Jan. 10, 1939. T. C. KORSMO 2,143,323

DIE CASTING APPARATUS

Filed Feb. 19, 1937 2 Sheets-Sheet 1

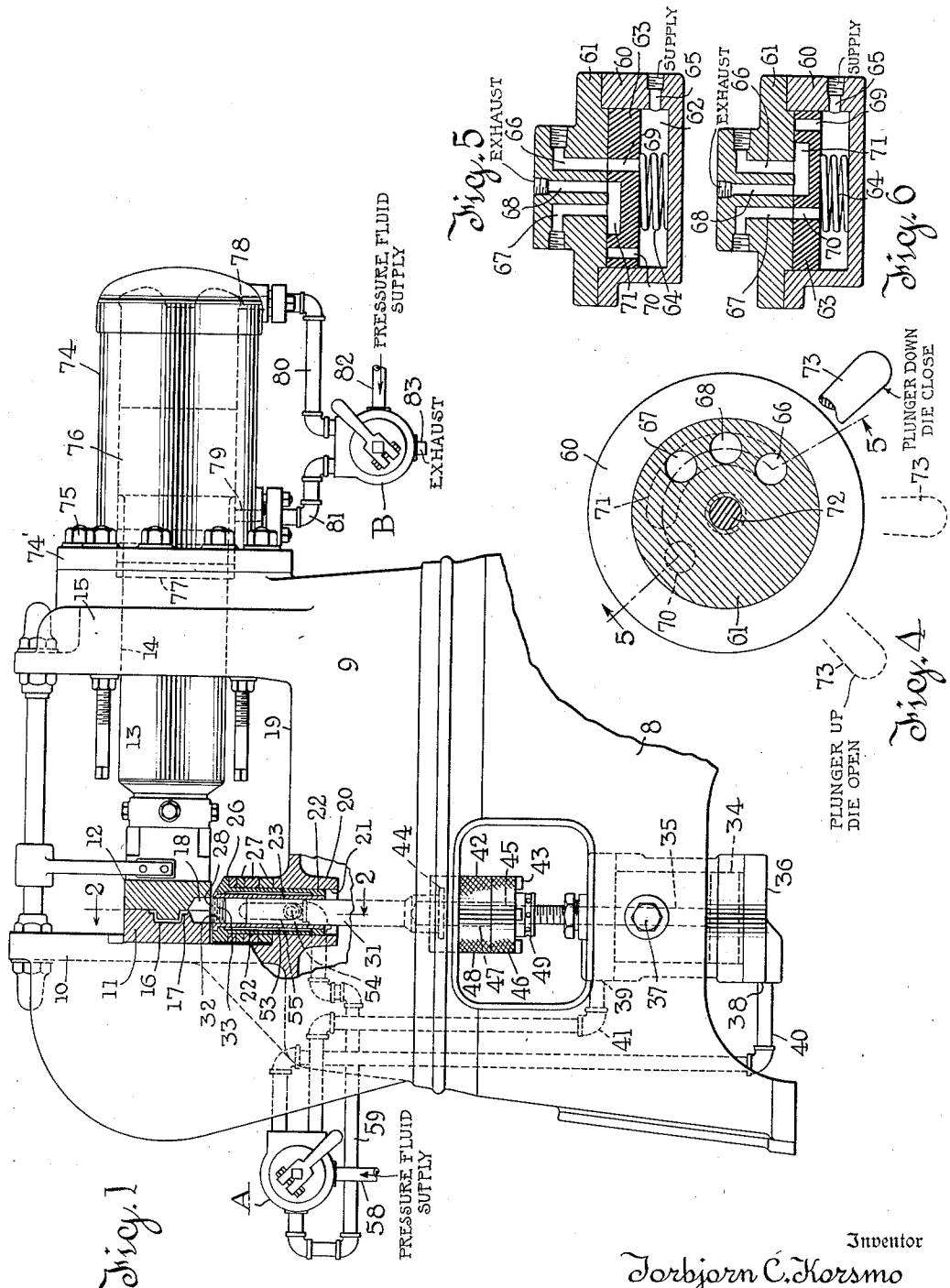


Fig. 1

Fig. 5 Fig. 6

Fig. 4

Inventor
Torbjorn C. Korsmo

By

Attorneys

