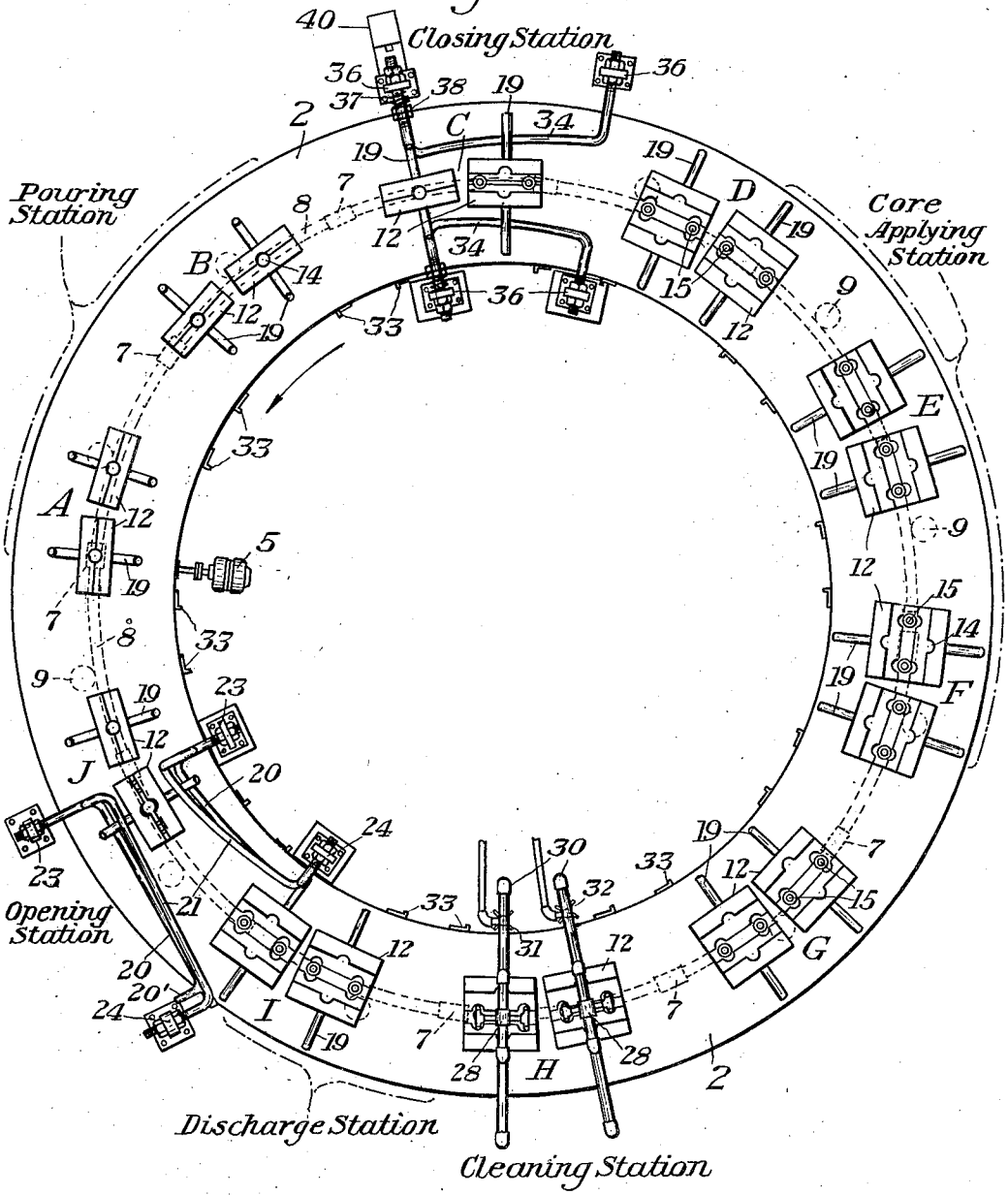
April 1, 1930. C. D. PETTIS 1,752,308

APPARATUS FOR MOLDING

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Fig. 1.



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APPARATUS FOR MOLDING

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Fig. 2.

