

May 26, 1959

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2,887,742

DIE CASTING MACHINE PRESSURE CHAMBERS

Filed Feb. 21, 1958

2 Sheets-Sheet 1

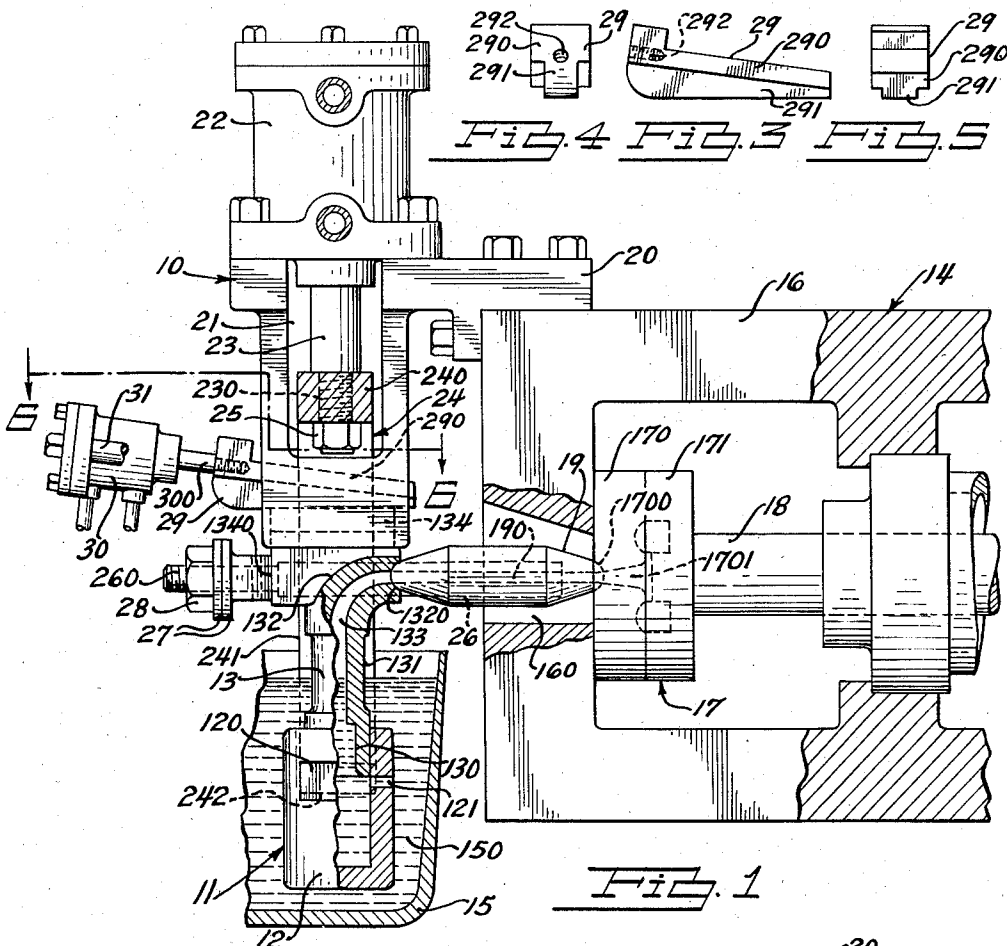


FIG. 1

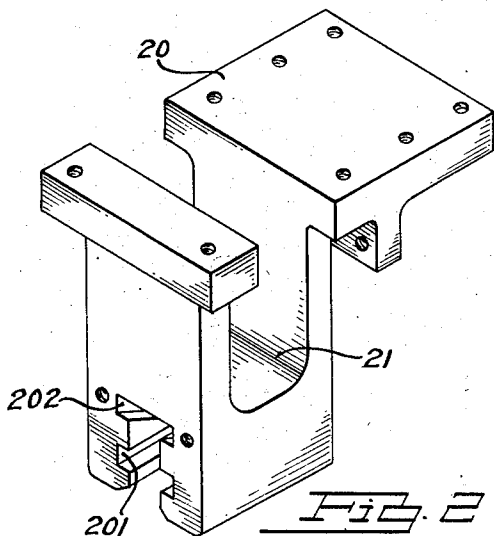


FIG. 2

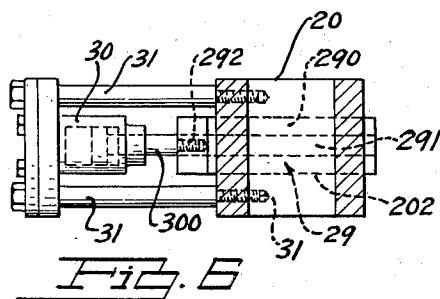


FIG. 6

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2 Sheets-Sheet 2

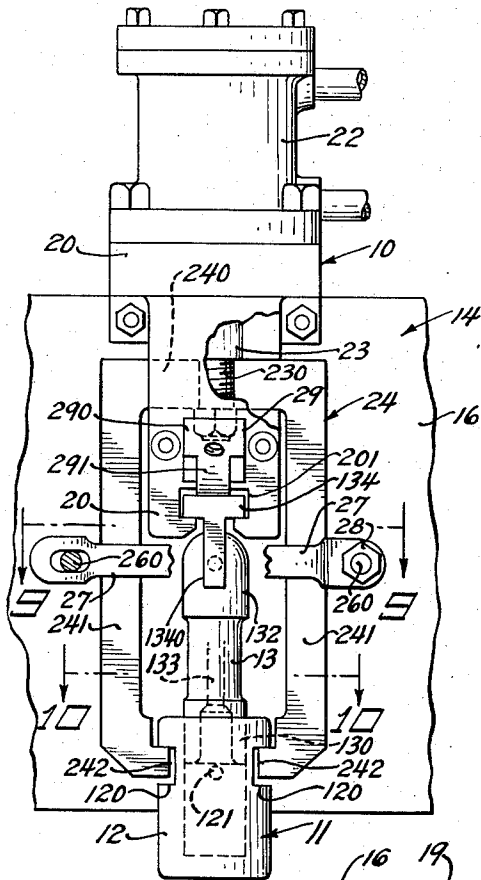


FIG. 7

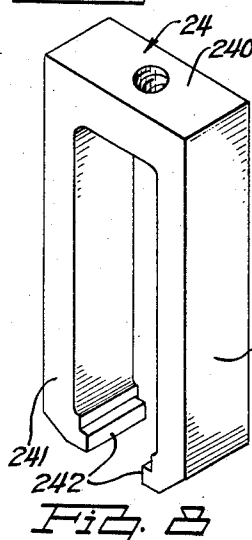


FIG. 8

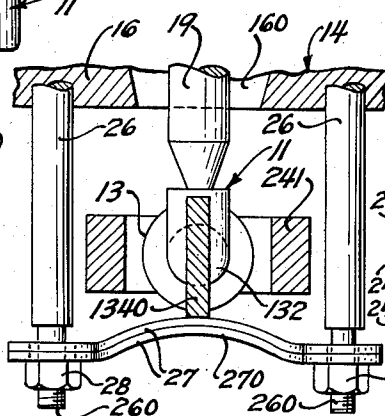


FIG. 9

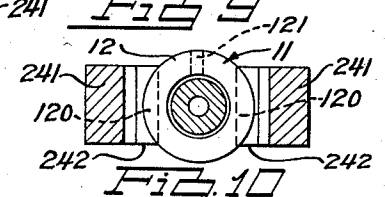


FIG. 10

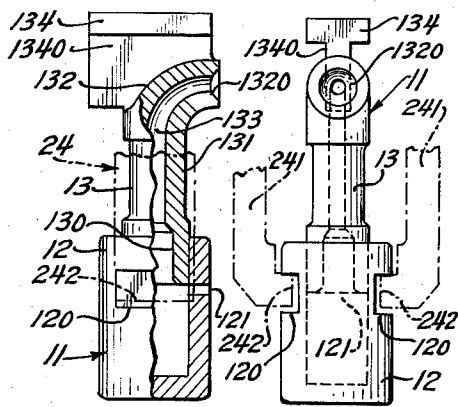


FIG. 11 FIG. 12

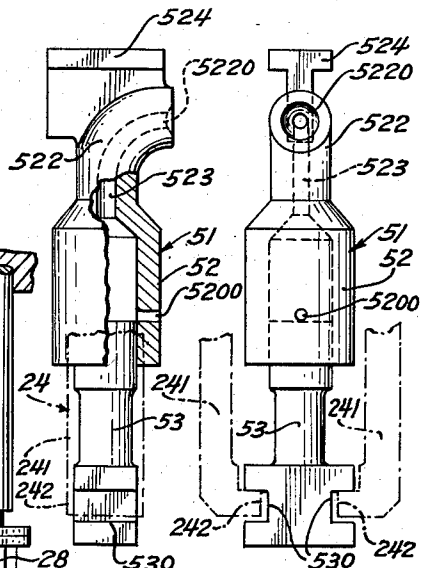


FIG. 13 FIG. 14

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DIE CASTING MACHINE PRESSURE CHAMBERS

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10 Claims. (Cl. 22—68)

This invention relates to die casting machines, and in particular to improvements in die casting machine pressure chambers of the submerged type.

The present invention is an improvement over the die casting machine pressure chamber construction disclosed and claimed in U.S. Patent No. 2,786,247, issued March 26, 1957, to Marc Stern, the inventor in the instant case.

Conventional die casting machines of the type to which this invention relates are employed to injection mold low melting point alloy castings, which machines generally include a pressure chamber which is submerged into a pot of molten metal wherein the said pressure chamber receives its charge of molten metal by gravity. During the operating or injection molding cycle of the die casting machine, molten metal is forced from the pressure chamber into a die by means of a power actuated plunger or piston operating in the pressure chamber. After molten metal has been injected into the die, the plunger retracts, and a new charge of molten metal flows from the pot into the pressure chamber filling it prior to the next operating cycle of the die casting machine.