Jan. 10, 1939. T. C. KORSMO 2,143,323

DIE CASTING APPARATUS

Filed Feb. 19, 1937 2 Sheets-Sheet 2

Fig. 7

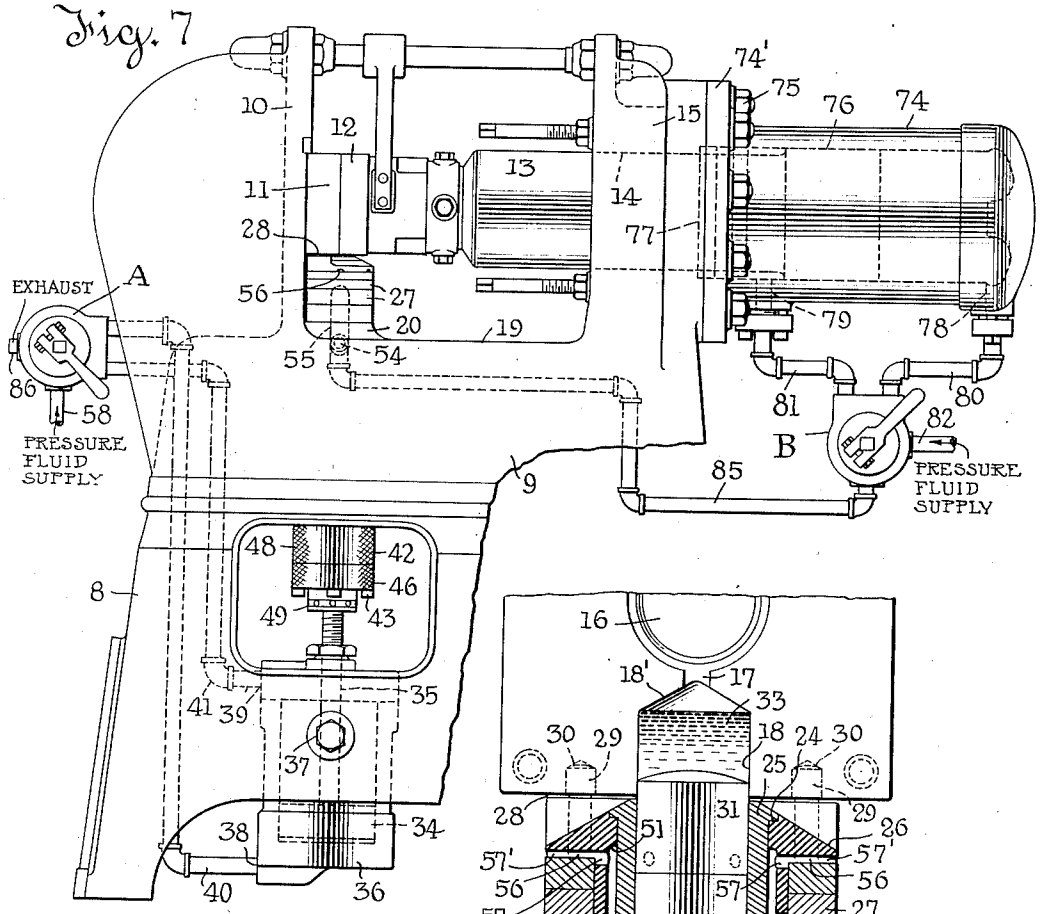


Fig. 2

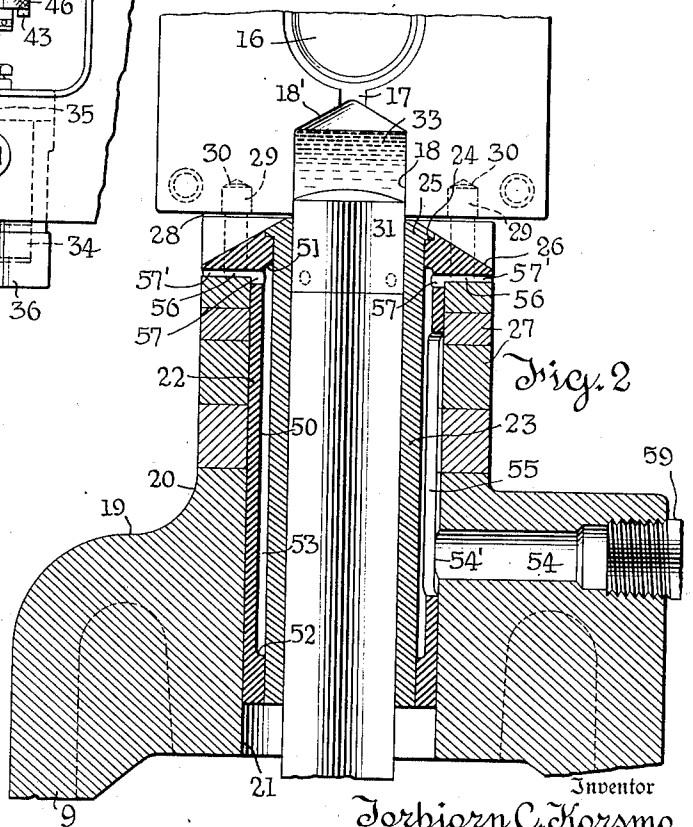
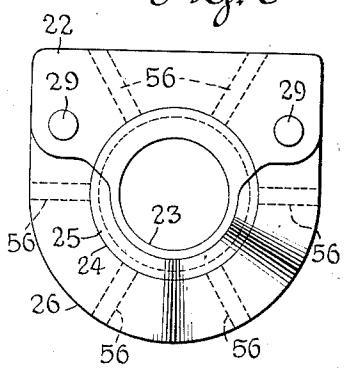


