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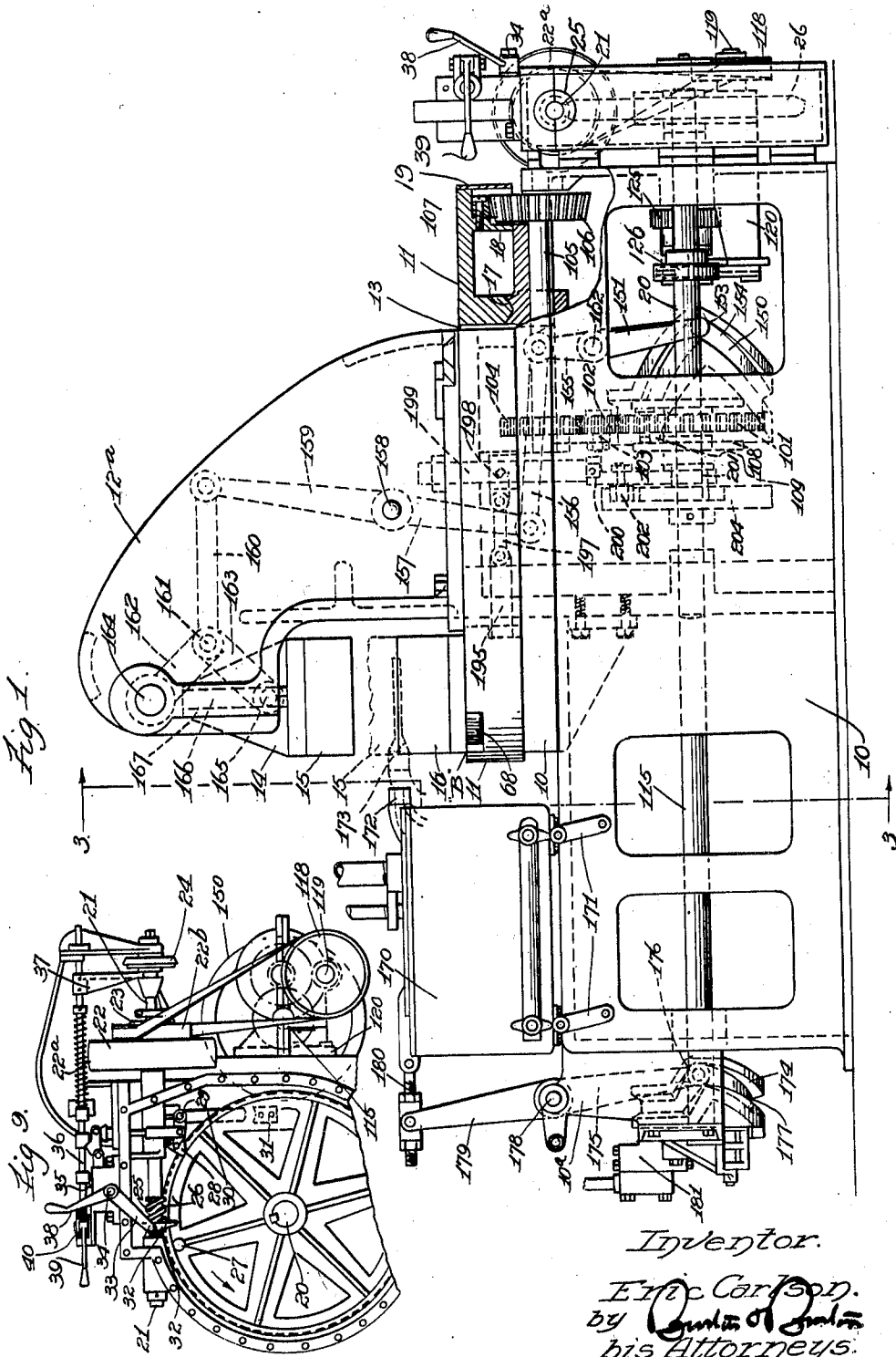
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AUTOMATIC DIE CASTING MACHINE

