March 26, 1957 M. STERN 2,786,247

DIE CASTING MACHINE PRESSURE CHAMBERS

Filed Feb. 3, 1955

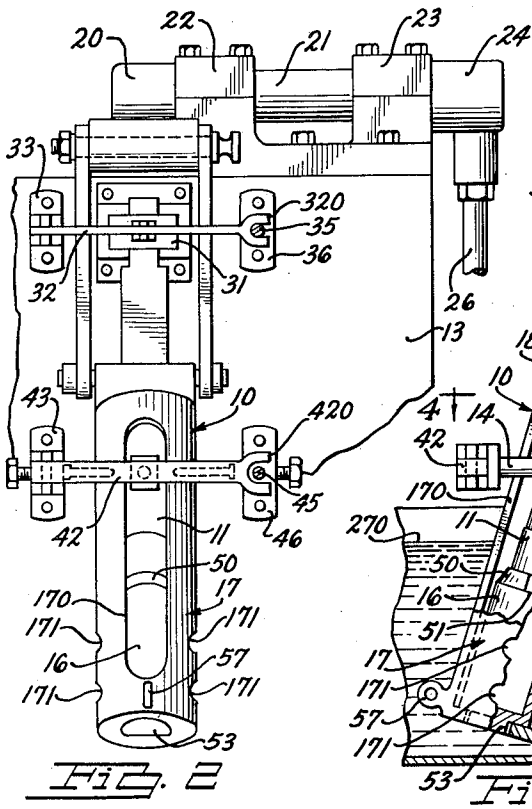


Fig. 2

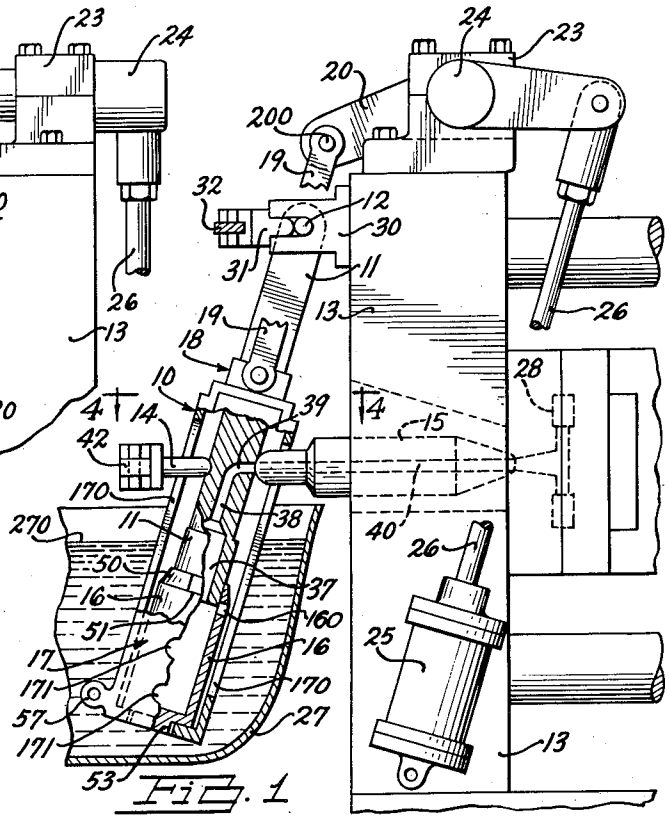


Fig. 1

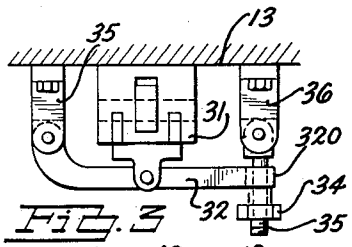


Fig. 3

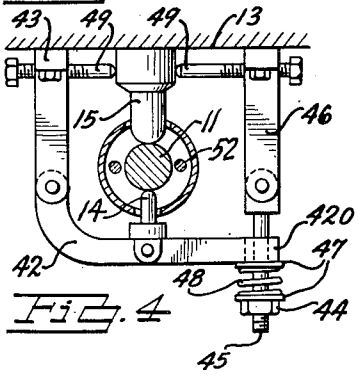


Fig. 4

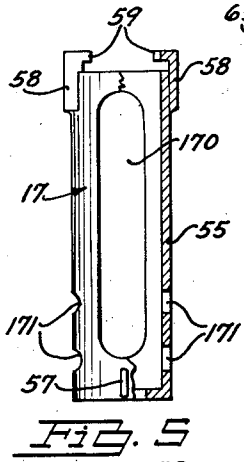


Fig. 5

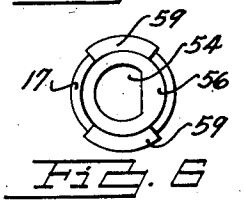


Fig. 6

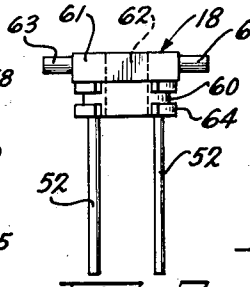


Fig. 7

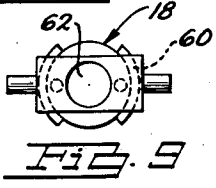


Fig. 9

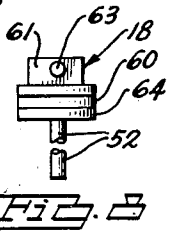


Fig. 8

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DIE CASTING MACHINE PRESSURE CHAMBERS

Marc Stern, Flint, Mich.

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6 Claims. (Cl. 22—70)

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

Conventional die casting machines of the type to which this invention relates are employed to injection mold low melting point alloy castings, which machines include a stationary pressure chamber submerged into a pot of molten metal. The pressure chamber receives the molten metal by gravity, and, during the injection molding cycle, the molten metal is forced into a die by a plunger operating in the pressure chamber. After the metal has been injected into the die, the plunger retracts and molten metal in the pot again flows by gravity into the pressure chamber filling it prior to the next injection molding cycle.