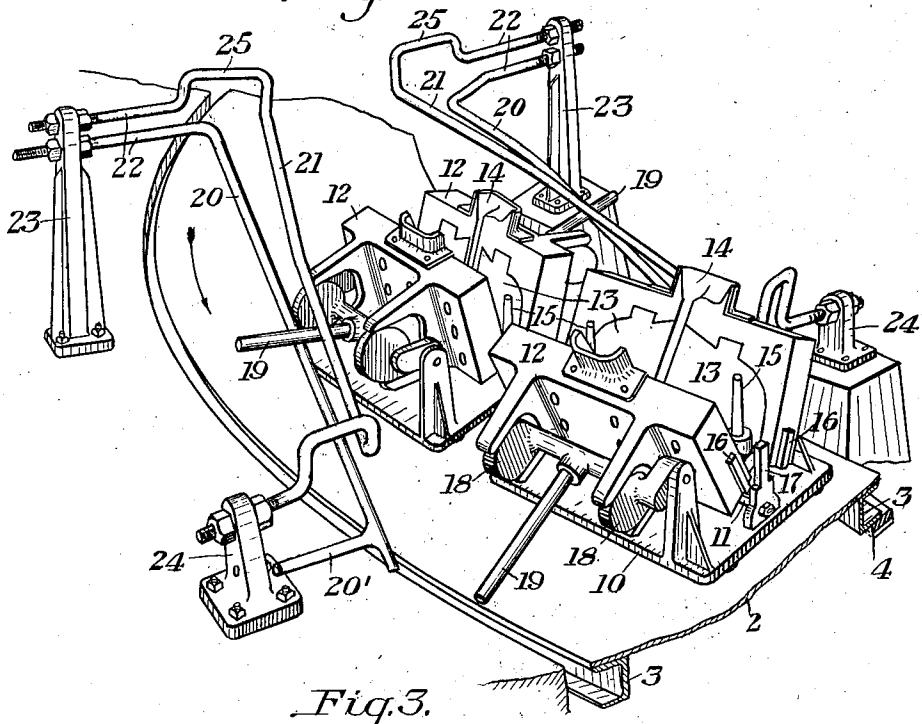
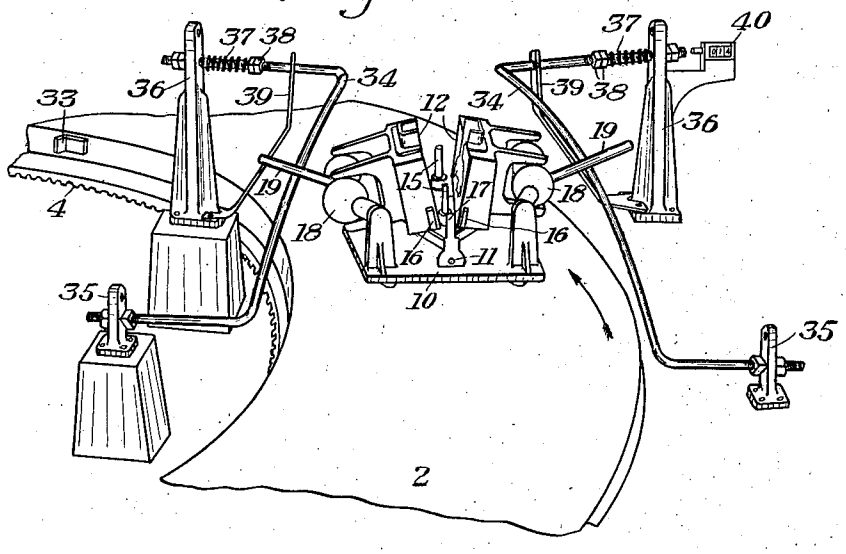


Fig. 3.



