

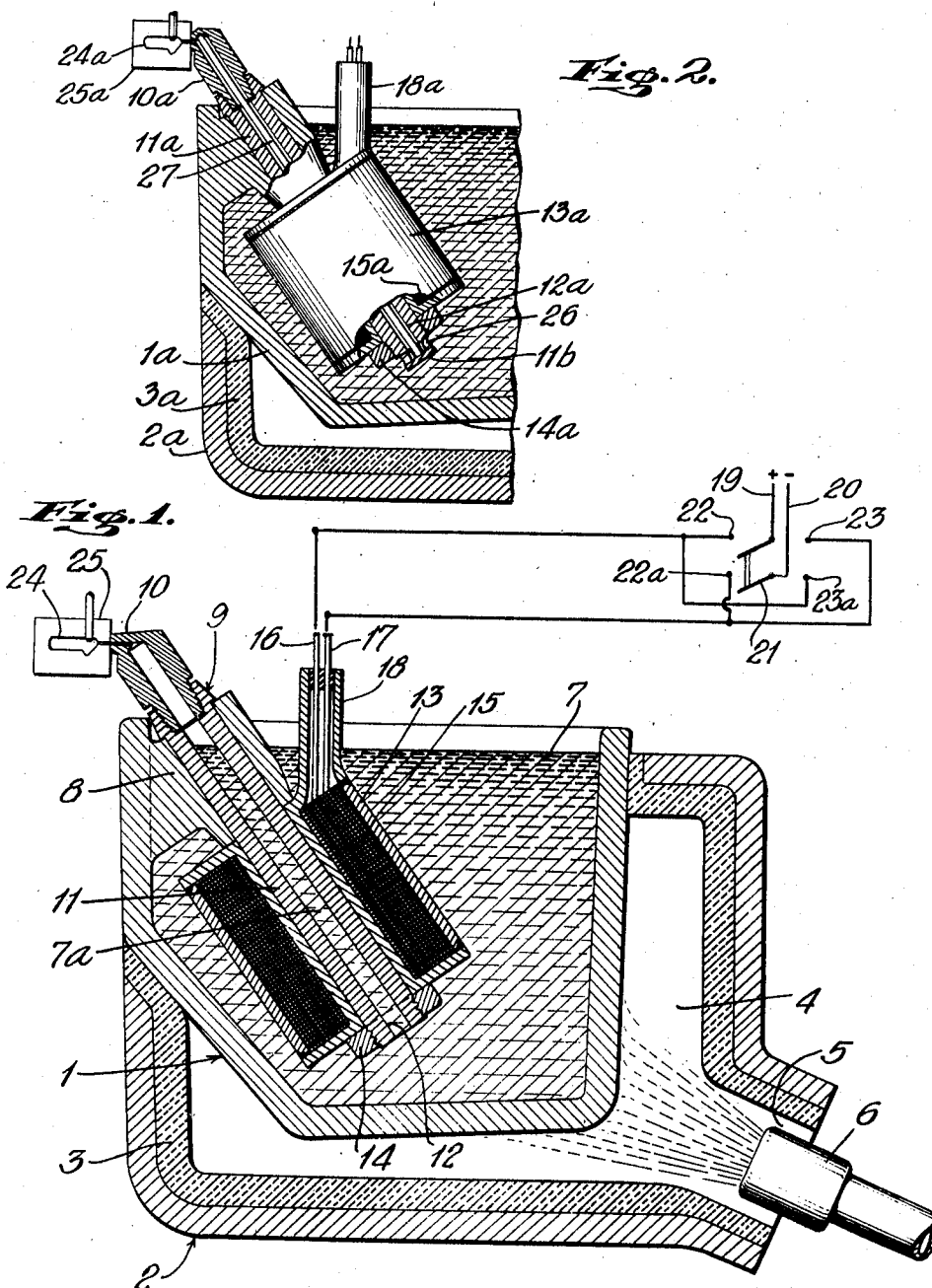
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METHOD OF DIE CASTING BY ELECTRICAL INDUCTION