Stationary pressure chambers of the type presently in general use consist of a cylinder having a plunger reciprocatingly mounted therein and a gooseneck outlet communicating from 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 molten metal flowing into the cylinder is withdrawn from the pot somewhat below the upper level of the molten metal therein. This type of pressure chamber is generally referred to as a "gooseneck" deriving its name from the shape of the outlet. Such prior art structure is illustrated in Fig. 1 of Patent No. 2,145,956, issued February 7, 1939, to Marc Stern, the inventor in the instant case.

In an average size commercial die casting machine, the gooseneck weighs as much as 300 pounds and oftentimes more. It requires considerable shaping, boring, contouring and facing in its manufacture. The curved gooseneck type outlet channel limits its manufacture to sand molding. Due to its length and relatively small diameter, it presents a considerable problem in maintaining the sand core in position. A shift in the core will produce a thin wall on one side of the gooseneck causing it to fail under normal operating pressures of about 2500 lbs. per square inch. The shape of the gooseneck channel precludes the removal of the sand core with a rod or drill which necessitates slow pickling in acid to accomplish the core removal. Furthermore, if the supporting rods in the curved core are insufficiently covered with sand, they may fuse to the side walls of the gooseneck. Hence, in the manufacture of goosenecks there are many rejects for defective castings. The importance of obtaining a porosity-free casting to withstand rugged use makes the old style gooseneck construction very costly, even before the cost of difficult machining and finishing operations is added to the basic casting.