Pressure chambers of the type presently in general use consist of a cylinder having a plunger reciprocatingly mounted therein and a gooseneck outlet extending from said cylinder and communicating between the bottom of the said cylinder to the injection nozzle of the injection molding machine. An inlet extends from near the top of the cylinder downwardly into the pot of molten metal so that the molten metal flowing to the cylinder is always withdrawn from the pot at a point somewhat below the upper level of molten metal therein. This type of pressure chamber is generally referred to as a "gooseneck," deriving its name from the shape of its outlet. Such prior art structure is disclosed in Fig. 1 of U.S. Patent No. 2,145,956, issued February 7, 1939, to Marc Stern, the inventor in the instant case.

Because of the high cost of the manufacture of high pressure resistant and porosity free gooseneck type pressure chamber castings, and the cost of machining and maintaining gooseneck pressure chambers, and due to the difficulty of handling gooseneck type pressure chambers to drain the molten metal therefrom whenever replacement or removing the same from the pot becomes necessary, and because the plunger must be withdrawn from the cylinder of the gooseneck before the gooseneck may be removed from the pot, an improved and simplified pressure chamber construction was developed and patented by the instant inventor, see Patent No. 2,786,247 of March 26, 1957, to Marc Stern referred to above.

While the last mentioned improvement over the earlier gooseneck type pressure chamber cured certain of the defects of the prior art, it was found to be still quite difficult to remove the pressure chamber from the molten metal and the die casting machine. Furthermore, the pressure chamber could not readily adjust itself to, or free itself from, variable expansion and contraction stresses occasioned during heating and cooling of the molten metal, the pressure chamber and the nozzle arising

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from temporary suspensions of operation of the die casting machine, which stresses oftentimes cause distortion and breakage of various elements of the pressure chamber.

With the foregoing in view, the primary object of the instant invention is to provide an improved submerged type pressure chamber construction for die casting machines including a molten metal pressure delivery unit consisting of a pressure chamber cylinder and piston which may be readily placed into and removed from service in the die casting machine whereby to facilitate replacement thereof by like molten metal delivery units of the same or different capacities with a minimum of die casting machine "down" time.

Another object of the invention is to provide an improved pressure chamber construction for die casting machines employing a readily removable molten metal pressure delivery unit and mounting means therefor incorporating large anchorage and supporting areas to adequately absorb the repeated heavy thrusts occurring during the molten metal delivery cycles of operation of the die casting machine whereby to eliminate the extreme wear normally encountered in the usual pin connected or hinged supporting means generally employed in pressure chamber construction.