Fig. 3



Inventor

Torbjorn C. Korsmo

By

Dodge Reid Jones

Attorneys

Patented Jan. 10, 1939

2,143,323

UNITED STATES PATENT OFFICE

2,143,323

DIE CASTING APPARATUS

Torbjorn C. Korsmo, Madison, Wis., assignor to Madison-Kipp Corporation, Madison, Wis., a corporation of Wisconsin

Application February 19, 1937, Serial No. 126,708

12 Claims. (Cl. 22—68)

The present invention relates to die casting apparatus and particularly to providing for cooling of the means for feeding metal in moldable condition to the die for compression therein.

In a form of die casting machine now known, plunger means function to transfer a charge of metal from an upright tubular container or well into a closed, multi-part die and to compress the metal therein. The plunger is then retracted, the die opened to remove the casting, another charge of metal placed in the well, and the die closed again, ready for the plunger means to shoot the next casting. The die is of the two-part, vertically split type having a split gate or pressure chamber opening onto its lower face and into which the plunger moves during the die charging operation. The well, into the upper end of which the successive charges of metal are ladled when the die is open, and from which the charges are transferred to the die, is stationary on the machine, with its discharge end accurately registering with the split gate of the closed die, but slightly spaced from the die to freely permit necessary relative movement between the die parts during opening and closing of the die. The well is removable, and also adjustable to accommodate it to different sized dies.

The machine referred to is semi-automatic in that separate pressure fluid means such as piston and cylinder units are employed to automatically actuate the die and reciprocatory plunger of the metal feeding means in the desired direction, upon manual operation of separate control valves provided on the machine for this purpose.

It is an important object of the present invention to provide fluid means adapted to properly cool the metal feeding means of machines of the above-mentioned type. However, while the cooling means described hereinafter are particularly effective and desirable when applied to this type of machine, use of the cooling means is not limited thereto. They may be advantageously employed in other types of die casting apparatus, and hence it will be understood that such use is contemplated herein.

A particularly important object of the invention is the provision of fluid cooling means for the metal feeding means which are operated intermittently and automatically incidental to the operation of the machine, and hence only during operation of the machine. Thus, overcooling of the metal feeding means and the metal therein, and resulting cessation of production, are avoided, and cooling is provided automatically, but only when needed, so that the cooling means require no attention from the operator even when the machine is shut down. High speed operation of the machine to effect a maximum output of castings is permitted by providing for automatic cooling of the metal feed means every time a casting is made.

Another important object is to provide for efficient cooling of the metal feed means so that the feeding means will function properly at all times and will be protected from damage by overheating.

A further object is provision for connection of the cooling fluid conducting means to the well in any of its adjusted positions.

A further important object resides in using the exhaust pressure fluid from either the intermittently actuated pressure fluid means employed to operate the die, or the similar means which operate the metal feeding means, to serve as the cooling medium for the latter. This not only effects appreciable economy because of utilization of the otherwise wasted pressure fluid, but also provides for the desired automatic and intermittent operation of the cooling means incidental to operation of the machine. Other objects and advantages will appear hereinafter.

Reference is had to the accompanying drawings which illustrate two practical forms of a semi-automatic machine of the type mentioned which embody the features of the present invention.