Zinc alloys are most commonly used in die casting. Their coefficient of expansion is quite different from cast

iron, therefore repeated freezing and melting of die cast metal alloys sets up severe strains within the gooseneck which produce unexpected cracks even when the gooseneck is machined from a sound casting. The shape and weight of the gooseneck makes it a slow and difficult operation to remove it from the pot of molten metal and drain it whenever it needs replacement either because of insufficient capacity when molds are changed or because it becomes worn or cracked. Obviously, before the gooseneck may be removed from the pot, the plunger must be withdrawn therefrom which involves an additional relatively difficult operation.

With the foregoing in view, the primary object of this invention is to overcome the above indicated difficulties by providing a new and improved pressure chamber wherein the gooseneck construction is eliminated and the pressure chamber becomes a movable element. This permits both the pressure chamber cylinder and the plunger thereof to be made of special steel forgings, but even if these elements were cast, no delicate coring is involved. The improved pressure chamber construction permits most of the finishing to be done by grinding, hence it makes it possible to employ alloys too difficult to machine which will withstand the wear and corrosive action much better than materials heretofore employed. Furthermore, the improved pressure chamber weighs only a fraction of the weight of a conventional gooseneck of a corresponding capacity, which fact makes the use of costly alloys in the manufacture of pressure chambers embodying the invention no handicap.

The most commonly used metal for die casting consists of a zinc alloy containing 1% to 3% copper. There is a tendency for the copper in die cast metal to settle in the bottom of the melting pot. The turbulence created by the operation of the movable pressure chamber of the improved construction prevents the settling out of components of the die casting alloy.

Furthermore, the instant invention provides an improved pressure chamber construction, which, unlike the gooseneck, is substantially uniform and symmetrical about its axis. The molten metal in the old gooseneck construction was required to pass under pressure around a substantially 180 degree bend which was not only inefficient but placed the gooseneck under severe stresses at the sharp bend of the passage therethrough, all of which has been eliminated in the improved pressure chamber.

Because of its symmetry, the improved pressure chamber will retain a truer bore during repeated heating and cooling, and therefore the plunger therein can be held to closer tolerances than heretofore possible. As a result, leakage past the piston can be reduced to a minimum.

It is common practice to remove the plunger from conventional gooseneck construction when the casting machine is permitted to stand idle for any length of time. The plunger otherwise would have a tendency to "freeze," and no amount of pressure applied thereto will dislodge it. The present invention completely avoids this problem by the provision of means whereby the whole pressure chamber may be swung clear of the molten metal for the purpose of draining molten metal therefrom when the pressure chamber is hot.

A further object of the invention is to provide an improved pressure chamber assembly which replaces the conventional gooseneck construction arranged and mounted in operating relationship in the pot of a die casting machine in a manner that will cut to a small fraction the time normally expended in changing the old

gooseneck type pressure chamber from one capacity to another, thereby cutting to a minimum the usual relatively high percentage of "machine down" time required in the operation of prior art die casting machines.

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

Fig. 1 is a side elevational view with portions shown in section of a pressure chamber embodying the invention.

Fig. 2 is a front elevational view of the pressure chamber disclosed in Fig. 1.

Fig. 3 is a plan view of the pivot clamp preferably employed to swingably support the pressure chamber on the die cast machine frame.

Fig. 4 is a cross sectional view taken on the line 4—4 of Fig. 1 showing the pressure clamp preferably employed to connect the outlet of the piston of the pressure chamber to the nozzle of the die cast machine.

Fig. 5 is a front view part in section and part in elevation of the cylinder cage.

Fig. 6 is a top plan view of the cylinder cage turned ninety degrees in respect to the front view thereof shown in Fig. 5.

Fig. 7 is a front view of the cylinder cage trunnion and coupling element employed to couple the cylinder to its power link.

Fig. 8 is a side elevational view of the trunnion and coupling element.

Fig. 9 is a top plan view of the trunnion and coupling element.