Filed June 28, 1928

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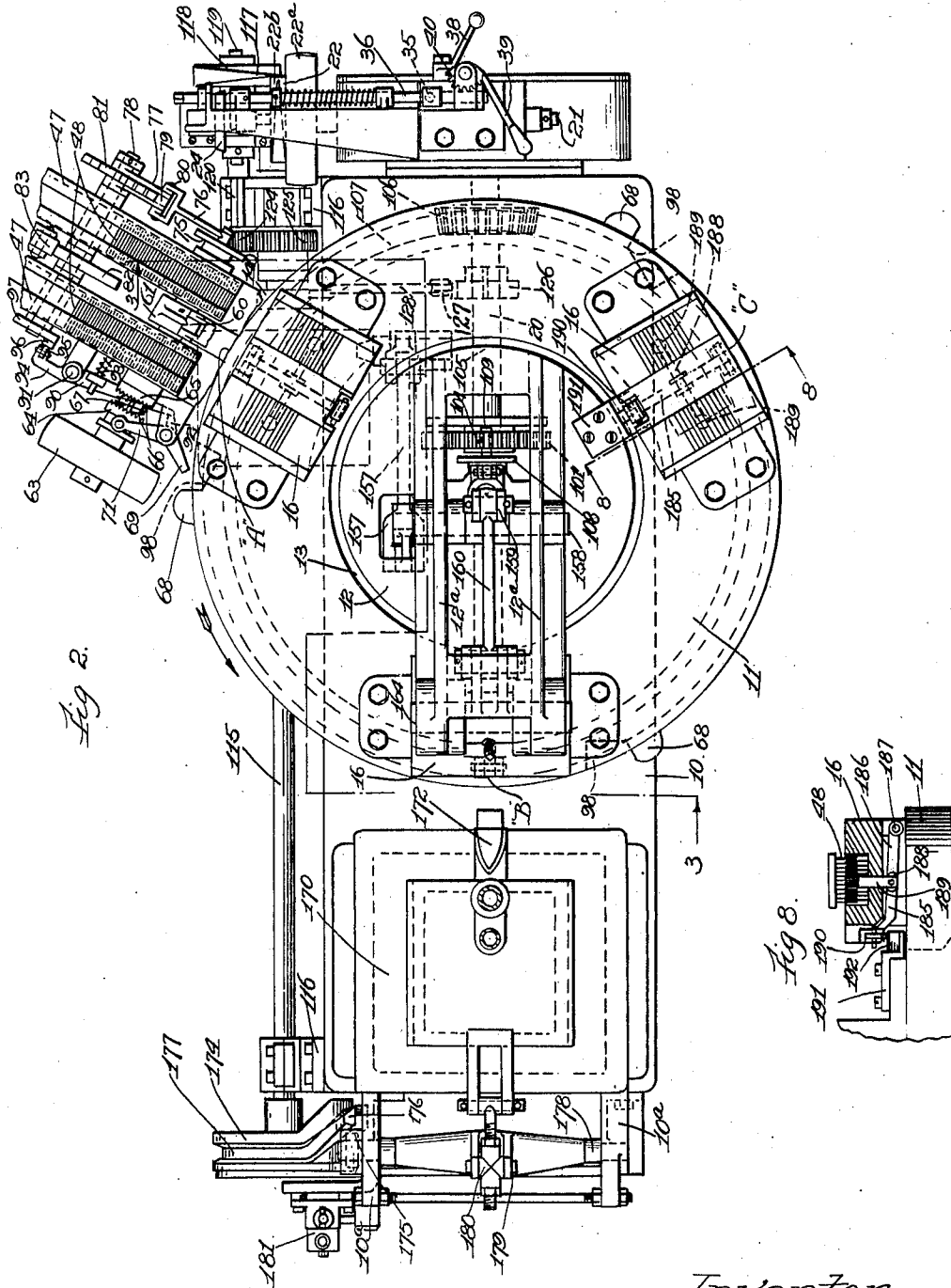
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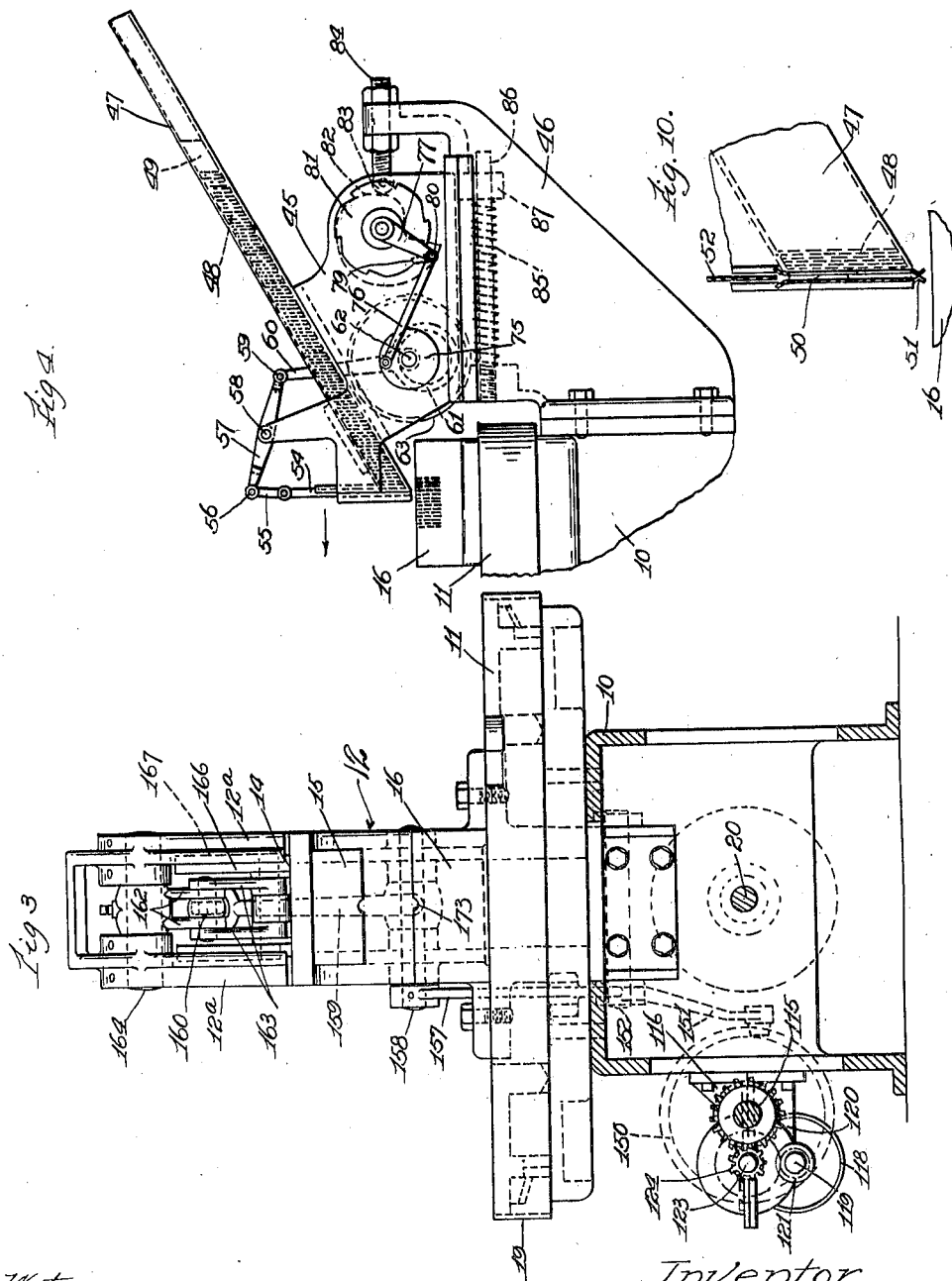
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AUTOMATIC DIE CASTING MACHINE

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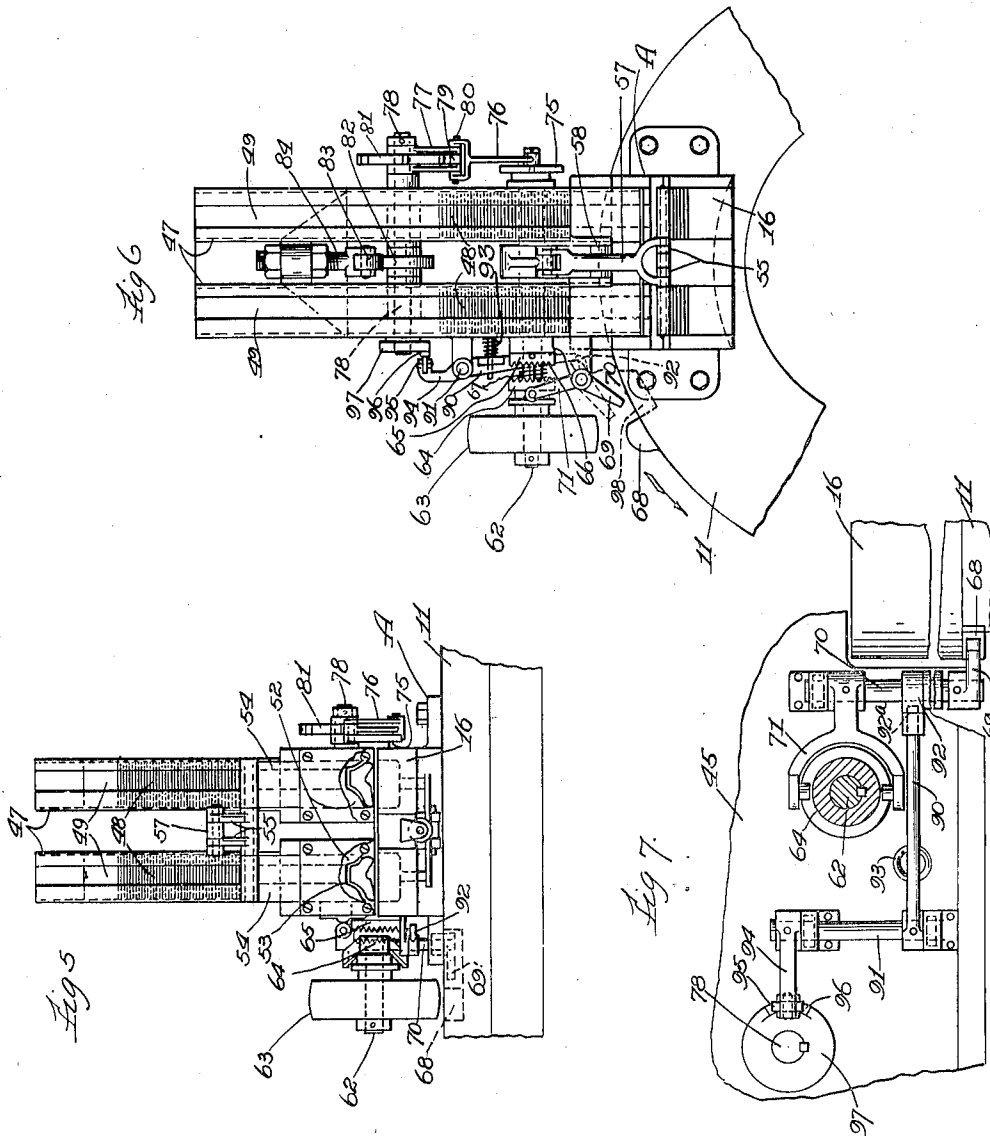
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AUTOMATIC DIE CASTING MACHINE