A further object of the invention is to provide wedge lock means for holding the removable and replaceable molten metal pressure delivery unit in firm operating position, which wedge lock means may be locked and unlocked periodically or at the beginning and end of each cycle of operation of the die casting machine whereby to periodically or cyclically relieve the pressure chamber elements of expansion and contraction stresses, and thereby materially reduce the hazards of permanent distortion or breakage of the pressure chamber elements occasioned under the many heating and cooling phases to which they are subjected during normal production die casting machine operation such as repeated placement of the die casting machine into and out of operation occasioned by breaks in continuity of production due to operator rest periods or die maintenance, and during replacement of the molten metal pressure delivery unit by like units of the same or different capacity.

Other objects of the invention will become apparent by reference to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a side elevational view of a die casting machine pressure chamber embodying the invention, portions being broken away to more clearly illustrate the construction.

Fig. 2 is a view in perspective of the mounting block for mounting the pressure chamber on the frame of a die casting machine.

Figs. 3, 4 and 5 are side and end elevational views of the wedge lock member employed to removably fix the molten metal pressure delivery unit in operating position during the die casting cycle of operation of the die casting machine.

Fig. 6 is a horizontal sectional view taken on the line 6—6 of Fig. 1 of the wedge lock actuating mechanism fixed on the mounting block and with the wedge lock member disposed in its locked position.

Fig. 7 is a front elevational view of the die casting machine pressure chamber disclosed in Fig. 1 with the wedge lock actuating mechanism removed and parts broken away to more clearly illustrate the construction.

Fig. 8 is a view in perspective of the bifurcated cage element employed to removably engage the pressure chamber cylinder of the molten metal pressure delivery unit.

Fig. 9 is a horizontal sectional view taken on the line 9—9 of Fig. 7.

Fig. 10 is a horizontal sectional view taken on the line 10—10 of Fig. 7.

Figs. 11 and 12 are side and front elevational views of the molten metal delivery unit preferably employed.

Figs. 13 and 14 are side and front elevational views of an alternate molten metal delivery unit construction wherein the disposition of the pressure chamber cylinder and the piston has been reversed.

Referring now to the drawings wherein like reference characters refer to like and corresponding parts throughout the several views, the die casting pressure chamber 10 disclosed in Figs. 1–12, inclusive, for the purpose of illustrating the invention consists of a molten metal pressure delivery unit 11 which includes a pressure chamber cylinder 12 and piston 13 and means hereinafter described for removably mounting and releasably fixing the said pressure delivery unit in operating position on a die casting machine 14 and in the molten metal pot 15 thereof.

The usual die casting machine 14 includes at one end thereof a frame element 16 into which the fixed and movable die elements 170 and 171 of a partable die 17 is mounted. The fixed die element 170 is mounted on the frame 16 opposite a nozzle opening 160 therein while the movable die element 171 is mounted on the die carrying ram 18 of the die casting machine 14, which ram 18 is operated by hydraulic or mechanical means, not shown, to open and close the partable die 17 for removal of castings therefrom. Molten metal 150 from the molten metal pot 15 is supplied to the die 17 through a nozzle 19 communicating between the delivery neck 132 of the piston 13 of the molten metal delivery unit 11 and the sprue 1701 of the die 17 as indicated in Fig. 1.

The die casting machine pressure chamber 10 includes a mounting block 20 shown in Fig. 2 fixed in cantilever relationship on the frame 16 of the die casting machine 14 as indicated in Fig. 1. The said mounting block 20 has a transversely disposed U-shaped vertically disposed cavity 21 therein at the top thereof over which is preferably mounted a double acting hydraulic cylinder 22 having a ram 23 extending downwardly therefrom and reciprocable vertically in the said U-shaped cavity 21. A bifurcated cage element 24 is fixed at its transversely disposed head 240 on the threaded bottom end 230 of the ram 23 of the hydraulic cylinder 22 by a nut 25. The depending arms 241 of the said bifurcated cage element 24 terminate in oppositely and inwardly horizontally disposed fingers 242 which removably engage the pressure chamber cylinder 12 of the pressure delivery unit 11 at horizontally disposed slots 120 provided therein. With the foregoing construction, actuation of the hydraulic cylinder 22 in one direction causes its ram 23 to move upwardly and move the bifurcated cage element 24 and the pressure chamber cylinder 12 upwardly from its position shown in Fig. 1, and subsequent reversal of the hydraulic cylinder 22 returns the said pressure chamber cylinder 12 to its initial position as shown.