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METHOD OF DIE CASTING BY ELECTRICAL INDUCTION

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The present invention relates to the art of die casting and particularly to a novel method of feeding or transmitting molten material from a pot or other container to the impression of a die in forming a predetermined casting, and more particularly the invention relates to a method of conveying or feeding the molten material by electric induction. The novel features of the invention will be best understood from the following description when taken together with the accompanying drawing, in which one embodiment of the invention is disclosed and in which the separate parts are designated by suitable reference characters, and in which:

Fig. 1 represents a diagrammatic sectional view of a melting pot and discharge, illustrating one method of carrying my invention into effect, and

Fig. 2 is a partial diagrammatic section showing another adaptation of the invention.

In accordance with the known methods of forming die castings in the casting of various types and kinds of metals and metal alloys, the molten metals have been discharged through the conventional gooseneck or discharge nozzle into the impression of the die by various types and kinds of mechanically actuated pistons or plungers, and further through the medium of compressed air. However, the objection to such known methods or processes has been in the jamming or seizing of the pistons or plungers due to wear, the difficulty experienced by virtue of oxidation, and various objectionable features which of course have not rendered the art of die casting inoperative, but have brought about considerable trouble and unnecessary expense in maintenance of the parts and in the repair thereof.

The difficulty in the use of compressed air, especially in connection with casting machines operating at relatively high speeds; that is to say, in producing two hundred or more independent castings per minute, has been in the exhausting of the air after each injection stroke. It will be understood that the air pressure must be relieved from the metal so as to prevent discharge of the molten material from the nozzle when the dies are not in registering alignment therewith, or in other words when the dies are open to remove a pre-formed casting. On the other hand, if a quick discharge of the compressed air were permitted, this would establish a vacuum which would be sufficient to suck the metal out of the melting pot through the air-line pipe and clogging the line. While various types of valves

have been tried to solve these problems, nevertheless the entire operation has been far from fool-proof.

To obviate the foregoing objectionable features of the present modes of procedure in the die casting art, I employ an electric coil around the gooseneck or the inner end portion thereof and pass an electric current through the coil which will develop or create an electro-motive force in the tubular gooseneck part which will act upon the molten metal therein to feed the same under pressure into a die or the impression of a die. By reversing the direction of the current, the molten metal may be moved in the opposite direction through the gooseneck. It will of course be apparent that the entire operation of the invention will be automatic in a machine designed for the purpose intended, and in the accompanying drawing is submitted simply a diagrammatic illustration which represents the performance of my novel method.

In the drawing, 1 represents a melting pot of any particular type or kind depending entirely upon the use to which the invention is applied. At 2 is shown a casing or housing enveloping the lower portion of the pot and preferably insulated as seen at 3. The casing forms a combustion chamber around the pot 1 as at 4 having an admission end 5 in which is disposed a gas burner 6 for heating the metal 7 in the pot 1. At this point it will of course be apparent that any type and kind of heating medium may be employed, the illustration in the accompanying drawing being simply to represent one possible arrangement.

Supported in the upper forward side of the pot 1, for example in a suitable mounting 8, is a conduit in the form of a gooseneck 9 having a nozzle discharge end 10 and an elongated tubular end 11, the bore 12 of which is exposed to the metal 7 in the pot 1 so that a level of the metal 7 maintained in the pot 1 will also be maintained in the bore 12 of the gooseneck, substantially as is illustrated. A sealed housing or casing 13 is arranged around the tubular portion 11 and held against displacement therefrom by a nut 14 in threaded engagement with the lower end of the tube 11. Within the housing 13 and surrounding the tube is a suitably wound electric coil 15, the circuit wires 16 and 17 from which extend outwardly through an upwardly directed tubular extension 18 on the housing 13 and are in circuit with a suitable source of electric supply represented by the circuit wires 19, 20 diagrammatically illustrated at the top of Fig. 1

of the drawing. The circuit between the wires 19, 20 and 16 and 17 is controlled by any suitable switch device 21, a double-throw switch being shown for illustrative purposes.