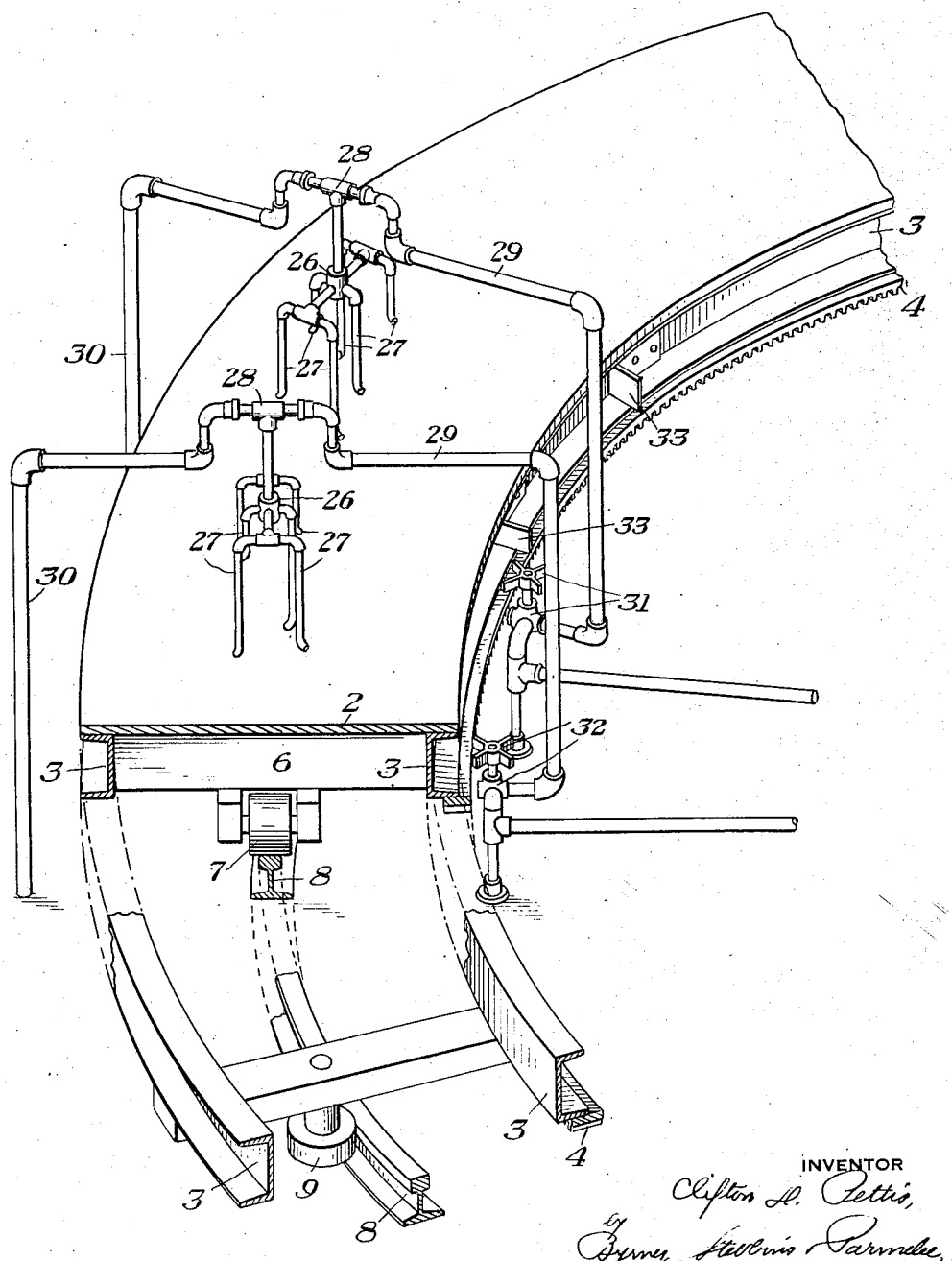
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APPARATUS FOR MOLDING

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Fig. 4.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR MOLDING

Application filed October 17, 1925. Serial No. 63,032.

The present invention relates broadly to the art of metal working, and more particularly as applicable to the production of metal castings in large quantities, the utility of the invention not being limited to any particular kind or composition of casting.

In the standard foundry practice of making castings it is customary to utilize so called sand molds. These molds are either made up and placed directly on the foundry floor over a comparatively large area and the molten metal carried to them, or they are secured to a flexible carrier which is driven to bring the molds successively to predetermined stations. Both of these methods are open to the objection that each mold is capable of a single use only, thereby requiring a rehandling and remolding of the sand for each new casting. This necessarily increases both the equipment and number of men required, and correspondingly reduces the possible production.

With the perfection of so called repetition or permanent molds, it has been possible to effect the production of castings under much more favorable conditions, and the present invention has for one of its objects the mounting and operation of molds more particularly of this general type in such manner that not only is uniformity as to successive castings insured, but that the number of castings per unit of equipment and employee is greatly increased.