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5 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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AUTOMATIC DIE-CASTING MACHINE

Application filed June 28, 1928. Serial No. 289,034.

The present invention relates to a power actuated die casting machine, and has for its principal object to provide a machine of improved construction automatically actuated and manually controlled. The machine proper, is provided with mechanism for automatically loading in a die member, parts that are to be cast integrally in a die cast object; the die member with the parts loaded therein then being conveyed in timed relation for assembly with the other die member to form a complete mold; co-operating in timed relation with the mold is a molten metal reservoir arranged for charging the mold under pneumatic pressure with automatically controlled mechanism for cutting off the charge and separating the mold at a timed predetermined period; the die cast object remaining in the lower die member which is then conveyed to an automatic mechanism for ejecting the object from the die member and again repeating the cycle.

A further object is to provide a machine that is positive and efficient in operation in which manual labor is practically entirely dispensed with. Another object of my invention is to so construct a unitary machine to provide substantially a continuous operation of loading parts into a die member, charging the mold and ejecting the die cast object therefrom; these operations being entirely automatic, but under manual control. It consists in certain features and elements of construction, in combination, herein shown and described, as indicated by the claims.

In the drawings:

Figure 1 is a side elevation of a complete machine embodying the present invention, a portion of the main frame being broken away to show the manner of supporting and driving the rotative feeding table.

Figure 2 is a plan view of the machine showing the automatic loading mechanism broken away from the machine proper, but in relative alignment with one of the lower die members mounted on the rotary feeding table.

Figure 3 is a vertical staggered transverse section through the machine, taken as indicated at line 3—3 on Figure 1.

Figure 4 is a fragmentary detail view in side elevation of the automatic loading mechanism as supported on the main frame.

Figure 5 is a front elevation of the loading mechanism in operating position for loading a die member on the rotary feeding table.

Figure 6 is a plan view of the loading mechanism shown in Figure 5.

Figure 7 is a fragmentary detail view in side elevation of the driving connections for the loading mechanism, with the driving pulley broken away.

Figure 8 is a detail view taken through a lower die member illustrating an automatic ejecting mechanism for ejecting a die cast object from the lower die member.

Figure 9 is a view in side elevation of the driving mechanism at the rear end of the machine including the automatic starting and stopping devices.

Figure 10 is a sectional detail view of the lower end of a magazine of the loading mechanism.

Figure 11 is a staggered vertical fragmentary section showing in side elevation the automatic driving and tripping mechanism for controlling the movement of the top die member and the molten metal charging pot, and turn table.

Figure 12 is a transverse section through the automatic tripping mechanism taken substantially as indicated at line 12—12 on Figure 11.

Figure 13 is an axial section through a portion of the tripping mechanism taken at line 13—13 on Figure 12.

Figure 14 is a section at the line 14—14 on Figure 11.

The machine as illustrated in the drawings comprises a main base frame, 10, upon which is mounted a rotary feeding table, 11, having drive connection as will hereinafter be described. An upright frame structure, 12, is supported on the main frame and extends upwardly and centrally through a circular opening, 13 (see Fig. 2), in the rotary table, 11. This upright frame includes a pair of laterally spaced curved overhanging arms, 12*, which provide guidance and support to a vertically reciprocating top die-carrying

head, 14, to which is secured the top die member, 15, which co-operates with any of the three lower die members, 16 (see Figs. 1, 2, 4 and 6), bolted to the top of the rotary feeding table, 11, and spaced thereon at equal angular distances from each other. These lower die members are arranged to be positioned for alternate co-operation with the upper die member, 15, to form a complete mold. The rotary feeding table, 11, has bearing support on the main frame, 10, and is guided in a true rotary path by the circular V-shaped guide-ways, 17 (see Fig. 11), adjacent the opening, 13, while the outer portion of said table is supported by the vertical web, 18, adjacent the outer edge and bearing on the flat upper surface of the main frame, as illustrated in Figures 1, 3 and 11. A vertically disposed guard plate, 19, is secured to the outer periphery of the table, 11, and extends completely therearound.

A longitudinally extending drive shaft, 20, is disposed centrally and journaled in the rearward portion of the main frame, 10, and is operatively connected to driving mechanism for rotating the shaft and automatically stopping the same at each complete revolution. This driving mechanism is identical in all respects with that shown in my co-pending joint application with Walter O. Will, Serial No. 85,165, filed February 1, 1926, and a detailed description of the operating members is believed unnecessary except to state in general the function and manner of operation which is as follows:

A transversely disposed power shaft, 21 (see Figs. 1, 2 and 11), is journaled at the rear end of the main frame, 10, having a double pulley unit, 22, loosely mounted thereon. Said pulley unit includes a driven pulley, 22^a, adapted to be driven by a belt (not shown) from any suitable power source, while the adjacent pulley, 22^b, of said unit is adapted to provide driving connections to the mechanism for actuating the top die-carrying head and the metal pot in timed relation, as will hereinafter be described. A friction clutch, 23, is mounted on said shaft adjacent the pulley, 22^b, and a brake, 24, on the shaft outwardly of said clutch; the clutch and brake being co-operatively arranged so that when the clutch is normally engaged with the pulley for driving said shaft, the brake, 24, is in inoperative position, or when said clutch is disengaged from the pulley the brake is engaged to maintain said shaft in a stationary position. A worm, 25, (see Fig. 9), is mounted on the shaft, 21, meshed with a worm gear, 26, secured on the rearward end of the drive shaft, 20. The drive shaft, 20, is driven intermittently by the worm gear, 26 (see Fig. 1); that is, it is rotated one complete revolution and then stopped, during which period certain operating mechanisms are actuated. The drive connection to

the shaft, 20, is disengaged automatically so that the shaft becomes arrested after it completes a revolution; this mechanism includes a tripping lug, 27, on the worm gear 26 which engages an arm, 28, of a bell crank pivoted at 29, which throws a latch member, 30, into a downward position in a path to be encountered by an abutment, 31, located on said worm wheel a predetermined distance behind the lug, 27. After the lug, 27, has engaged the arm, 28, the worm wheel continues to rotate through an arc of a few degrees until it strikes a trip finger, 32, on the lever, 33, pivoted at 34. Through the movement of a lever, 33, a pin, 35, is disengaged from a shifting rod, 36, which is spring tensioned for disengaging the clutch, 23, and actuating the brake, 24, by a shifting fork, 37, whereby to stop the rotation of the shafts, 20 and 21, almost instantaneously. The trip finger, 32, and lever, 33, are positioned so as to be operated by lug, 27, to stop the rotation of shaft, 21, at a time just before the latch, 30, encounters the abutment, 31.