The piston 13 of the molten metal pressure delivery unit 11 consists of a hollow piston head 130 and a shank 131 thereabove terminating in a curved delivery neck 132, the said shank 131 having a passage 133 therethrough preferably somewhat smaller than the cavity of the hollow piston head 130 communicating between the hollow piston head 130 and a semispherical socket 1320 formed at the outlet end of the said curved delivery neck 132. The fixed die element 170 of the partable die 17 has a like semispherical socket 1700 at the outer end of the sprue 1701 thereof. The nozzle 19 which communicates between the delivery neck 132 of the piston 13 and the sprue 1701 of the die 17 is provided with a longitudinal passage 190 therethrough, and has semispherical ends which seat in the semispherical sockets 1320 and 1700 of the piston 13 and die 17 respectively when the molten metal delivery unit 11 is assembled in

the die casting machine pressure chamber 10 as herein-after described.

The piston 13 is provided with a T-slide element 134 integral with the curved delivery neck 132 of the said piston 13, disposed thereabove and parallel to the outlet end of the said delivery neck 132. The said mounting block 20 of the die casting machine pressure chamber 10 is provided with a horizontally disposed T-slot 201 which telescopically receives the T-slide element 134 of the piston 13 so that the semispherical socket 1320 at the outlet end of the curved delivery neck 132 is in substantial alignment with the semispherical socket 1700 of the partable die 17.

A pair of anchor bars 26 extend forwardly outward from the frame 16 of the die casting machine 14 onto the threaded ends 260 of which are positioned leaf springs 27. The said leaf springs 27 are preferably bowed at 270 to contact the outer end of the vertically disposed shank 1340 of the said T-slide element 134 formed integral with the curved delivery neck 132 of the piston 13. Tightening of nuts 28 threaded on the threaded ends 260 of the anchor bars 26 compresses the leaf springs 27 and urges the delivery neck socket 1320 of the piston 13 firmly into sealed relationship with one end of the nozzle 19 whereupon the other end of the nozzle 19 is urged firmly into sealed relationship with the socket 1700 of the partable die 17 as shown in Figs. 1 and 9.

The mounting block 20 is also provided with a sloping T-slot 202 into which a T-shaped wedge 29 shown in Figs. 3, 4 and 5 having a head 290 and a shank 291 is telescoped. The said T-slot 202 is disposed just above the T-slot 201 and communicates vertically therewith so that the shank 291 of the T-shaped wedge 29 will contact the top of the T-slide element 134 of the piston 13 and firmly fix the said piston 13 in depending relationship from the mounting block 20 of the die casting machine pressure chamber 10. When the T-shaped wedge 29 is retracted, the piston 13 is supported in the T-slot 201 in the mounting block 20 and is spring urged against the nozzle 19, the remaining connection between the said piston 13 and the mounting block 20 having sufficient play to avoid the introduction of expansion and contraction stresses therebetween.

By advancing the T-shaped wedge 29, the piston 13 remains spring urged against the nozzle 19, and, in addition, the remaining connection between the said piston 13 and the mounting block 20 becomes locked-up firmly so as to resist any tendency for the piston 13 to wobble in its support and part from the nozzle 19. Such lock-up of the piston 13 also resists any tendency of the nozzle 19 to part from the die 17 during the pressure delivery of molten metal 150 by the molten metal pressure delivery unit 11. Obviously, the retraction of the T-shaped wedge 29 unlocks the piston 13 and allows play between the piston 13 and the block 20 to relieve expansion and contraction stresses in the die casting machine pressure chamber 10.