5 The switch 21 is adapted to complete circuits to pairs of contacts 22, 22a or 23, 23a in changing the direction of current flow through the coil 15. It will appear that the contacts 22, 23a are both in circuit with the wire 16, whereas the contacts 23, 22a are both in circuit with the wire 17. It will readily appear that when the switch 21 is in engagement with the contacts 22, 22a, a circuit will be formed such that the electric current will pass in one direction through the coil 15, whereas when in engagement with the contacts 23, 23a, a second circuit will be formed, such that the current will pass through the coil 15 in the opposite direction. The coil 15 is so wound that when one of said circuits is formed, the resulting electro-motive force will feed the molten metal 7a, in the bore 12, into the cavity 24 of a mold 25. By closing the other circuit, the pull of the electro-motive force is reversed, thus reversing the direction of flow of the material 7a or that portion thereof which may remain in the bore 12, so that it will be moved in the reverse direction, or in other words, backwardly into the pot. It will be understood that this latter operation will simply be momentary, the circuit through the coil then being preferably broken quickly enough so that the metal 7a in the bore will not go substantially below its original level.

35 It will of course be understood that in operating at high speeds, automatic means will be provided for controlling the making and breaking of the circuits to reverse the flow of current, and in such instances the return or inward drawing of the molten metal in the passage 12 may be checked by the reversal of the current before the metal, as at 7a, would have the opportunity to reach the level of the material 7 in the pot 1. In other words, by proper timing of the operations of the switch 21, the metal in the bore 12 may be maintained at a higher level than in the pot outside the gooseneck or conduit.

As in other die casting methods, commonly known in this art, the dies are of course chilled so as to establish a substantially instantaneous solidification of the molten material, notwithstanding the fact that this material may in truth be still at a high temperature.

55 It will of course be apparent that the various parts of the pot, gooseneck, casing, as well as the dies, will be constructed to adapt the same for use in connection with various types and kinds of molding materials. In this connection it will be apparent that any suitable metals or metal alloys may be employed which when subjected to the influence of the electro-motive force will, when disposed within the bore 12, be moved in both directions therein depending upon the direction of the electro-motive force. In other words, when the metal is moved through the gooseneck in one direction, it will be discharged under pressure into a cavity as at 24 of a die 25 and when moved in the other direction the metal remaining in the gooseneck will be drawn or pulled backwardly by the opposed electro-motive force.

75 The material of which the various parts of the apparatus shown in the drawing are constructed will naturally vary with the kind of molten metal which is contained within the apparatus. It is

not necessary to discuss those details for a proper understanding of the invention claimed herein. Refractory materials may be used wherever desired, particularly when dealing with molten metal at high temperatures. It will also be apparent that both direct and alternating currents and particularly current of high frequency may be used in carrying the invention into effect.

10 In Fig. 2 of the drawing I have shown another adaptation of the invention wherein certain structural features as disclosed in my prior Patent #2,145,553 granted January 31, 1939 are incorporated. That is to say, the tube 11a which takes the place of the tube 11, includes a protruding end wall or stop wall 11b at the lower end thereof, the tube being apertured as seen at 26 adjacent the end wall 11b to admit the casting material into the bore or passage 12a of the tube 11a. With this construction, a rod 27 is arranged within the passage 12a and extends into the discharge nozzle 10a and seats upon the end wall 11b and is utilized to more accurately control and regulate the flow of material through the tube 11a and through the discharge of the nozzle into the impression 24a of a die 25a. The rod 27 will also form a tubular passage of the passage 12a thus restricting the volume of the material and facilitating the action of electric induction upon the material in discharging the same from the nozzle. The pin or rod 27 is preferably of a metallic structure, thus adding to the surface exposure of the electrical force to the tubular column of metal rather than a solid body of metal as in the structure shown in Fig. 1.

35 Aside from the foregoing structural differences, the structure shown in Fig. 2 will be the same as that shown in Fig. 1, the parts 13a, 14a, 15a and 18a as well as the parts 1a, 2a and 3a being of the same construction as the correspondingly identified parts in Fig. 1.