The lever, 33, is connected with a control handle, 38, so that the engagement or disengagement of the clutch and brake for any reason whatever may be manually operated. A reset lever, 39, is mounted on the frame and has a segment, 40, meshed with a rack 40^a, provided on the end of rod, 36, whereby to draw the same rearwardly under spring tension to disengage the brake, 24, and engage the clutch, 23, with the pulley, 22^b, for driving the shafts, 21 and 20, respectively. As the rod, 36, is pulled rearwardly by the operation of the reset lever, it is again engaged by the pin, 35, and held in locked driving position to again repeat the cycle. The latch, 30, with its co-operating abutment, 31, serves as a safety device to prevent the worm wheel, 26, from being rotated through more than one revolution at one driving operation. Ordinarily the latch is in a position about to engage the abutment when the trip lug, 27, throws the clutch out and engages the brake to stop the mechanism so that the latch does not encounter the abutment, 31. The purpose of this latch, however, is to obviate possible damage to the various mechanisms due to the failure of the drive shaft, 20, to stop intermittently after each revolution which may possibly result from wear and tear on the clutch and brake mechanism. It will be understood that after the mechanism is stopped, the resetting or engaging of the clutch again by the operator also resets the bell crank lever with the latch, 30, out of the path of the abutment, 31, to permit the worm wheel, 26, to again be rotated.

The rotary table, 11, with the three lower die members, 16, secured rigidly thereto, is rotated intermittently through the driving mechanism above described in the direction indicated by the arrow in Figure 2. It is to

be understood that each time the drive shaft, 20, is rotated through one revolution the rotary feed table, 11, is rotated one-third of a revolution so as to align each of the three lower die members in their respective operating positions indicated at "A", "B" and "C"; the period of time between movements of the feed table depending entirely upon the work being performed on the lower die members at these positions before the operator again sets the feeding table in motion. In connection with the drawings it will be clear that each of the lower die members alternately go through three different stages of operation, viz, (1) the loading operation indicated at "A", in Figure 2 at which the lower die member is loaded with the members that are to be die cast in an integral unit; (2) the die casting position indicated at "B", at front central position below and in direct vertical alignment with the top die member, 15, to which position the loaded die members, 16, are transported from the loading position, "A"; and (3) the "knock-out" and "clean-out" positions indicated at "C", to which final position the lower die members, 16, are conveyed after the casting operation at "B". The lower die members at "C" are then cleansed and conveyed to position "A" to again repeat the cycle.

The machine as illustrated in the drawings, is especially adaptable for assembling and securing in a fixed relation, a number of plates of an electrical condenser, die casting the plate-retaining metal about a corresponding portion of all the plates for securing them together as an integral unit. The die members, 15 and 16, forming the complete mold in which these plates are inserted are of a conventional design similar to that disclosed in my Patent No. 1,617,577, issued February 15, 1927. Of course it is to be understood that these die members are provided with the number and shape of openings corresponding to the type of condenser required. The rotary feeding table, 11, is provided with timed locking means, hereinafter described, for engaging the table at the exact interval and securing it in fixed position so as to positively align the lower die members at the respective operating positions "A", "B" and "C".

Referring now to the loading mechanism for the die members, 16, indicated at position "A", it will be seen that the loading mechanism proper is off-set laterally from the rotary table. The entire loading mechanism is carried in a frame, 45 (see Fig. 4), slidable horizontally and radially with respect to said rotary table in suitable guides formed in a frame bracket, 46, extending outwardly from and bolted to the main frame, 10. For production purposes, the die members are formed so that two complete units may be produced at one time. Consequently the

loading mechanism is also of a duplex type, including a pair of magazines, 47 (see Figs. 5 and 6), carrying a supply of the condenser plates, 48; these magazines are laterally spaced on the frame, 45, extending in a rearwardly inclined position. The function of the loading mechanism consists in thrusting the plates, 48, one-by-one, in the openings provided in the die members, 16, and is accomplished by means, moving the entire loading mechanism forwardly and radially with respect to said table in a step-by-step manner so that the plates are fed to the successive openings in the die members. This mechanism is so arranged that when the last plate is thrust into the die member, the mechanism is automatically stopped and returned to its initial retracted position. As may be seen from Figure 4, the loading mechanism has about half loaded the die member with the plates, 48. The plates in the magazines are at all times vertically disposed due to the inclination of said magazine, together with the co-operating weight, 49, at the upper end thereof, tending to force the plates downwardly one-by-one into a compartment, 50 at the lower end of said magazine; the compartments being a fairly close fit for only one plate; the lower ends of the side walls of said compartments being slightly sprung inwardly at 51 (see Fig. 10), to provide sufficient friction to hold the plate therein in position, so as to be struck by a vertically reciprocating plunger for driving the plate into the aligned opening in the die member, 16. The plungers for each of the magazines include an impinging plate, 52, (see Figure 10), somewhat thinner than the plates, 48, so that it will pass freely between the walls of the compartment, 50. The lower edge of the plate, 52, is cut at 53, to conform to the general contour of the upper edge of said plates, 48 (see Fig. 5), so that the thrust may be equally distributed over a relatively wide area.

The reciprocating plunger plates, 52, are secured to the lower ends of supporting arms, 54 (see Fig. 4), which are pivotally supported at their upper ends to toggle links, 55, which are also pivoted at 56, on the opposite sides of the forked end of a balance lever, 57, fulcrumed at 58, at its middle to the sliding frame, 45. The opposite end of lever, 57, being pivotally connected at 59, to a pitman, 60, connected to an eccentric, 61, on a horizontally disposed operating shaft, 62, journaled in the frame, 45, and bodily movable therewith. One end of said shaft extends beyond the frame and has a driving pulley, 63, loosely mounted thereon driven by a belt, (not shown), from any suitable power source. Integral with said pulley is a clutch member, 64 (see Figs. 5, 6, and 7), detachably engageable with a co-operating clutch member, 65, mounted on the shaft, 62, for driving the same. These clutch members are provided

with a plurality of relatively small clutch jaws, 66, spaced closely together so that upon engagement or disengagement the action is almost instantaneous so that the shaft, 62, will be started or stopped very rapidly. Of course it is to be understood that a friction clutch of any suitable type might equally well suffice. The clutch members, 64 and 65 are normally maintained out of mesh by a spring, 67, interposed therebetween on said shaft, 62. This loading mechanism is so constructed that the feeding of the plates, 48, to the openings in the die members, 16, is automatically instituted and takes place almost instantaneously with the alignment of a lower die member therewith by means of lugs, 68, provided on the outer periphery of the feeding table, 11, extending through the guard plate, 19, immediately forward of each of the die members, which lug encounters a horizontally disposed trip finger, 69, mounted on a vertical rock shaft, 70, which is loosely mounted in brackets on the outer wall of the frame, 45. This trip finger rocks the shaft, 70, when engaged by the lug, 68, so that a shifting fork, 71, mounted on said shaft is swung laterally, carrying the clutch member, 64, into driving mesh with the clutch member, 65, against the reaction of spring, 67, for setting the loading mechanism into operation, which action is almost instantaneous with the aligning of the die member with said loading mechanism.