Referring now to the drawing wherein like numerals refer to like and corresponding parts throughout the several views, the die casting pressure chamber **10** disclosed for the purpose of illustrating the invention consists of a swingable piston **11** removably pivoted by means of a pivot **12** to the frame **13** of a die casting machine, the said piston **11** being swung against and connected by means of a pin **14** in operating relationship over the butt end of a nozzle **15** of the die casting machine. A cylinder **16** is reciprocatingly mounted on the lower end of the piston **11**, the said cylinder **16** being carried by a cage **17** removably connected by means of a combined trunnion and coupling element **18** and link bars **19** to a suitable casting crank arm **20** on the die casting machine.

In a typical die casting machine of a type with which the pressure chamber **10** may be employed, a casting shaft **21** is mounted in pillow blocks **22** and **23** fixed to the casting machine frame **13**. The casting crank arm **20** is keyed on one end of the said casting shaft **21** while an actuating crank arm **24** is keyed on the other end thereof. The actuating crank arm **24** is moved arcuately by a piston **25** connected thereto by a connecting rod **26**. With such or similar construction, the cylinder **16** of the improved die casting pressure chamber **10** is caused to reciprocate. The said cylinder **16**, being submerged in a molten metal pot **27** of the die casting machine, supplies molten die cast metal **270** from the molten metal pot **27** under pressure into the die **28** through the nozzle **15**. The said die **28** is supported in any suitable manner on and carried by the die casting machine frame **13**.

The removable pivoting of the upper end of the swingable piston **11** to the frame **13** of the die casting machine is preferably accomplished by such means as the use of a bifurcated pivot block **30** secured to the said frame **13** of the die casting machine. The said pivot block **30** receives the pivot **12** which extends through the upper end of the said swingable piston **11**, and the pivot **12** is removably fixed into the said pivot block **30** by means of a keeper block **31** carried by a swinging keeper arm **32** pivoted at one end on a bracket **33** secured to the casting machine frame **13** and anchored at its free bifurcated end **320** under a keeper nut **34** threaded on a stud **35** pivotally connected to a bracket **36** secured to the casting machine frame **13**.

The lower end of the swingable piston **11** is bored and counterbored at **37** and **38** and the rear thereof is diagonally bored at **39** to communicate with the molten metal passage **40** in the nozzle **15** of the die casting machine. As best shown in Fig. 1, the rear of the swingable piston **11** is suitably concaved at the bore **39** to accommodate the butt end of the nozzle **15**. The front of the swingable piston **11** is provided with a suitable notch to receive the end of the pin **14** carried by a swinging keeper arm **42** pivoted at one end on a bracket **43** secured to the casting machine frame **13** and anchored at its free bifurcated end **420** under a keeper nut **44** threaded on a stud **45** pivotally connected to a bracket **46** secured to the casting machine frame **13**. A pair of washers **47** and a spring **48** are interposed between the bifurcated end **420** of the keeper arm **42** and the keeper nut **44** to prevent too great a pressure from being applied on the nozzle **15** of the die casting machine as a result of expansion when the machine is in operation through the pin **14** and swingable piston **11**. Studs **49** extending through the brackets **43** and **46** engage the sides of the body of the die casting machine nozzle **15** at suitable dimples formed therein to position it and to prevent it from falling into the molten metal pot **27** when the keeper arm **42** is released.

The foregoing construction permits the pressure chamber **10** to be completely removed from the die casting machine, or, as an alternate, the pressure chamber **10** may be pivoted about the pivot **12** completely out of the molten metal pot **27** whereupon molten metal is drained therefrom through the molten metal passage **160** in the cylinder **16**.

The cylinder **16** which is slidably mounted on the lower end of the swingable piston **11** is preferably tapered at **50** at the upper end thereof, and is provided with a pair of diametrically opposite axially facing seats **51**, one on each side of the said taper **50** onto which the cylinder return rods **52** are seated. The bottom of the said cylinder **16** is provided with an other-than-round key **53** for the purpose of maintaining the said cylinder **16** in non-rotatable relationship with respect to the cylinder cage **17**, the said cylinder cage **17** having a complementary keyway **54** in the bottom thereof to receive the said key **53**. The cylinder **16** has an inlet aperture **160** therein near the top thereof through which molten metal flows thereinto from the molten metal pot **27** when the cylinder **16** is retracted downwardly on the piston **11** as shown in Fig. 1.