In the accompanying drawings there is shown for purposes of illustration only, a preferred embodiment of the present invention, it being understood that the drawings do not define the limits of my invention, as changes in the construction and operation disclosed therein may be made without departing from the spirit of the invention or scope of my broader claims.

In the drawings:

Figure 1 is a diagrammatic top plan view illustrating one form of apparatus constructed in accordance with the present invention;

Figure 2 is a perspective view on an enlarged scale illustrating more particularly that portion of the apparatus adapted for automatically opening the molds to permit removal of the finished castings;

Figure 3 is a view similar to Figure 2 illustrating that portion of the apparatus for automatically closing the molds, and

Figure 4 is a perspective view of the portion of the apparatus which effects cleaning of the molds during their travel.

In carrying out the present invention there may be provided an endless carrier preferably in the form of an annulus 2 forming a turn table herein illustrated as carrying ten pairs of molds designated respectively A to J both inclusive. By arranging the molds in pairs in the general manner indicated diagrammatically in Figure 1, the capacity of the table is increased, an operator's platform is provided between adjacent pairs of molds, and the operation of the apparatus is facilitated as will be hereinafter more fully apparent.

The table 2 is conveniently formed by securing substantially flat plate sections to side beams 3, the inner of which has a rack 4 projecting downwardly therefrom. This rack provides convenient means for effecting rotation of the table at the desired speed through the medium of a motor 5. For strengthening the table, and providing means for supporting the same in operative position, it is formed with a sub-frame 6 having mounted thereon at equidistant points a plurality of track wheels 7 traveling on a track 8. Cooperating with the track wheels is a plurality of centering rollers 9 engaging the outside of the track and preventing lateral movement of the table.

While the present invention is adaptable for use with repetition molds of any desired construction, there are shown herein molds of the general character disclosed and claimed in my Patent No. 1,542,640, granted June 16, 1925. Each of these molds comprises generally a suitable base 10 carrying a pivot rod 11 on which are supported mold halves 12. These halves are preferably of similar construction, each carrying a plurality of matrix sections 13 cooperating with a centrally disposed pouring gate 14, and adapted for the simultaneous production of a plu-

rality of castings. The mold halves are adapted to close about core pins 15 projecting upwardly between the halves, and adapted to receive and support either one piece or sectional cores of the contour required for cored castings. It is obvious that when solid castings are being formed, the core pins may be omitted entirely and the matrix sections changed in contour as required. Each mold half may also be provided with a stop shoulder 16 adapted to cooperate in closed position with a centering stop 17 limiting the maximum closing movement of any mold half.

The closing and opening means for the molds while it may be of a wide variety of constructions, is conveniently of the type shown and claimed in my Patent No. 1,542,642, granted June 16, 1925. This comprises generally cams or eccentrics 18 arranged in pairs, and rotatable by means of handles 19 about centers preferably located outside of the periphery of the cams or eccentrics. By reason of such a construction, movement of the handles upwardly will gradually close the mold halves and effect substantial locking in closed position, while movement in the opposite direction will open the molds.

I have found that very desirable results are produced in repetition molding where successive pours in the same mold occur at substantially definite time intervals whereby successive pours are made with the molds within the same average temperature range. Such timing insures uniformity as to the action of the molds on the molten metal. It is also desirable that the molds should be opened in general timed relation to the pouring operation whereby successive castings are uniformly cooled and solidified, such opening of the molds breaking the contact between the molds and castings and permitting removal of the castings, the castings being detached by and temporarily supported on the core pins during the mold opening operation.

The foregoing operations, as well as cleaning the molds, applying the cores when required and closing of the molds may be satisfactorily carried out by rotating the table at a definite predetermined speed, and then performing successive operations on the molds as they reach different stations. Accordingly, the rotation of the table is adapted to bring the pairs of molds successively to a pouring station, an opening station, a discharge station, a cleaning station, a core applying station and a closing station.