A face plate, 75, is mounted on the shaft, 62, opposite the end at which the pulley, 63, is secured, said plate having pivotally connected thereto, off-center, the end of a pitman, 76, the opposite end of which is forked and pivotally secured to the bifurcated lever arm, 77, which is loosely mounted on the cam shaft, 78; said shaft is journaled in the frame, 45, rearwardly of the operating shaft, 62. A spring-actuated pawl, 79, supported on the pivot pin, 80, intermediate the forked ends of said pitman and lever arm engages the teeth of a ratchet, 81, keyed on the outer end of the cam shaft. A cam, 82 (see Fig. 6), is mounted on said shaft, 78, centrally with respect to the frame, 45, the outer surface of said cam being progressively increased and positioned for engagement by a roller, 83, carried on the end of an adjustable supporting screw, 84, mounted in the end of the bracket, 46. It will now be clear that for each revolution of the drive shaft, 62, the reciprocating plunger will thrust a plate, 48, into an opening in the die member while the cam shaft rotates only a partial revolution, an amount which depends on the spacing of the teeth on the ratchet, 81, which is directly proportional to the increasing cam surface, so that the thrust of the cam against the roller, 83, feeds the entire loading mechanism and frame, 45, forwardly a predetermined amount so that the plates, 48, will be successively

aligned with the respective openings in the die members, 16, for loading therein by the reciprocating plunger. The timed relation of the plunger and the feeding horizontally of the complete mechanism on the bracket, 46, ensures exact positioning of the plates, 48, at the time they are encountered by the plunger impinging plate, 52.

It is to be understood that the number of plates to be secured together as a unit may vary to suit the individual requirements; the die members, of course, having a number of plate-receiving openings corresponding to the number of plates to be formed as a unit in an electrical condenser. The cam shaft, 78, will be rotated a fraction of a revolution, at each rotation of shaft, 62, corresponding to the number of plates to be driven into a die member as a condenser unit; that is, for example, in a five-plate unit, the cam shaft will be rotated in intervals of one-fifth of a revolution, the cam, 82, being progressively designed so that for a complete rotation, the entire mechanism has been fed forwardly the exact distance at timed intervals corresponding to the spacing of the plates. The number of teeth on the ratchet, of course, will correspond to the number of plates to be fitted in the die member. It will be clear that any change in the number of plates to be assembled in a die member will require the resetting of the position of roller, 83, with its adjusting screw, 84, as well as requiring a cam and ratchet member corresponding to the change in the number of plates for assembly in the die member, in order that the feeding movement of the entire mechanism by the cam on the roller, 83, will properly align the plunger for driving the plates into the openings of the die members, 16.

The design of the cam must, of course, be such that the initial feeding point is approximately radially aligned with the final or high point, which is the end of the forward feeding movement of the mechanism; and the return from the final position to the initial position on the cam takes place just prior to the stopping of the complete mechanism by an automatic means hereinafter described. Instantaneously with the change in the contact from the final to the initial position on the cam with the roller, 83, the entire loading mechanism is slid rearwardly on the bracket, 46, to the starting position by means of a spring, 85, disposed on a screw, 86, which is secured at one end in the bracket, 46, the opposite end having sliding support in a lug, 87, on the under side of the frame, 45, which abuts against the spring so that as the mechanism is fed forwardly by the cam engaging the roller, the spring is gradually compressed, and as soon as the change in the cam-engaging surface from final to initial position with the roller takes place, the spring

tension will return the mechanism to the starting position to repeat the cycle, after another die has been aligned with the mechanism.

5 The trip finger, 69, at the time it is operated by impingement against the lug, 68, besides throwing the clutch in to operate the loading mechanism, also sets an automatic tripping device for stopping the mechanism after the last plate has been thrust into the die member. This device comprises a horizontally disposed lever arm, 90, secured at one end on a vertical rock shaft, 91, which is supported in brackets on the side of the frame, 15 45; the opposite end of said lever being engaged by a trip dog, 92, on the shaft, 70, which, when the trip finger, 69, is in position to be engaged by the lug, 68, maintains the lever in position against the frame, 45, as shown in Figure 6, reacting against a spring, 23 93, interposed between said lever and the frame, 45. A lever arm, 94, is secured to the upper end of the rock shaft, 91, having a roller, 95, at its free end for engagement with a tripping lug, 96, provided adjacent the outer edge of a rotary plate, 97, which is secured adjacent the end of the cam shaft, 78, at the end opposite said ratchet. Normally, when the mechanism is idle, the lever, 90, is held in place by means of the dog, 92, the rock shaft, 33 91, being positioned so that the roller on the arm, 94, is spaced laterally out of the path of engagement from the lug, 96, on the plate, 97. This trip lug, 96, is so located on the plate, 97, and aligned so as to be engaged by 35 the roller, 95, when the cam shaft, 78, completes a revolution, which is also the time at which the last plate is driven into the die member, 16. It will be understood that when the trip finger, 69, is operated through engagement with the lug, 68, on the rotary table, 40 the shaft, 70, will be rocked so that the trip dog, 92, will be swung laterally to permit the engaged end of the lever, 90, to swing outwardly by the spring, 93, and held in position on the upper side of said dog by a lug, 92*, 45 formed thereon; the movement of the lever, 90, rocking the shaft, 91, thereby actuating the lever, 94, and swinging the same laterally, bringing the roller, 95, into the path of engagement of the lug, 96, on the plate, 97, which action takes place when the mechanism has been fed forwardly to the limit of its movement by the cam, 82, which is also the 55 time said cam completes a revolution. By the engagement of the roller, 95, with the lug, 96, the shaft, 91, through the lever, 94, is rocked in opposite direction so that the lever, 90, is swung inwardly toward the frame, 45, against the reaction of the spring, 93, the 60 trip dog, 92, then returning to engage the end of the lever, 90, to hold it in place due to the spring, 67, forcing the clutch jaws, 64 and 65, out of mesh, carrying the shifting fork, 71, laterally, rocking the shaft, 70, on

which the trip dog, 92, is mounted, and also resetting the trip finger, 69, in position in the path to be encountered by the lug, 68, in front of the next die member to be loaded, which is now positioned at "C". The stopping mechanism is so timed relative to the cam-feeding means and the reciprocating movement of the plunger that it is operated simultaneously with the plunger stroke, as the plunger thrusts the last plate into the die member, which action takes place about the same time the change in the cam-feeding surfaces from final to the initial operating position for carrying the entire mechanism rearwardly by the compressed spring, 85.