The cage is preferably formed with a tubular body **55** having an internal diameter somewhat larger than the external diameter of the cylinder **16**. The cage **17** has a bottom **56** with the aforementioned keyway **54** cut therein to receive the key **53** formed on the bottom of the cylinder **16**. The key **53** maintains the cylinder **16** properly oriented in respect to the cage **17** so that the seats **51** on the cylinder **16** are always positioned in alignment with the thrust rods **52** of the trunnion and coupling element **18**. The front and rear of the cage **17** are provided with longitudinal slots **170** and the sides thereof have apertures **171** therein, the said slots **170** and apertures **171** being sufficiently large to assure a free flow of molten metal to, around and into the cylinder **16**. The top of the cage **17** has oppositely disposed arcuate members **58** welded thereto and include male bayonet fittings **59** which cooperate with the female bayonet fitting **60** formed on the trunnion and coupling element **18** for the purpose of removably securing the cage **17** to the trunnion and coupling element **18**.

The said trunnion and coupling element **18** is preferably formed with a rectangular head block **61** having an aperture **62** therethrough to freely accommodate the piston **11**. A pair of oppositely extending trunnions **63** extend laterally from the said head block **61**. Below the head block **61** is a circular fitting block **64** into which is cut the female bayonet fitting **60** which receives the male bayonet fittings **59** of the cage **17**. Extending downwardly from the fitting block **64** is a pair of cylinder

return thrust rods 52 which contact the top of the cylinder 16 at the seats 51 therein. It will be observed that the cylinder 16 is reciprocated by the cage 17 through the link bars 19 pivoted at their upper ends to the casting crank arm 20 by the pivot 200 and pivoted at their lower ends on the trunnion 63 of the trunnion and coupling element 18. It also will be observed that the cylinder 16 is free within the cage 17 except that it is properly oriented by the key 53 and it is maintained against the bottom of the cage 17 by the thrust rods 52. This means for holding of the cylinder 16 properly in the cage 17 and the employment of the trunnion and coupling element 18 makes the draining and changing of cylinders from one capacity to another extremely simple under the conditions which exist when handling hot pressure chambers of die casting machines.

Although but a single embodiment of the invention has been disclosed and described in detail, it is obvious that many changes may be made in the size, shape, arrangement and detail of the various elements of the invention to accommodate it to the various die casting machines presently in use, all without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. In a die casting machine including a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into a die, a pressure chamber means for transferring molten metal under pressure from said pot to said nozzle, said pressure chamber means including a piston swingably mounted on said machine and having its lower end submerged in the molten metal in said pot, a cylinder slidably mounted on the lower end of said piston and having an aperture therein through which molten metal enters said cylinder when the said cylinder is in an extended position in respect to the end of said piston, the said piston having a communicating passage from said cylinder located to register with said nozzle passage when said piston is swung thereagainst, pivoted spring loaded lever means removably securing said piston resiliently locked in said swung position whereby to accommodate the assembly to expansion and contraction, and means reciprocating said cylinder in respect to said piston forcing molten metal from said pot through said piston and said nozzle into said die.

2. In a die casting machine including a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into a die, a pressure chamber means for transferring molten metal under pressure from said pot to said nozzle, said pressure chamber means including a piston and pivot means swingably mounting said pressure chamber and piston on said machine with the lower end of said pressure chamber and piston submerged in the molten metal in said pot, pivoted lever means removably locking said piston pivot means in its swingable position on said machine, a cylinder slidably mounted on the lower end of said piston having an aperture therein through which molten metal enters the cylinder when the said cylinder is in an extended position in respect to the end of said piston, the said piston having a communicating passage from said cylinder located to register with said nozzle passage when said piston is swung against said nozzle, means removably securing said piston in pressure tight relationship against said nozzle, and means reciprocating said cylinder in respect to said piston forcing molten metal from said pot through said piston and said nozzle into said die.