40 It will be understood that in some instances I may utilize what is known as polyphase winding in the coils. In fact a winding will be used which will give the most beneficial results with respect to the electric induction desired to satisfy the different metals or alloys that may be employed or desired in the production of different types and kinds of castings.

45 For the sake of clarity and simplicity of this description, the movement of the heated or molten metal in the direction of the die may be termed upward or induced injection, whereas the other movement may be said to be downward or induced withdrawal or suck-back. It will also appear that in a process or method of the type defined, a very simple, efficient and substantially fool-proof method of forming die castings is provided. It will also be understood that from time to time, small quantities of the casting material will be introduced into the pot or crucible, consistent with the formation of castings, as is the usual practice, thus a substantially high level of casting material is always maintained in the pot or crucible as well as in the bore 12, 12a.

60 It will be understood that the basic principles of the method herein disclosed may be utilized in conjunction with various types and kinds of apparatus or processes wherein it is desirable to move molten metal at least in one direction through a tubular member or passage. The present illustrations are to be considered solely as diagrammatic illustrations of one adaptation of the invention.

75 Having fully described my invention, what I

claim as new and desire to secure by Letters Patent, is:

1. The herein described method of forming metallic die castings, which consist in providing
5 a body of heated molten metal, arranging one end portion of a tubular discharge member within said molten metal with the molten metal arranged in said member, subjecting the molten metal within said member to an electro-motive
10 force to move the molten metal in the direction of the discharge end of said member in pressure injecting the molten metal into the impression of a die at the discharge end of said member, and then subjecting the molten metal in said member
15 to an electro-motive force operating in the opposite direction to move the molten metal away from the discharge end of said member.

2. The herein described method of moving molten metal from a source of molten metal
20 supply to forming means, which consists in providing a tubular passage placing the molten metal in communication with the forming means, gravity feeding molten metal into one end portion of the passage, arranging an electric coil around
25 the inner end of said passage, passing a high frequency current through the coil to move the molten metal in said passage longitudinally of the passage and into said forming means, intermittently actuating the circuit to said coil to
30 provide intermittent formations of castings in the forming means, and reversing the current in said coil intermediate each casting operation to reverse the flow of the molten metal in said passage.

3. The herein described method of pressure
35 injecting molten metal into a die cavity by electric induction in forming die castings, which consists in providing an elongated gooseneck tube having a nozzle discharge at one end, exposing the other end portion of the tube to a source of
40 molten metal supply to normally dispose the molten metal in the bore of said second named end portion of the tube, arranging a pin with-

in the bore of the tube to form a tubular column of molten metal therein, subjecting said tubular column of molten metal to an electric induction force to move said column of molten metal in the direction of the nozzle discharge of said tube for
5 injection into the cavity of a die supported at said nozzle discharge, and then subjecting the column of molten metal in the tube to an electric induction force operating in the opposed direction to move the molten metal in the direction
10 of the source of supply.

4. The method of feeding molten metal into a mold cavity from a conduit which comprises creating an electro-motive force in the metal in
15 said conduit, said force having a direction lengthwise of the conduit and exerting a pull towards said cavity, and then discontinuing said force and creating another electro-motive force exerting a pull in the opposite direction lengthwise of the
20 conduit.

5. In combination, a mold having a cavity therein, a conduit having a discharge end adjacent said cavity, means to maintain a supply of molten metal in said conduit, and means to alternately create electro-motive forces in said metal,
25 with said forces exerting pulls lengthwise of the conduit and one pull tending to move said metal towards the cavity and the other tending to move the metal away from the cavity.

6. In combination, a mold having a cavity
30 therein, a conduit having a discharge end adjacent said cavity, means to maintain a supply of molten metal in said conduit, an electric coil surrounding said conduit and adapted when energized to create at different times forces in the
35 conduit having pulls in opposite directions lengthwise of the conduit, two circuits, each arranged to supply current to said coil in such a way as to create one of said forces, and means to alternately close each of said circuits while simultaneously
40 opening the other circuit.

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