A pocket, 98 (see Fig. 2), is formed in the circular guard plate, 19, of the rotary table, 11, immediately rearward of the lug, 68, to provide clearance for the trip finger, 69, as it is carried forwardly with the loading mechanism during operation.

Referring now to the driving mechanism for rotating the table, 11, so as to feed the lower die members, 16, which are loaded at the position indicated at "A", to position "B", for assembly with the top die member, 15, to make a complete mold for the casting operation at which time the die members at "B" and "C" are conveyed to the positions "C" and "A" respectively; a gear, 101 (see Fig. 2), is secured on the drive shaft, 20, and meshed with an idler gear, 102 (see Fig. 10), loosely mounted on a pin, 103, journaled in the main frame, said idler gear being operatively meshed with a gear, 104, secured on a longitudinally extending stud shaft, 105, journaled in the main frame, 10, said shaft being parallel to and in vertical alignment with the drive shaft, 20. A beveled pinion, 106, is mounted adjacent the rear end of the shaft, 105, in driving mesh with a beveled gear ring, 107, bolted to the under side of the rotary table, 11, for rotating the same. It will be understood that the gearing for the rotary table is so proportioned that for each revolution of the drive shaft, 20, the table is rotated one-third revolution. The shaft, 20, which is operated by driving mechanism hereinbefore described, is automatically stopped intermittently at each complete revolution. The positioning of the lower die members, 16, on the table are in corresponding arrangement so that the table, once stopped, aligns the die members with the respective operating mechanisms at "A", "B" and "C". The table is again set in motion at will by the operator by resetting of the lever, 39, of the driving mechanism to again rotate the shaft, 20, through a complete revolution. A bracket, 108, is secured on said shaft, 20, having a braking pin, 109, interconnected with the gear, 101, so that the drive to the rotary table may be disengaged by the shearing of the pin when the strains on the gearing exceed a predetermined load,

The casting operation, which takes place at the position indicated at "B", consists in bringing together the top die member, 15, and the lower die member, 16 (see Fig. 3), aligned therewith, forming a complete mold. These die members remain together for a period of time during which molten metal is injected therein under pneumatic pressure as will hereinafter be described. It is to be understood that the actuation of the die members for closing and opening the mold takes place in a proper timed relation with the injection of the metal in the mold, said movements being caused by a common automatically actuated driving mechanism, which also controls the starting and completion of these movements in exact timed relation to the feeding movement of the rotary feeding table, 11. This mechanism includes a longitudinally disposed operating shaft, 115 (see Fig. 1), journaled in bearing brackets, 116, secured to the outside of the frame, 10, disposed parallel to shafts, 20 and 105, and extending the length of said frame, 10. The drive to the shaft, 115, includes a belt, 117, trained over pulley, 22^b, which is part of the pulley unit, 22, loosely mounted on power shaft, 21, thence over a pulley, 118, mounted on a stub shaft, 119 (see Figs. 1, 3 and 9), which is supported in a frame, 120, secured to the side of frame, 10, adjacent the rear end thereof. A pinion, 121, is mounted on shaft, 119, operatively meshed with a gear, 122, on a stub shaft, 123, journaled in the frame, 120, and in bearing bracket, 116, and extending above and parallel to the shaft, 119. The shaft, 122, extends inwardly of the bearing bracket, 116, and has a pinion, 124, secured on the end, operatively meshed with a gear, 125, loosely mounted on the operating shaft, 115, for driving the same intermittently. The operating shaft is set in operation to complete a revolution, and then stopped by an automatic tripping mechanism actuated by and in timed relation with the drive shaft 20.

This tripping mechanism includes an operating cam, 126 (see Fig. 12), keyed on the drive shaft, 20, the cam being engaged by a roller, 127, carried on the end of a lever arm, 128, of a bell crank fulcrumed at 129, to an extension of the frame, 120, the other arm, 130 of the bell crank being pivoted at 131, to an upright tripping dog, 132, which is yieldingly urged forwardly by a spring, 133, wrapped about said pivotal connection, 131. The roller, 127, is yieldingly held in contact with the cam by a spring, 134, reacting against the arm, 128. The tripping dog co-operates with a pin, 135, extending laterally from a latch member, 136, pivoted at 137, and extending into the path of engagement with a co-operating groove, 138, formed in a driving plug, 139, carried in a driving collar, 140, which is keyed to the shaft, 115, adjacent the

gear, 125. Said plug is urged outwardly of said collar by a reacting spring, 141, tending to force said driving plug into apertures, 142, in the gear, 125, for driving the operating shaft, 115. The latch member, 136, is also yieldingly urged upward by a spring, 143, for engagement in the groove of the driving plug. It will be understood that the cam, 126, is so positioned on the operating shaft, 20, that when said shaft is stopped after completing a revolution, as hereinbefore described, (which stops the feed table in proper aligned positions) the initial high point on the cam surface, indicated at 126^a, is aligned with the roller, 127, and the arrow on the cam is aligned vertically with the arrow indicated at a position in the plane of the vertical axis of said cam; so that the tripping action commences almost instantaneous with the stopping of the drive shaft, 20. It will be clear from the drawings that when the roller, 127, is moved laterally by engagement with the high cam surface, the bell crank is rocked backward, drawing the trip dog, 132, downwardly, which also carries the latch member, 136, by its pin, 135, out of engagement with the groove in the driving plug, thereby permitting said plug to be projected into driving engagement with the gear, 125, by its spring, 141, for rotating the shaft, 115.

A trip lug, 144, is provided on the periphery of the driving collar, forwardly of the driving plug, in the path of engagement with the tripping dog, 132, so that very soon after said shaft is set in motion the lug, 144, impinges against the trip dog, 132, forcing it rearwardly to free the pin, 135, and permitting the latch member to be forced upward by the reaction of the spring, 143, with its knife edge, 136^a, aligned in the path for engagement in the groove, 138, of the driving plug, 139. The knife edge on said latch is so designed that as it engages in the groove of the plug it forces it out of driving mesh with the gear, 125, against the reaction of spring, 141, thereby stopping the shaft, 115. The shaft, 115, which operates at a relatively slow speed, will stop almost immediately upon the withdrawing of the driving plug from the gear, due to the load on the shaft. The tripping dog, 132, remains out of operative position until the drive shaft, 20, is again operated, due to the position of the roller on the cam, 126. It will be seen that for a period after shaft, 20, is rotated, the mechanism remains in an in-operative position until the lower camming surface, 126^b, permits the bell crank to move forwardly by its spring, 134, thereby moving the trip dog, 132, into operative position with the pin, 135, on the latch, so that the mechanism is reset for operation by the time the initial high point, 126^a, aligns itself under roller, 127, when the shaft, 20, is again stopped.