Figure 1 is a front elevation of the preferred form of the machine in which the cooling fluid is provided by the metal plunger operating cylinder exhaust, certain parts being broken away to show the metal charge in the well ready to be transferred into the closed die.

Fig. 2, an enlarged section on line 2—2 of Fig. 1, showing certain parts in elevation, the details of the cooling passages in the well, and the metal charge raised into the pressure chamber in the die;

Fig. 3, a plan of the metal well with its liner;

Fig. 4, a vertical section through the hand control valve for either the metal plunger actuating cylinder or the die actuating cylinder of Fig. 1, the valve being shown in the position to which it is moved to lower the plunger or close the die, as shown in Fig. 1;

Fig. 5, a section on line 5—5 of Fig. 4, except that the parts are shown diagrammatically in order to bring the passages into a single plane;

Fig. 6, a similar view of the valve moved to the plunger elevating or die opening position; and

Fig. 7, a view similar to Fig. 1 showing a modi-

fied form of the machine in which the well cooling fluid is provided by the die operating cylinder exhaust.

Each of the machines illustrated comprises a frame made up of a hollow base 8 supporting a hollow frame body 9. Base 8 is open at the top and body 9 at the bottom to provide a free space for the metal plunger operating means described later. Base 8 and body 9 are suitably secured together at their abutting edges.

Frame body 9 has an upright 10 to which the fixed half 11 of the die is removably secured. The movable half 12 of the die is detachably affixed to one end of a ram 13 mounted for reciprocation, in an opening 14 extending through a second upright 15 on the opposite end of the machine, to open or close the die. The manner of operating die half 12 will be referred to later.

As shown in Figs. 1 and 2, the type of die illustrated, when closed, has a casting cavity 16, a restricted ingate 17 and a communicating cylindrical gate or pressure chamber 18 opening onto the bottom face of the die. Chamber 18 is located on the parting line of the die with half of the chamber in each half of the die. This chamber receives the charge of metal for the die through its open bottom end, the metal then being forced through ingate 17 and compressed under high pressure in cavity 16 by the metal supplying, transferring and compressing means now to be described.

Horizontal portion 19 of frame body 9 is provided with an upright portion 20 having a cylindrical passage 21 extending therethrough. Snugly, but slidably, mounted in passage 21 is a cylindrical metal magazine or well 22 having a removable bushing or liner 23. The well is rabbeted at 24 and the liner flanged at 25 to support the liner in place in the well, but permit its removal for renewal purposes. Liner 23 is arranged in exact alinement with cylindrical pressure chamber 18 in the closed die, and its interior diameter is substantially the same as that of the pressure chamber.

Well 22 has an annular flange portion 26 at its upper end. Surrounding the well between flange 26 and the upper end of frame portion 20, is a series of stacked, ring-like members 27. These members support the upper end of the well assembly in close proximity to, but slightly spaced from, the bottom face of the closed die, as indicated at 28 in Figs. 1 and 2, in order to permit free movement of die part 12. When the die is open and die part 11 removed, well 22 and its liner may be lifted out for renewal or other purposes. At this time, certain of the ring-like members 27 may be interchanged for others of different thicknesses, or certain of them added or removed, to change the vertical position of the well, as would be necessary were a die with its bottom face at a different level substituted. Guide pins 29, 29 on the upper end of well 22 (Figs. 2 and 3) engage sockets 30, 30 in fixed die half 11 to insure exact alinement between liner 23 and chamber 18.

A plunger 31 is mounted for reciprocation in the lower open end of well 22 and controls the metal receiving capacity thereof. When the plunger is in its lowermost position (Fig. 1), and movable die part 12 is retracted, metal in any suitable condition for casting, generally in the molten state, is taken from any convenient source of supply and ladled by the operator into the well above the plunger until well space 32 (Fig. 1) is substantially full. The die is then closed, and certain power means, described later, set into operation to raise plunger 31. The plunger transfers metal charge 33 from the well into pressure chamber 18 (as shown in Fig. 2), and then continues its movement in the pressure chamber, with which it has a somewhat closer fit than with well 22, to force the metal through ingate 17 and into die cavity 16. Plunger 31 is then lowered into the well, the die is opened and the casting removed. The machine is now ready for the next casting operation.

The means for operating plunger 31 comprise a power piston 34 having a rod 35 connected to the metal plunger, the piston operating in a cylinder 36 suitably secured at 37 inside of the machine base 8. Cylinder 36 is ported at 38 and 39 to receive pipe connections 40, 41, respectively, whereby compressed air may be admitted to or exhausted from each end of the cylinder to move piston 34 in the desired direction. The manual valve adapted to control operation of this piston will be described later.