At the pouring station, as indicated in Figure 1, the molds are in closed position adapted to receive molten metal, the pairs of molds A and B being shown at this station. Located conveniently to this station is a source of molten metal, not shown, whereby an operator with a pouring ladle may step onto the table between the pairs of molds and pour first the trailing mold of the pair A and then the leading mold of the pair B, the table rotating in the direction indicated by the arrow. During this time the pair of molds C will be coming into position at the pouring station. As the first operator steps from the table at the conclusion of his pouring operation, a second operator will step into position between the pairs of molds B and C, and commence pouring first in the trailing mold of the pair B and thereafter in the leading mold of pair C. This will continue as the table rotates, each mold receiving its molten metal at substantially the same point in the rotation of the table. This general point may be moved forwardly or backwardly with respect to the direction of rotation by arbitrarily changing the position at which the pouring is commenced, the pouring station being long enough to permit such adjustment in accordance with the nature of the metal being utilized and the character and size of the castings. Experience has shown that capable operators will perform successive pouring steps in almost exactly the same time intervals, so that if the pouring is initially started at the same point, substantial uniformity is obtained. If desired, the ladles containing the molten metal may be supported in known manner by an overhead track.

As the filled molds leave the pouring station, they come to the opening station at which means is provided for effecting the gradual automatic opening of the molds. This means comprises a pair of lower rods 20 and a pair of upper rods 21. Both pairs of rods have their upper ends 22 turned outwardly with respect to the table 2 and adjustably secured in the upper ends of standards 23. These rods are all inclined generally downwardly in the direction of rotation of the table, and diverge outwardly. At their lower ends the rods 21 are adjustably secured in standards 24, while the lower ends of the rods 20, which terminate substantially in the plane of the table 2 are left free for a limited vertical movement, the purpose of which will hereinafter be more fully pointed out, the position of these lower ends being defined by stop projections 20'. Adjacent both their upper and lower ends the rods 21 are formed with offsets 25 so dimensioned as to permit the free entry of the handles 19 between the rods, and pasasge therefrom.

Due to the construction described, the rotation of the table will bring the mold handles into position between the rods in substantially timed relation to the pouring operation. The upper rods will engage the inner sides of the handles, and gradually swing the same downwardly as required for opening the molds, while the lower rods will tend to engage the outer sides of the handles and

prevent sudden dropping thereof and consequent undue jarring of the molds or undue rapidity in the mold opening such as might injure the castings.

It is desirable that the apparatus shall be as nearly "foolproof" in operation as possible, and it is with this in mind that the lower ends of the rods 20 are left free. It is possible that either by accident or intention a mold is opened at the pouring station, and accidentally left open during travel to the opening station. If the lower rods were rigidly secured at their lower ends, either the rods or the handles would necessarily be damaged. By permitting these ends of the rods to float, however, they may move upwardly freely during the passage of the handles below the same, thus obviating possibility of damage to the apparatus.

As the molds leave the opening station, they enter the discharge station adjacent which stands an operator who by the use of tongs or the like may readily remove the castings, which are supported at this time on the pins where cores are utilized, or directly by the molds where cores are not used.

Following the discharge station is a cleaning station at which means is provided for effectively cleaning the molds of any material which may remain between the mold halves. This cleaning means may comprise a pair of cleaning heads 26 illustrated in detail in Figure 4. Each cleaning head may consist of a plurality of discharge nozzles 27 terminating in different planes, and discharging at different angles whereby all parts of the mold cavities are subjected to a blast of a cleaning fluid, such as air. The heads are preferably adjustably supported by suitable fittings 28 in the fluid supply pipes 29. By reason of this construction, in the event the heads are accidentally engaged by any portion of the molds they may readily swing upwardly to inoperative position about the pipes 29 as an axis, thereby preventing possibility of damage to the apparatus. The outer ends 30 of these pipes may be extended downwardly and supported in any desired manner to maintain the cleaning heads in the desired position. At their opposite ends the pipes may be provided with control valves 31 and 32, respectively, adapted upon operation to first turn on and then off the supply of fluid to the cleaning heads. These valves are adapted to be automatically operated upon rotation of the table whereby cleaning fluid issues from the nozzles only when they are in cooperative relation to the molds. This is accomplished by providing the inner beam 3 with pairs of operating projections 33 shaped to cooperate during the rotation of the table with the valve handles, whereby engagement between one projection and the valve handle will turn on the fluid, while the engagement of the succeeding projection will turn it off.