Referring now more particularly to the

mechanism for actuating the top die carrying-head, 14, for closing and opening the mold (see Figs. 3 and 11), a peripheral cam, 150 is keyed on the operating shaft, 115, co-operating with a vertically disposed lever, 151, mounted on a rocking pin, 152, journaled in the web of the main frame. Said lever having a cam roll, 158, on its lower end, engaging in the peripheral groove, 154, of the cam, 150, for oscillating longitudinally a lever arm, 155, secured on the opposite end of said pin, 152. Pivoted to the end of arm, 155, is a horizontal toggle arm, 156, which is also pivoted to the lower end of a lever arm, 157; said lever arm is mounted on the end of a transverse rock shaft, 158, journaled in the upright side portions 12^a, of the frame, 12. An upwardly extending lever, 159, is mounted on said shaft intermediate the frame side portions, 12^a, and is pivoted at its upper end to an actuating link, 160, the opposite end of which is pivotally connected at 161, between two pair of toggle links, 162, and 163, respectively. The upper links, 162, being integral at their upper end and mounted on a pin, 164, journaled in the upper ends of the side frames, 12^a, while the lower links, 163, overlap the links, 162, at the pivot connection, 161, the opposite ends of said link being pivoted at 165, to the top die carrying-head, 14. The top die carrying-head is provided with guide ribs, 166, on opposite ends, slidable vertically in guide ways, 167, formed on the inner sides of the frame sides, 12^a, so that the top die carrying-head with the top die member, 16, may be vertically reciprocated in a true path for co-operation with the aligned die member, 16, for closing and opening the mold, by actuation of the linkage by the cam, 150, as described. The cam, 150, is so designed as to cause the linkage controlling the movement of the top die member to remain stationary for a certain period, after the top die member, 15 closes on the lower die member, 16, while said cam continues to rotate, during which period the die members remain in closed position to allow time for charging the mold and permit the metal to set before the linkage connection is again actuated to raise the top die member-opening the mold.

Mounted on the main frame, 10, forwardly of the top die head is a reservoir or pot, 170 (see Fig. 1), for molten metal, provided with a conventional heating means, the details of which forms no part of the present invention. The reservoir is connected with toggle links, 171, on opposite sides of the main frame, on which said reservoir is carried to and fro in timed relation with the closing of the die members, 15 and 16, so that the nozzle, 172, will be moved into registration with the die inlet, indicated at 173, to permit the molten metal to be injected into the mold. The timed movement of the reservoir with respect to the closing of the mold is had by a

peripheral cam, 174, on the end of the shaft, 115, having a lever, 175 provided at its lower end with a cam roll, 176, for engaging in cam groove, 177. This lever is mounted on a transverse rock shaft, 178, journaled in extensions, 10^a, at the forward end of the main frame, 10. An upwardly extending lever arm, 179, is carried on the rock shaft, central with the machine; said lever is forked at its upper end to straddle a pusher bar, 180, pivotally connected to and centrally aligned with the reservoir, 170, for moving the same to and fro on the toggle links, 171. The cam, 174, is also designed to permit an idle period, that is a period at which the reservoir remains in charging position with the mold.

Automatic valve control mechanism indicated generally at 181, is timed from the shaft, 115, so that the metal will be injected into the mold at the exact time under pneumatic pressure. This valve construction and pneumatic control mechanism need not be described, as they are of a similar type as that illustrated in my co-pending joint application with Walter Will, Serial Number 85,165, filed February 1, 1926.

Referring now to the operation which takes place at the position indicated at "C", it will be understood that the die cast object will remain in the lower die member, when the same is conveyed from the position "B" to "C", at which point automatic means knocks the object loose in the lower die member for removal by the operator. The automatic means includes a lever arm, 185 (see Fig. 8), extending transversely across the center of the die member, 16, on the underside thereof, in a cavity, 186; said lever being pivoted at 187, at the outside edge of said die member to swing vertically and having a cross arm, 188, extending transverse to said lever near its center, carrying at each end vertically extending pins, 189, aligned with the two separate die portions of the die member, 16, and fitted in openings formed in the underside of the mold, extending into the die proper for movement therein to eject the die cast object from the mold. The free end of the lever arm, 185, is provided with a roller, 190, adapted to normally rest on the table, 11, when in all positions except when aligned at "C". The roller carries the lever, 185, in such a position that the upper end of the pins, 189, extend in exact alignment with the bottom of the die, so that it really serves as a bottom for certain openings in the die members, 16, when the plates, 48, are inserted therein. Aligned at position "C", is a bracket, 191, secured on the upright frame, 12, provided with a cam, 192, extending into the path of movement of the roller, 190, so that as the lower die member is approaching position "C" the roller rides up on the cam, 192, thereby moving the pins, 189, upwardly engaging the bottom of the plates of the con-

denser and bodily ejecting the die cast object in an upward direction to be removed by the operator. As the die member at "C" is started in its movement to position "A", the lever and roller with the ejecting pins are again returned to their normal position, after passing over the cam surface on the opposite end of the cam, 192.

For convenience, the operator would stand on the side of the machine adjacent position "C", so that the machine may be controlled by the reset lever, 39; the operator at this position has sufficient time to cleanse the lower die member, 16, at "C", and remove any foreign matter while the other operations are being performed at "A" and "B".

Although the driving connections to the rotary feeding table, 11, are such that the table will be intermittently rotated through one-third revolution, it is desirable to positively align the lower die members at their respective operating positions "A", "B" and "C", and locking said table in fixed position during the operations at these positions. This locking mechanism comprises a horizontally disposed locking pin, 195, slidable in the main frame and adapted to be registered in any one of the three openings, 196, provided on the inner periphery of the table, 11. These openings are aligned with each of the lower die members, so that when the pin is locked in engagement with any of said openings the die members are aligned at positions "A", "B" and "C", and fixed in place until the table is again rotated. The pin, 195, is pivotally connected to a toggle link, 197, pivoted to a carrying arm, 198, secured to a vertically movable guide rod, 199, slidable in the frames, 10 and 12, as illustrated in Figure 11. The lower end of rod, 199, is connected to a carrier, 200, movable vertically with the rod, 199; the lower end of said carrier being forked and guided in grooves of a guide block 201, loosely mounted on the drive shaft, 20. Said carrier, 200, is provided with a cam roll, 202, guided in a cam groove, 203, in a cam, 204, mounted on the shaft, 20. Thus it will be clear that due to the rotation of the cam, the guide rod, 199, is vertically reciprocated to move the locking pin in and out of registration with the openings, 196, in the table. Of course it is to be understood that the cam groove is so shaped that the actuation of the locking pin is performed very rapidly.

Since the drive connections for the rotary table and locking means are from the common drive shaft, 20, it is desirable that the lock pin is thrown into engagement after the table is stopped rotating, and out of engagement prior to the starting of the table. This arrangement may be accomplished by providing the gear, 101, of a certain diameter greater than necessary for the exact speed reduction to drive the table one-third revo-

lution to each revolution of the shaft, 20. The number of teeth on said gear in excess to that required normally for the exact reduction, being omitted to form a single opening, the diameter of the gear at this point being the root diameter of the teeth. The gear is so positioned on the shaft, 20, that when the mechanism is started for causing rotation of the table, the gear will rotate through a certain number of degrees with the open peripheral portion aligned with the idler gear, 102, before the teeth of said gear, 101, mesh with the idler gear, for rotating the table, during which time the cam with its connections draws the locking pin, 195, out of registration with the table. And vice versa, the driving connections to the table are completed slightly before shaft, 20, completes a revolution and the table, 11, is stopped, a portion of the opening formed by the omitted teeth in gear, 101, again being aligned with the idler gear, 102, and during this continued short period of rotation of said gear and shaft, 20, the cam mechanism throws the locking pin, 195, into registration with the aligned opening for locking said table in the aligned position.