A longitudinally adjustable connection between plunger 31 and piston rod 35 provides for regulating the lowermost position to which the plunger may move, i. e., the position with piston 34 at the bottom of its cylinder, so that the capacity of well space 32, and hence the size of metal charge 33, may be varied to take care of different sized castings. This adjustable connection consists of a coupling 42 comprising a plurality of separable members secured together by machine screws 43. Plunger 32 extends into the upper end of the coupling and has a flange and groove connection 44 therewith to prevent lengthwise movement between the parts. The upper end of piston rod 35 is threaded and extends through a threaded passage 45 in the lower member 46 of the coupling, and into a chamber 47 in member 48 of the coupling. A lock nut 49 on rod 35 secures the coupling. Thus, when nut 49 is retracted, coupling 42 may be rotated on rod 35 to raise or lower plunger 32 to any desired position in the well, whereupon the coupling is secured by the lock nut.

When plunger 31 is to be removed for renewal or other purposes, the die is first opened and die part 11 and the well parts removed. Screws 43 are then loosened and the parts of coupling 42 separated, so that plunger 31 may be tilted in opening 21 to clear the parts, and thus permit withdrawal of the plunger from below.

As stated, well 22 is spaced slightly from the bottom of the closed die and leaves a clearance 28. The presence of cylindrical pressure chamber 18 enables plunger 22 to move the metal charge 33 freely into the die, thus permitting passage of the metal past clearance 28 without leakage of metal therethrough. However, the metal charge is subjected to considerable pressure as it is forced through ingate 17 and into the die cavity and, in order to prevent escape of metal under high pressure at clearance 28, which would endanger the operator, provision is made for transfer of the entire metal charge to the die before the metal is placed under pressure. For this purpose, chamber 18 is made sufficiently large to receive the entire charge of metal 33, and of such shape as to permit its free passage therethrough until plunger 31 enters and seals the bottom end of the pressure chamber, as shown in Fig. 2. Plunger 31 then moves the metal into tapered gate portion 18' and forces the charge into the cavity through ingate 17. Obviously, the free movement of the metal into the pressure cham-

ber, above mentioned, is aided by the usual venting of the air from the die which takes place as the metal moves into the pressure chamber.

In order to prevent escape of metal under pressure at clearance **28** when the metal is being forced into the die cavity, the volumetric capacity and shape of chamber **18** must always be such as to receive freely the entire metal charge for the particular size casting being made, i. e., the volume of metal necessary to fill the die cavity and extend sufficiently into the pressure chamber **18** to be acted upon by the plunger. This volume determines the size of the metal charge which is to be placed in well **22**. It also indicates any necessary adjustment of plunger **31** in the well so that the capacity of well space **32** will be such that, when the well is full, it will contain a charge of proper volume.

No claim is made herein to the die casting machine features so far described, since they are fully covered by application Serial No. 72,161, filed April 1, 1936, by Raymond J. Schultz (Patent No. 2,103,438, dated December 28, 1937). The fluid cooling means for the metal feeding means for the die which form the subject matter of the present improvements, will now be described.

Referring first to the preferred form of construction of Figs. 1 to 6, it will be noted, in Fig. 2 particularly, that well sleeve **22** is formed internally with a wide annular groove **50** closed at its top **51** and at its bottom **52**. Thus there is provided, with well liner **23**, an annular chamber **53** extending substantially the entire length of the well and adapted to have a cooling fluid circulated therethrough. An inlet passage **54** (Fig. 2) is provided in frame portion **20** for introduction of the cooling fluid. Inner end **54'** of passage **54** registers with a slot **55** in well **22** to feed the cooling fluid into the lower portion of the cooling chamber, whence it is evenly distributed and circulated around the outside of well liner **23**, and into contact with substantially the entire outer surface of the liner and the entire inner surface of well sleeve **22**. The cooling fluid then escapes at the top of the well through a plurality of radial, equiangularly arranged outlets **56** formed by openings **57** in well sleeve **22** and grooves **57'** on the underside of well flange **26**. This arrangement of the outlets materially aids in uniform circulation of the cooling fluid throughout chamber **53** during its passage therethrough. The elongated form of slot **55** provides for admission of the cooling fluid irrespective of the height to which well **22** is adjusted for use with different sized dies.