The T-shaped wedge 29 may be moved into and out of its locked position in the sloping T-slot 202 of the mounting block 20 against the top of the T-slide 134 of the piston 13 by such suitable means as a double acting hydraulic cylinder 30 supported on mounting bars 31 extending outwardly from the mounting block 20 as best shown in Figs. 1 and 6. The ram 300 of the hydraulic cylinder 30 is threaded or otherwise fixed to the front end of the T-shaped wedge block 29 which is threaded at 292 to accommodate the said ram 300.

By actuating the said cylinder 30 to advance the T-shaped wedge block 29 before each molten metal delivery pressure stroke of the molten metal delivery unit 11, and then actuating the said cylinder to retract the said T-shaped wedge block 29 after each return stroke of the said molten metal delivery unit 11, the die casting machine pressure chamber will constantly accommodate itself to expansion and contraction of its several elements,

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and thereby eliminate any possibility of destruction of its elements responsive to expansion and contraction stresses. Alternatively, the cylinder 30 may be omitted, and the T-shaped wedge block 29 may be urged to its advanced or retracted position manually or by mechanical means, in which event, the said T-shaped wedge block 29 preferably would be advanced after the molten metal and the molten metal delivery unit 11 had been heated up to operating temperatures, and withdrawn whenever a production run of the die casting machine was completed or whenever production was temporarily suspended before the die casting machine was permitted to cool.

The piston 13 and the pressure chamber cylinder 12 of the improved die casting machine pressure chamber 10 are in effect floatingly mounted on the die casting machine frame 16 to allow for expansion and contraction of the several elements thereof directly in contact with molten metal during heating-up and cooling-down of the said pressure chamber 10, the said pressure chamber 10 being locked prior to die casting into an integral operating whole responsive to the movement of the wedge lock means 29 into its locked position thereby fixing the otherwise floating piston 13 in respect to the mounting block 20 in the position to which the said floating piston 13 is spring urged by the springs 27 as hereinbefore described.

As best shown in Figs. 1, 7, 11 and 12 the cylinder 12 of the molten metal pressure delivery unit 11 of the die casting machine pressure chamber 10 is reciprocally mounted on the lower hollow piston head 130 of the piston 13. The said cylinder 12 has an inlet aperture 121 therein suitably located so that the said cylinder 12 will fill with molten metal 150 each time the said cylinder 12 is retracted by the hydraulic cylinder 22 to its position shown in Fig. 1. The said cylinder 12 is engaged for movement by the double acting hydraulic cylinder 22 by the fingers 242 on the depending arms 241 of the bifurcated cage element 240 which is connected to the threaded end 230 of the ram 23 of the said hydraulic cylinder 22 by a nut 25 as hereinbefore described.

Figs. 13 and 14 show how the cylinder 12 and the piston 13 of the molten metal delivery unit 11 may be reversed, which is accomplished by constructing a molten metal delivery unit 51 including a cylinder 52 having an inlet aperture 5200 formed with a shank 521, a curved neck 522 having a passage 523 therethrough, a semi-spherical socket 5220 at the forward end of the said curved neck 522 at the end of the said passage 523 therethrough, and a T-slide 524 at the top of the said curved neck 522. The said molten metal delivery unit 51 also includes a piston 53 reciprocally fit in the cylinder 52 thereof, the said piston 53 having horizontal slots 530 therein to permit gripping the said piston 53 by the fingers 242 on the depending arms 241 of the bifurcated cage element 24. Obviously, with such reversal of the cylinder and piston, the embodiment of the molten metal pressure unit 51 shown in Figs. 13 and 14 may readily be substituted for the embodiment of the molten metal pressure unit 11 shown in Figs. 11 and 12 and elsewhere throughout the drawings.

Although but a single embodiment of the invention and alternate construction of several elements thereof have been disclosed and described in detail, it is obvious that many changes may be made in the size, shape, arrangement and specific details of the various elements of the invention without departing from the spirit and scope thereof as defined by the appended claims.