With the parts in position shown in Figure 1, the cleaning heads will both be discharging fluid, the heads being in cooperative relation to the molds of the pair H. This delivery of fluid from both heads will continue until the projection substantially opposite the trailing end of the second mold of the pair H engages the valve 31, whereupon passage of fluid from the head controlled thereby will cease, this mold passing into cooperative relation to the head controlled by valve 32. As the same projection reaches valve 32, fluid will be cut off from this head, both heads at this time being substantially in the space between the pairs of molds H and I. Continued rotation of the table will bring the leading mold of the pair I into cooperative relation to the head controlled by valve 31, and at the same time bring the other projection 33 of this pair into engagement with the valve 31 to open the same. Thereafter as the leading mold moves into position to embrace the head controlled by valve 32 and the trailing mold into position to embrace the head controlled by valve 31, said projection will open valve 32. This condition corresponds with that shown in Figure 1, and will continue until the projection substantially opposite the trailing end of the second mold of the pair I again successively closes the valves. In this manner the pressure supply of cooling fluid is conserved, but always rendered automatically available when required.

As the molds leave the cleaning station they are ready for the positioning of cores therein or on the pins 15, if cores are required, this operation being effected at the core applying station, at which station they may also be inspected to make certain that all parts are in proper operating condition.

Upon passing from the core applying station the molds come to the closing station at which there is provided means for automatically closing the molds. This means comprises rods 34 illustrated in detail in Figure 3, these rods being inclined and converged in the opposite manner to that of the rods 20 and 21. At their lower ends the rods 34 are adjustably secured in standards 35 while at their upper ends they are mounted in standards 36 for sliding movement in opposition to springs 37 the initial load on which may be adjustably varied by means of nuts 38. Additional supporting brackets 39 may be provided for the upper ends of these rods. It will be understood that the lower ends of the rods terminate adjacent and substantially in the plane of the table 2, whereby the handles 19 readily pass thereover during rotation of the table. As rotation continues, the handles are gradually swung upwardly and inwardly to effect closing of the molds. Due to the practical

difficulties of having all of the handles occupy the same relative positions to the molds when closed, the upper ends of the rods 34 are normally slightly closer than the distance between handles 19, the springs permitting yielding of the rods to accommodate the handles while exerting a pressure sufficient to effect the desired closing of the molds and locking in closed position.

At the present time it is customary to pay workmen on the piece basis for castings produced, and where endless carriers are utilized, count is normally kept by the use of brass checks placed on the molds by the workmen, and collected by a special operator provided for that purpose. In accordance with the present invention, count may be automatically kept by providing a counter 40 of any desired construction adapted to be operated by the movement of one of the rods 34. This insures absolute certainty of count and makes possible a reduction in the number of operators required. It will be apparent that the present apparatus lends itself to the use of various forms of automatic counting mechanisms either cooperating with the rods 34 or directly with the handles 19 on which may be placed projections of different lengths cooperating with different counters as may be desirable when a number of different types of castings are being made on one table at the same time.

The closed molds are ready for the next pouring operation, and as they leave the closing means they come to the pouring station where the operations previously referred to are repeated.

It will be apparent that any desired number of molds may be provided on one table, these molds being of any preferred construction and mounted as desired. In operation, however, the repetition casting in the same molds tends to bring these molds up to a definite temperature range. By making successive pours while the molds are within this temperature range, uniformity is insured as between successive castings from the same molds. Thus, certain advantages of the present invention arise from the provision of an installation comprising a plurality of repetition molds movable successively to a plurality of stations at definite time intervals, thereby establishing a general time relationship between successive operations.

Other advantages of the invention arise from the provision of means for automatically opening and closing the molds, as well as the means for insuring cleaning of the molds preparatory to the application of cores, where necessary, and prior to a succeeding pouring operation.

Still other advantages arise from the construction of the mold opening, cleaning and closing means making their operation substantially "foolproof", and from the use of means automatically operable for keeping count of the number of castings produced during any given run of the apparatus.

I claim:

1. In a molding apparatus, a movable carrier, a plurality of molds thereon movable to open and closed positions, fluid pressure cleaning means cooperating with said carrier for cleaning the molds while in open position, and a movable mounting for said cleaning means, substantially as described.

2. In a molding apparatus, a movable carrier, a plurality of groups of molds thereon movable to open and closed positions, a group of cleaning means cooperating with said carrier for cleaning the molds while in open position, a movable mounting for each cleaning means of the group, rigidly mounted control valves for the cleaning means, and means on said carrier and below the molds adapted to render the individual cleaning means of the group successively and progressively operative and inoperative once for each mold group, substantially as described.