A handle type, rotary control valve for power cylinder **36** is located at a convenient point on the machine, and is indicated at A in Fig. 1, with connections to pipes **40**, **41**, whereby pressure fluid may be simultaneously supplied to and exhausted from opposite ends of the cylinder to move piston **34** in the desired direction. The inlet of the valve is connected by pipe **58** to a continuous source of supply of compressed air, and the exhaust port thereof leads by way of pipe **59** to passage **54** (Fig. 2) communicating with the well cooling chamber **53**.

Details of valve A appear in Figs. 4 to 6. The valve comprises a casing **60** having a ported valve seat cover **61**. Chamber **62** in casing **60** contains a rotatable ported valve member **63** urged against seat member **61** by a coil spring **64**. Valve inlet **65** continuously supplies compressed air to chamber **62** from pipe **58**. Cylinder pipe line **41** connects to passage **66** in valve cover **61**, pipe line **40** to passage **67**, and exhaust pipe **59** to passage **68**, all of these passages opening onto the lower face of the cover in arcuate arrangement (see Fig. 4). Also arranged in alined, arcuate formation are a through passage **69**, a similar passage **70**, and a groove **71** in valve disk **63**. Valve member **63** is operated by a stem **72** (Fig. 4) having a handle **73**.

With metal plunger **31** lowered, as in Fig. 1, valve handle **73** is located in the position of Fig. 1 and the full line position of Fig. 4. At this time, the valve passages are connected as indicated in Figs. 4 and 5, full pressure flowing from valve chamber **62** through passages **69** and **66** to pipe **41**, and thence to the upper end of power cylinder **36**. At the same time, passage **70** is blanked, but groove **71** connects passages **67** and **68**, so as to exhaust the lower end of cylinder **36** through pipe **40** to exhaust pipe **59**, and thence through well cooling chamber **53** to the atmosphere.

When plunger **31** is to be elevated to shoot a casting, handle **73** is moved to the left hand dotted line position of Fig. 4. The positions of the ports at this time are shown in Fig. 6, in which full pressure from chamber **62** flows through passages **70** and **67** to pipe **40**, and thence to the bottom of cylinder **36** to move piston **34** upwardly and transfer the metal charge from the well to the die, where it is compressed into the cavity under extremely heavy pressure. At the same time, passage **69** is blanked, but groove **71** connects passages **66** and **68** to vent the top of cylinder **36** through pipe **41** to exhaust pipe **59**, and thence through well cooling chamber **53**, as before. Movement of handle **73** to the middle dotted line position of Fig. 4, blanks passages **69** and **70**, but connects passages **66** and **67** to passage **68**, and thus vents both ends of cylinder **36** into exhaust pipe **59**.

In the machine of Figs. 1 to 6, the separable die may be operated either manually or by power to open and close the dies. Since pressure fluid operating means preferably are used, this type is illustrated. These means comprise a power cylinder **74** having a flanged open end **74'** secured by bolts **75** to the outer face of upright **15**. Cylinder **74** receives the piston head **76** formed on the outer end of ram **13**, while the ram operates through a stuffing box **77** during its movements in cylinder **74**. This cylinder is ported at **78** and **79** to receive pipe connections **80** and **81**, respectively, whereby pressure fluid may be simultaneously admitted to and exhausted from opposite end of the cylinder to move piston **76** in the desired direction. A manually controlled valve for power cylinder **74**, similar to the metal plunger controlling valve A, is located at a convenient place on the machine and is indicated at B in Fig. 1, with connections to pipes **80** and **81**. The inlet of valve B is connected by pipe **82** to a supply of pressure fluid, and the exhaust port connects to a pipe **83** leading to atmosphere. Referring to Figs. 4 to 6, supply pipe **82** connects to inlet **65**, die operating cylinder pipe line **80** connects to passage **66**, and pipe line **81** to passage **67** in the valve.

With the die closed, handle **73** of die controlling valve B is located in the position of Fig. 1 and the full line position of Fig. 4, with the valve passages in the positions of Figs. 4 and 5, whereby, as will be clear, pressure fluid is supplied to the outer end of cylinder **74** and exhausted from the inner end thereof. Thus, the die closed position of valve B corresponds to the plunger lowered position of valve A. To open the die, handle

73 of valve B is moved to the left hand dotted line position of Fig. 4 so as to move the valve into the position of Fig. 6, whereby pressure fluid will be fed to the inner end of cylinder 74 and exhausted from the outer end thereof. Hence, the die open position of valve B corresponds to the plunger elevating position of valve A.