I claim:

1. In a die casting machine including a frame having a die mounted therein, a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into said die, pressure chamber means for injecting said molten metal into said die including a molten metal pressure delivery unit consisting of a cylinder and a piston, a power actuated reciprocable element fixed to said machine frame, means suspending said cylin-

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der in depending relationship in said metal pot from said power actuated element for reciprocation thereby, means suspending said piston loosely from said machine frame, the said molten metal delivery unit having a continuous passage through its cylinder and piston communicating between said molten metal pot and said nozzle, resilient means constantly urging said piston of the molten metal delivery unit in pressure contact against said nozzle and said nozzle against said die, and means releasably fixing the said piston of said molten metal pressure delivery unit to said means loosely suspending it from said machine frame holding said piston and nozzle immovable during the injection cycle of operation of the die casting machine.

2. In a die casting machine including a frame having a die mounted therein, a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into said die, a pressure chamber means for injecting said molten metal into said die including a molten metal pressure delivery unit consisting of a cylinder and a piston, power means fixed to said machine frame having a reciprocable element, means suspending said molten metal delivery unit from said machine frame with one of said cylinder and piston in loosely depending relationship therefrom and disposed against said nozzle and the other disposed in said molten metal and removably coupled to the reciprocable element of said power means for movement therewith, the said molten metal delivery unit having a continuous passage therethrough communicating between said molten metal pot and said nozzle, resilient means constantly urging said suspended one of said cylinder and piston of said molten metal delivery unit in pressure contact against said nozzle and said nozzle in pressure contact against said die, and means releasably fixing the said loosely suspended one of said cylinder and piston of said molten metal pressure delivery unit to said means suspending it from said machine frame.

3. In a die casting machine including a frame and a die mounted therein, a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into said die, pressure chamber means for injecting said molten metal into said die including a molten metal pressure delivery unit consisting of a cylinder and a piston, power means fixed to said machine frame having a reciprocating element suspending one of said cylinder and piston of said molten metal delivery unit therefrom, the other of said cylinder and piston of said molten metal delivery unit being loosely suspended from said machine frame and disposed against said nozzle, the said molten metal delivery unit having a continuous passage therethrough and communicating between said molten metal pot and said nozzle, resilient means constantly urging said element of molten metal delivery unit suspended loosely from said machine frame into pressure engagement with said nozzle and said nozzle into pressure engagement with said die, and means releasably fixing the said loosely suspended element of the molten metal delivery unit to its suspension means whereby to maintain said molten metal delivery element, said nozzle and said die in pressure engagement during injection of molten metal into said die responsive to actuation of said power means.

4. In a die casting machine including a frame having a die mounted therein, a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into said die, pressure chamber means for injecting said molten metal into said die including a molten metal pressure delivery unit consisting of a cylinder and a piston, a power actuated reciprocable element fixed to said machine frame, means connected to said reciprocable element removably and slidably suspending said cylinder in depending relationship in said metal pot, means slidably suspending said piston loosely from said machine frame, the said molten metal delivery unit having a continuous passage through its cylinder and

piston communicating between said molten metal pot and said nozzle, resilient means constantly urging said piston of the molten metal delivery unit in pressure contact against said nozzle and said nozzle against said die, and wedge means adapted to engage said piston of said molten metal pressure delivery unit releasably fixing said piston with respect to said means suspending it from said machine frame.

5. In a die casting machine including a frame having a die mounted therein, a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into said die, pressure chamber means for injecting said molten metal into said die including a molten metal pressure delivery unit consisting of a cylinder and a piston, a power actuated reciprocable element fixed to said machine frame, means connected to said reciprocable element removably and slidably suspending said cylinder in depending relationship in said metal pot, means slidably suspending said piston loosely from said machine frame, the said molten metal delivery unit having a continuous passage through its cylinder and piston communicating between said molten metal pot and said nozzle, resilient means constantly urging said piston of the molten metal delivery unit in pressure contact against said nozzle and said nozzle against said die, and wedge means movable within said means slidably suspending said piston of said molten metal pressure delivery unit loosely from said machine frame releasably locking the said piston with respect to said means suspending it from said machine frame, and means for moving said wedge means into and out of its piston engaging position.