3. In a molding apparatus, a carrier, a plurality of molds thereon arranged in groups to provide an operator's platform between adjacent groups of molds, means for operating said carrier, a plurality of cleaning heads cooperating with said carrier and adapted to simultaneously clean the molds of a predetermined group, a movable mounting for each cleaning head, and means for rendering said cleaning heads operative and inoperative once for each mold group, said means including a rigidly mounted valve for each cleaning head, substantially as described.

4. In a molding apparatus, a carrier, a plurality of molds thereon arranged in groups to provide an operator's platform between adjacent groups of molds, means for operating said carrier, a plurality of cleaning heads cooperating with said carrier and adapted to clean said molds, means projecting laterally from the carrier below the plane of the molds for rendering said cleaning heads operative and inoperative in succession with each head in operation during the passage of an entire group, and valves rigidly mounted in the path of said projecting means, substantially as described.

5. In a molding apparatus, a movable carrier, a plurality of molds thereon, and cleaning means cooperating with said carrier, said cleaning means being mounted for movement to inoperative position if engaged by one of said molds, substantially as described.

6. In a molding apparatus, a movable carrier, a plurality of openable molds thereon, and inclined means yielding on opposite sides of the molds cooperating with said carrier during movement thereof for periodically opening said molds, substantially as described.

7. In a molding apparatus, a movable carrier, a plurality of molds thereon operable about horizontal axes, and means on opposite sides of the molds cooperating with said carrier during movement thereof for periodically opening said molds and controlling the rate of opening movement, substantially as described.

8. In a molding apparatus, a movable carrier, a plurality of molds thereon operable about horizontal axes, and means on opposite sides of the molds cooperating with said carrier during movement thereof for periodically closing said molds, substantially as described.

9. In a molding apparatus, a movable carrier, a plurality of openable molds thereon, and yielding means cooperating with said carrier during movement thereof and disposed on opposite sides thereof for successively closing said molds, substantially as described.

10. In a molding apparatus, a movable carrier, a plurality of openable molds thereon, and means cooperating with said carrier during movement thereof for periodically opening said molds, said means comprising spaced rods on opposite sides of said carrier, substantially as described.

11. In a molding apparatus, a movable carrier, a plurality of openable molds thereon, and means cooperating with said carrier during movement thereof for periodically opening said molds, said means comprising spaced rods on opposite sides of said carrier, certain of said rods being supported for floating movement, substantially as described.

12. In a molding apparatus, a movable carrier, a plurality of openable molds thereon, yielding means cooperating with said carrier during movement thereof for successively closing said molds, and counting means cooperating with said yielding means, substantially as described.

13. In a molding apparatus, a carrier, a plurality of molds mounted thereon operable about horizontal axes, means for moving said carrier to successively bring the molds to a pouring station, an opening station, and a closing station, means at the opening station for swinging the mold parts downwardly for opening the molds, and means at the closing station for swinging the mold parts upwardly for closing said molds, substantially as described.

14. In a molding apparatus, a carrier, a plurality of molds mounted thereon operable about horizontal axes, means for moving said carrier to successively bring the molds to a pouring station, an opening station, and a closing station, means at the opening station for swinging the mold parts downwardly for opening the molds, means at the closing station for swinging the mold parts upwardly for closing said molds, and means intermediate the opening and closing stations for cleaning the open molds, substantially as described.

15. In a molding apparatus, a rotating carrier, a plurality of molds thereon, having laterally projecting opening and closing means, horizontal axes about which said molds are openable, and means cooperating with said laterally projecting means for opening and closing said molds.

16. In a molding apparatus, a rotating carrier, a plurality of molds thereon, having laterally projecting opening and closing means, horizontal axes about which said molds are openable, and means cooperating with said laterally projecting means for opening and closing said molds, said last mentioned means comprising inclined operating rods.

17. In a molding apparatus, a carrier, a plurality of molds mounted thereon in spaced groups to provide an operator's platform between adjacent groups, and means for moving said carrier, said molds each being openable upon axes substantially tangent to the path of movement of the molds to maintain the operator's platforms of substantially constant width, substantially as described.

In testimony whereof I have hereunto set my hand.

CLIFTON D. PETTIS.