As indicated, the complete cycle of operations of the machine, starting with the die open, plunger lowered position, comprises placing the metal charge in the well, operating valve B to close the die, operating valve A to shoot the casting, operating valve A again to lower plunger 31, and then operating valve B again to open the die so the casting may be removed. During this cycle of operations, a large predetermined quantity of exhaust compressed air from power cylinder 36 is automatically fed twice to well cooling chamber 53 as a result of operation of valve A, once when the plunger is elevated and again when it is lowered. Thus, means are provided which not only effectively cool the metal feeding means, i. e., the well, its liner and the plunger therein, but which are operated automatically and intermittently incidental to the operation of the machine, and only during its operation.

Various practical advantages accrue from this arrangement. Cooling of the metal well each time a casting is shot permits high speed operation of the machine by preventing overheating and thus insuring proper operation of the metal feeding means. The cooling means function automatically, and only when needed, and hence require no attention from the operator, even when the machine is shut down. The intermittent cooling action effected by the operation of the machine prevents overcooling of the metal well and the metal charge, and resulting stoppages of production, particularly those stoppages which would occur as a result of overcooling between casting "shots" were continuous cooling, especially water cooling, used. Regardless of the number of shots per hour, the intermittent cooling maintains the proper temperature balance for the metal well. With constant cooling this balance would be destroyed, since some castings must be produced at a lesser number of shots per hour than others, and hence the time intervals during which cooling between shots may take place, are longer.

The cooling means described insure proper functioning of the metal feed means at all times by chilling the metal charge sufficiently to prevent passage of the metal into the limited clearance between well liner 23 and plunger 31; also by uniformly cooling the well throughout its length so as to avoid distortion or warpage of the well which would be caused by cooling restricted to only a portion thereof. This method of cooling also aids in otherwise protecting the metal feeding parts from damage which would result from overheating. Formation of groove 50 in well sleeve 22, and the consequent location of the cooling chamber 53 between the well parts, simplifies the construction and minimizes the expense and number of well liner renewals. Cooling of the well is also aided due to the fact that the well is always spaced from the die at 28, thus avoiding direct conduction of heat thereto from the die.

Use of compressed air to cool the well also is highly advantageous as compared with water cooling, because no drain connection is required for the cooling fluid after it has performed its cooling function, air leakages to atmosphere in the cooling fluid conducting parts, or at least minor leakages, are unobjectionable, and, since plunger operating piston 34 is compressed air actuated, there is already present an available source of air supply. Use of the exhaust fluid from cylinder 36 not only provides for automatic and intermittent cooling of the well, but involves utilization of a convenient source of supply already on the machine, thus avoiding the need of a separate independent source, and is also important from the standpoint of economy of operation of the machine, since efficient use is thus made of pressure fluid which otherwise would be wasted.

The modified form of machine appearing in Fig. 7 is the same in construction and general mode of operation as that of Figs. 1 to 6, except that in the modified form the exhaust pressure fluid from die operating power cylinder 74 is utilized to cool the metal well 22, instead of the exhaust from metal plunger operating power cylinder 36, as in the preferred form. For this purpose, the exhaust port 68 of die control valve B, instead of leading to the atmosphere, as in Fig. 1, is connected by a pipe line 85 to passage 54 (Fig. 2) leading to well ventilating chamber 53.

The metal feeding means for the die, in this form of the machine, may be manually or power operated, but preferably are operated by the compressed air actuated type of means of Figs. 1 to 6, and hence such means are illustrated. In the modified machine, valve A, which controls movement of piston 34 in cylinder 36 to operate the metal feed means, has its exhaust port 68 connected to atmosphere by a pipe 86, instead of to passage 54 leading to metal well cooling chamber 53, as in the construction of Figs. 1 to 6.

It will thus be clear that during the complete cycle of operations of the modified machine, a large predetermined quantity of exhaust pressure fluid from power cylinder 74 is automatically fed twice to well cooling chamber 53 as a result of operation of valve B, once when the die is opened and again when it is closed. Consequently, substantially all, if not all, of the important practical advantages set forth in connection with the preferred construction of Figs. 1 to 6, are also characteristic of the modified machine of Fig. 7.

While two practical embodiments of the invention have been illustrated and described herein, it is obvious to those skilled in the art that various changes in the construction may be made within the scope of the invention, except as the same may be limited by the appended claims.