6. In a die casting machine including a frame having a die mounted therein, a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into said die, pressure chamber means for injecting said molten metal into said die including a molten metal pressure delivery unit consisting of a cylinder and a piston, a mounting block fixed to the machine frame, a power element fixed to said machine frame including a ram extending downwardly therefrom, means connected to said ram removably and slidably suspending said cylinder in said metal pot, the said mounting block having a T-slot at the bottom thereof, a T-head on said piston slidably suspending said piston loosely from said mounting block at the said T-slot therein, the said molten metal delivery unit having a continuous passage through its cylinder and piston communicating between said molten metal pot and said nozzle, resilient means constantly urging said piston of molten metal delivery unit into pressure contact against said nozzle and said nozzle into pressure contact with said die, a second T-slot in said mounting block above said first mentioned T-slot and communicating therewith, and wedge means slidable in said second T-slot engaging the T-head of said piston of said molten metal pressure delivery unit releasably fixing said piston with respect to said mounting block and said machine frame.

7. In a die casting machine including a frame having a die mounted therein, a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into said die, pressure chamber means for injecting said molten metal into said die including a molten metal pressure delivery unit consisting of a cylinder and a piston, a mounting block fixed to the machine frame, a power element fixed to said machine frame including a ram extending downwardly therefrom, means connected to said ram removably and slidably suspending said cylinder in said metal pot, the said mounting block having a T-slot at the bottom thereof, a T-head on said piston telescoped in said T-slot of said mounting block slidably suspending said piston loosely therefrom, the said molten metal delivery unit having a continuous passage through its cylinder and piston communicating between said molten metal pot and said nozzle, resilient

means constantly urging said piston of molten metal delivery unit into pressure contact against said nozzle and said nozzle into pressure contact with said die, a second T-slot in said mounting block above said first mentioned T-slot and communicating therewith, and wedge means slidable in said second T-slot engaging the T-head of said piston of said molten metal pressure delivery unit releasably locking said piston with respect to said mounting block and said machine frame, and means urging said wedge means into locked position during injection of molten metal by said molten metal pressure delivery unit.

8. A die casting machine pressure chamber as claimed in claim 7 wherein the said means for urging the said wedge means into and out of locked position consists of a hydraulic cylinder including a ram connected to said wedge means, and means mounting said hydraulic cylinder on and in spaced relationship outwardly from said mounting block.

9. In a die casting machine including a frame having a die mounted therein, a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into said die, pressure chamber means for injecting said molten metal into said die including a molten metal pressure delivery unit consisting of a cylinder and a piston, a mounting block fixed to the machine frame, a power element fixed to said machine frame including a ram extending downwardly therefrom, means connected to said ram removably and slidably suspending said cylinder in said metal pot, the said mounting block having a T-slot at the bottom thereof, a T-head on said piston telescoped in said T-slot of said mounting block slidably suspending said piston loosely therefrom, the said molten metal delivery unit having a continuous passage through its cylinder and piston communicating between said molten metal pot and said nozzle, a pair of anchor bars extending outwardly from said frame, leaf spring means fixed on said anchor bars constantly urging said piston of molten metal delivery unit into pressure contact against said nozzle and said nozzle into pressure contact with said die, a second T-slot in said mounting block above said first mentioned T-slot and communicating therewith, and wedge means in said second T-slot engaging the T-head of said piston of said molten metal pressure delivery unit releasably fixing said piston into its position with respect to said mounting block and said machine frame to which it is spring urged by said leaf spring means.

10. In a pressure chamber for a die casting machine including a frame having a die mounted thereon, a molten metal pot and a nozzle having a passage therethrough communicating with said die, said pressure chamber means comprising a molten metal pressure delivery unit including a cylinder and a piston mounted therein, the said molten metal pressure delivery unit having a passage therethrough communicating between said molten metal pot and said nozzle, suspension means floatingly mounting said delivery unit in depending relationship from said machine frame including power means adapted to cause said cylinder and piston to deliver molten metal from said molten metal pot to said nozzle, means constantly urging said delivery unit in pressure contact with said nozzle and said nozzle in pressure contact with said die, and wedge means mounted in said suspension means for anchoring said delivery unit in said pressure position prior to any die casting operation by said pressure chamber means after heating of the molten metal delivery unit, the said suspension means, delivery unit and wedge means presenting large flat areas of contact therebetween.

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