Heretofore in machines for the purpose, which this machine is especially adaptable, the die members were loaded by a separate machine, as shown in my patent, hereinbefore referred to; the loaded die members then being manually handled for operation in a die casting machine of a usual type, as for example, similar to that shown in my copending joint application, hereinbefore referred to; the die members then being again handled for removal of the castings and cleansing the mold. These operations required considerable time, the use of two machines and several operators for performing the operation, which my improved machine is capable of automatically performing, requiring practically no manual assistance, except for controlling the same at will, by the operator. The operation of a machine as herein described is continuous and will effect greater production and increased economy.

I claim:

1. In a machine of the character described, the combination of a main frame, conveying means supported by said frame, a die member carried by said conveying means, a movable head carrying a co-operating die member, and positively actuated means for stopping said conveying means at a predetermined point with said die members in exact alignment with each other.

2. In a machine of the character described, the combination of a main frame, conveying means supported by said frame, a die member carried by said means, a movable head carrying a co-operating die member, automatic means for stopping said conveying means at

a predetermined point, aligning said die members, and means automatically actuated in timed relation to said stopping means for actuating said movable head and co-operating die member into die closing and opening positions.

3. The construction defined in claim 2, said movable head actuating means comprising a rotative cam having a substantial part of its camming extent formed for holding said die member in closed position for a predetermined period.

4. In a machine of the character described, the combination of a main frame, conveying means supported by said frame, means for automatically stopping said conveying means at a plurality of predetermined points along its path of travel, die members mounted on said conveying means positioned for successive alignment at each of said predetermined points with a movable head supported on said frame carrying a co-operating die member, one of said predetermined points being positioned so that the co-operating die member is aligned with one of the die members on the conveying means, and means controlled at will for moving said conveying means whereby said co-operating die member is aligned with the successive die member positioned at the next predetermined point on the conveying means.

5. In the combination defined in claim 4, automatically actuated means operated in timed relation with the said stopping means, for carrying said movable head and co-operating die member into die closing and opening positions with respect to the aligned die member on said conveying means.

6. In a machine of the character described, the combination of a main frame, a feeding table mounted for rotative movement on said frame, means for automatically stopping said table at a plurality of predetermined positions, die members mounted on said table positioned for successive registration at said predetermined stops with a movable head supported on the frame carrying a co-operating die, means automatically actuated in timed relation upon the stopping of the table for bringing the co-operating die member into die closing and opening positions respectively with the aligned die member on the table, and co-operating means for injecting molten metal into said die while in closed position.

7. In a machine of the character described, the combination of a main frame, a feeding table mounted for rotative movement on said frame, means for automatically stopping said table at a plurality of predetermined positions, die members mounted on said table positioned for successive registration at said predetermined stops with a movable head supported on the frame carrying a co-operating die, means automatically actuated in timed relation upon the stopping of the table for

bringing the co-operating die member into die closing and opening positions respectively with the aligned die member on the table, co-operating means for injecting molten metal into said die while in closed position, and means controlled at will for again starting said table in motion, whereby the next successive die member on said table is aligned at the predetermined stopping point with the co-operating die member to repeat the cycle of operation.

8. In a machine of the character described, the combination of a main frame, a feeding table mounted for rotary movement thereon, means for stopping said table at a plurality of predetermined positions, die members on said table, positioned for successive alignment at such stops with a movable head supported in the frame, carrying a co-operating die member, means timed with the stopping means of the table for moving the co-operating die member into and out of die closing position with the die member on the table aligned therewith, and means for locking the table to the frame, when the same is stopped at the predetermined positions.

9. In the construction defined in claim 8, said molding means comprising a locking member and means for moving it into and out of locking position, associated with the table-stopping means for operation by the latter for locking approximately coincidentally with the stopping of the table.

10. The construction defined in claim 8 having the locking means comprising a locking member and means carrying it into and out of locking position; actuating means for moving said carrying means operatively associated with the table-stopping and starting means for causing the locking member to be carried into and out of locking position approximately coincidentally respectively with the stopping and starting of the table.

11. In a machine of the character described, the combination of a frame, a feeding table mounted for rotary movement thereon, means for stopping said table at a plurality of predetermined points along its path of movement, die members mounted on the table, loading means adjacent one of said stopping points, aligned successively with the die members on the table during its stops for loading parts into said die members that are to be included in the finished casting, and means controlled at will for starting the table rotating to carry the loaded die member into alignment with the next predetermined stop point and aligning another die member with the loading means.

12. In a machine of the character described, the combination of a frame, a feeding table mounted for rotary movement thereon, means for stopping said table at a plurality of predetermined points along its path of movement, die members mounted on the

loading means adjacent one of said stopping points, aligned successively with the die members on the table during its stops for loading parts into said die members that are to be included in the finished casting, means controlled at will for starting the table rotating to carry the loaded die member into alignment with the next predetermined stop point and aligning another die member with the loading means, a movable head supported in the frame aligned at a predetermined stopping point on the table beyond the loading means, said head carrying a co-operating die member aligned with the loaded die member at the predetermined stopping point, and means timed in co-relation with the stopping means for the table for bringing the co-operating die member into die closing and opening position with respect to the aligned loaded die member on the table.

13. In the combination defined in claim 12, means operating in timed relation with the means for closing and opening the die adapted to inject molten metal into said die while in a closed position.

14. In the construction defined in claim 12, means for injecting molten metal into the die at closed position of the latter, the means for opening and closing the die comprising a part arranged to co-operate with the metal-injecting means for injecting the metal into the die, the operating connections of said co-operating parts with the die opening and closing means and with the metal injecting means respectively being relatively arranged on said co-operating parts for actuating the metal injecting means intermediate the closing and opening movement of the die.

15. In a machine of the character described, the combination of a main frame, a feeding table mounted for rotary movement thereon, means for automatically arresting the movement of the table at a plurality of predetermined points, die members carried by the table and positioned for successive alignment with automatic means at one of the stopping points for loading the aligned die member on the table, means controlled at will for rotating said table to align the die member at the next successive arresting point with a head, movably supported in the frame beyond the loading means, said head carrying a co-operating die member, means timed in co-relation with the arresting means for the table for carrying the co-operating die member into and out of die closing position with respect to said aligned die member on the table, means timed with the die closing means for injecting molten metal into the die while in closed position, said die member on the table being moved to and aligned at a predetermined arresting point beyond the casting point, and automatic means operating adjacent said last named arresting point for loosening and ejecting the die cast object from said die member.

16. In the construction defined in claim 15, in combination with the parts co-operating for ejecting and the parts co-operating for arresting, the rotation of the table, being formed for timing the ejection of the casting to cause it to be completed before the arresting of the table occurs.

17. The construction defined in claim 2, said head actuating means comprising a rotative cam having a substantial part of its camming extent formed for holding said die members in closed position for a predetermined period, and means automatically actuated in timed relation to said die closing means for injecting molten metal into said die when in closed position.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 20th day of June, 1928.

ERIC CARLSON.