3. In a die casting machine including a molten metal pot and a nozzle leading to a die, a pressure chamber comprising a piston removably and swingably suspended on said machine, a cylinder having an inlet thereto normally submerged in said pot slidably mounted on the lower end of said piston, the said piston having an outlet therefrom communicating with said nozzle, means releasably securing said piston in said piston-to-nozzle communicating position during the operation of the die casting machine, a cage carrying said cylinder, means reciprocating said cage and the cylinder carried thereby in respect to said piston, readily separable connecting means between said cage and said means reciprocating said cage to facilitate removal of said cage and cylinder from said piston, said separable connecting means including thrust rods engaging said cylinder to hold the same in a fixed position against the bottom of said cage, the said piston, cage and cylinder carried thereby being swingable as a unit out of said molten metal to drain the same when the machine is not in operation.

4. In a die casting machine including a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into a die, a pressure chamber for transferring molten metal under pressure from said pot to said nozzle, said pressure chamber including a piston swingably mounted on said machine having its lower end submerged in the molten metal in said pot, a cylinder, slidably mounted on the lower end of said piston having an aperture therein through which molten metal enters said cylinder when the said cylinder is in an extended position in respect to the end of said piston, the said piston having a communicating passage from said cylinder located to register with said nozzle passage when said piston is swung thereagainst, means removably securing said piston in said swung position, a cage carrying said cylinder, means reciprocating said cage and the cylinder carried thereby in respect to said piston whereby to force molten metal to said die, and key means on the bottom of said cylinder registerable with a keyway in the bottom of said cage maintaining said cylinder oriented to present the molten metal aperture therein at the lower side of said cylinder.

5. In a die casting machine including a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into a die, a pressure chamber for transferring molten metal under pressure from said pot to said nozzle, said pressure chamber including a piston swingably mounted on said machine having its lower end submerged in the molten metal in said pot, a cylinder slidably mounted on the lower end of said piston having an aperture therein through which molten metal enters said cylinder when the said cylinder is in an extended position in respect to the end of said piston, the said piston having a communicating passage from said cylinder located to register with said nozzle passage when said piston is swung thereagainst, pivoted spring loaded lever means removably securing said piston resiliently locked in said swung position whereby to accommodate the assembly to expansion and contraction, a cage carrying said cylinder, means reciprocating said cage and the cylinder carried thereby in respect to said piston whereby to force molten metal to said die.

6. In a die casting machine including a molten metal pot and a nozzle having a passage therethrough through which molten metal is injected into a die, a pressure chamber for transferring molten metal under pressure from said pot to said nozzle, said pressure chamber including a piston, pivot means swingably mounting said piston on said machine with the lower end of said piston submerged in the molten metal in said pot, pivoted lever means removably locking said piston pivot means in its swingable position on said machine, a cylinder slidably mounted on the lower end of said piston having an aperture therein through which molten metal enters the cylinder when the said cylinder is in an extended position in respect to the end of said piston, the said piston having a communicating passage from said cylinder located to register with said nozzle passage when said piston is swung against said nozzle, spring loaded means removably securing said piston in pressure tight relationship against said nozzle, a cage carrying said cylinder, means reciprocating said cage and the cylinder carried thereby in respect to said piston whereby to force molten metal to said die, readily sepa-

rable connecting means between said cage and said means reciprocating said cage to facilitate removal of said cage and cylinder from said piston, said connection including thrust rods engaging said cylinder to accomplish its return stroke, and means interconnecting said cylinder and said cage orienting said cylinder within said cage to maintain the molten metal aperture in said cylinder at the lower side thereof, the said piston, cage and cylinder carried thereby being swingable as a unit out of said molten metal to drain the same when the machine is not in operation.

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