What is claimed is:

1. In a die casting machine, including a frame and a separable die, the combination of a removable well on said frame adapted to receive metal for transfer to the die, said well having a cooling fluid circulating chamber extending entirely around the well and substantially the full length thereof; and means for supplying a cooling fluid to said circulating chamber to regulate the temperature of the well and any metal therein.

2. The combination in a die casting machine, including a frame and a separable die, a well on said frame adapted to receive metal for transfer to the die, said well having an annular cooling chamber therein provided with a cooling fluid inlet at one end and a plurality of fluid outlets at its opposite end arranged at spaced intervals entirely around said chamber; and means for supplying a cooling fluid to said fluid inlet.

3. In a die casting machine, including a frame and a separable die, the combination of a well on the frame adapted to receive metal for transfer to the die, said well having a chamber for circulation of a cooling fluid and a cooling fluid inlet therefor, the well being provided with an upper supporting flange having at least one groove on its under side communicating with the cooling chamber to form an outlet therefor; and annular means surrounding the well and engaging said flange and said frame to support the well.

4. In a die casting machine, including a frame and a separable die, a removable well mounted on the frame to receive metal for transfer to the die, said well comprising an outer tubular member and an inner tubular liner member provided with an elongated tubular cooling compartment therebetween having a cooling fluid inlet and an outlet.

5. The combination in a die casting machine, including a separable die, of a frame having a cooling fluid supply port; and a well on the frame adapted to receive metal for transfer to the die, said well being adjustable relatively to the die and provided with means for circulation of a cooling fluid which communicate with said fluid supply port in the frame irrespective of adjustment of the well.

6. The combination in a die casting machine, including a separable die, of a frame having a cooling fluid supply port; and an upright well mounted on the frame for vertical adjustment towards or from the die and adapted to receive metal for transfer to the die, said well having a chamber for circulation of a cooling fluid therethrough and an inlet for said chamber communicating with said supply port, the inlet being elongated vertically to insure registry with the supply port irrespective of vertical adjustment of the well.

7. In a die casting machine, including a separable die operable to open and close the die, the combination of means operable to feed metal to the die when closed; pressure fluid actuating means which are adapted to be energized incidental to the cyclic operation of the machine and to discharge exhaust fluid therefrom; and means for directing said exhaust fluid into contact with the metal feeding means to cool the feeding means and regulate the temperature of any metal therein.

8. In a die casting machine, including a separable die, the combination of means for feeding metal to the die; means for operating the die to open and close the same; means for operating the metal feeding means, one of said operating means being presure fluid actuated; and means for cooling the metal feeding means and regulating the temperature of any metal therein by exhaust fluid from said pressure fluid actuated operating means.

9. In a die casting machine, including a vertically split die having a split gate, the combination of operating means for opening and closing the die; an upright well located beneath the die and adapted to receive metal for transfer to the die, said well having means adapted for circulation of a cooling fluid therethrough; means adapted for operation to transfer metal from the well into the die; pressure fluid actuating means for one of said operating means; and means, operated automatically as a result of operation of the machine, for feeding exhaust pressure fluid from said pressure fluid actuating means to said fluid circulating means for the well.

10. In a die casting machine, including a separable die operable to open and close the die, the combination of a well adapted to receive metal for transfer to the die; means adapted for operation to transfer metal from the well to the die when closed; operating means for the die; operating means for the metal transfer means, one of said operating means including a piston and cylinder unit; valve controlled means for feeding pressure fluid to said cylinder and venting exhaust fluid therefrom to actuate the piston; and means for conducting said exhaust fluid into contact with the metal well for cooling purposes.

11. In a die casting machine, including a separable die operable to open and close the die, the combination of a well adapted to receive metal for transfer to the die; means adapted for operation to transfer metal from the well to the closed die; operating means for the die; operating means for the metal transfer means, one of said operating means including a piston and cylinder unit; means, including a control valve, for periodically supplying pressure fluid to said cylinder to operate the piston therein; and means controlled by said valve for conducting a cooling fluid into contact with said well.

12. The combination in a die casting machine, including a separable die, of operating means for the die; means for feeding metal to the die; means for operating the metal feeding means; means for directing a cooling fluid into contact with the metal feeding means; and cooling fluid supply means which are operated automatically as a result of operation of the machine so that cooling fluid is supplied to said fluid directing means only during operation of the machine.

TORBJORN C. KORSMO.