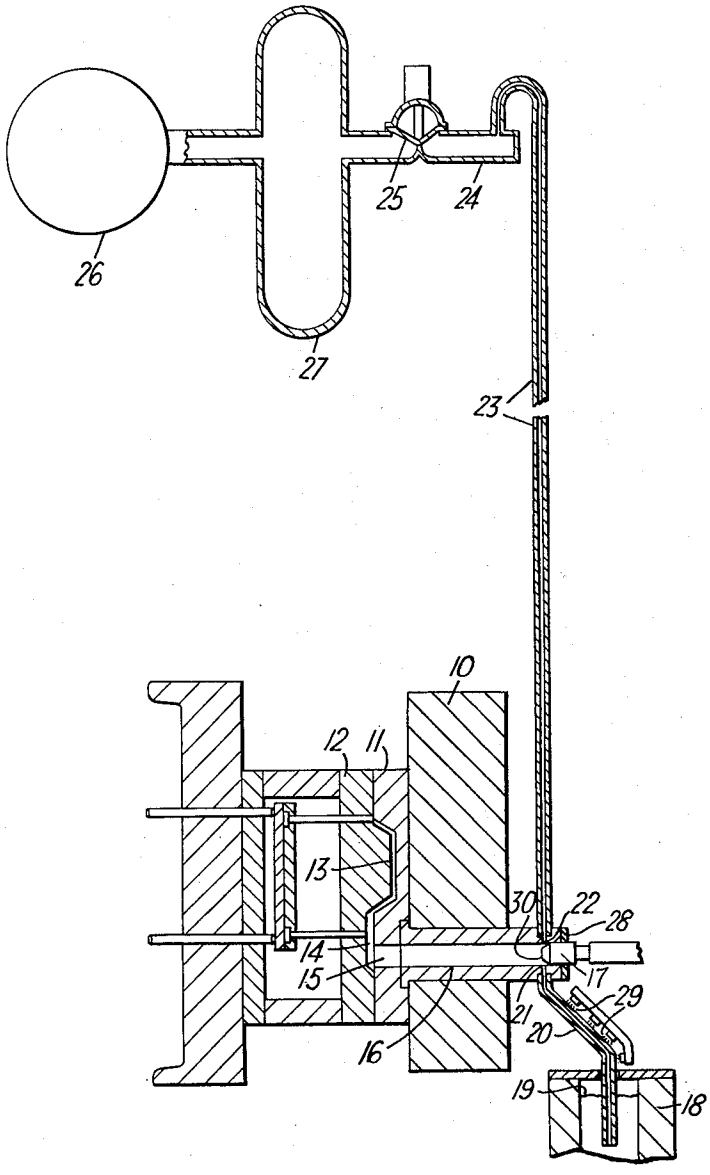
May 30, 1961 K. D. HESKETT 2,985,928

METHOD AND APPARATUS FOR DIE CASTING AND MOULDING

Filed Nov. 18, 1958



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United States Patent Office 2,985,928
Patented May 30, 1961

2,985,928

METHOD AND APPARATUS FOR DIE CASTING AND MOULDING

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Filed Nov. 18, 1958, Ser. No. 774,722

Claims priority, application Great Britain Nov. 22, 1957

1 Claim. (Cl. 22—73)

This invention relates to apparatus for the die casting of metals and for the moulding of other materials such, for example, as synthetic thermoplastic materials.

It is an object of this invention to provide improved apparatus for feeding flowable material such as molten metal or other mouldable material from a reservoir to a die in which the die casting or moulding operation takes place.

According to the invention, apparatus for feeding flowable material to the charging chamber of a die casting or moulding machine comprises a feed conduit which extends from a reservoir for the flowable material to a port in the charging chamber, a vacuum conduit which extends from a second port in the charging chamber and which is connected to a source of vacuum via a vacuum valve, and a charging plunger which is slidable in the charging chamber for delivering flowable material therefrom, said charging plunger acting to close the ports during its delivery stroke and to uncover them during its return stroke, and means being provided for preventing flowable material from being sucked along the vacuum conduit into the source of vacuum.

Preferably the means for preventing flowable material from reaching the source of vacuum consists of arranging the vacuum conduit to extend upwardly from the charging chamber for at least a sufficient portion of its length to render this sucking in of flowable material unlikely to occur. For example, the vacuum conduit could extend upwardly to a minimum vertical height of, say, one third of the height at which a column of the flowable material would be supported by a perfect vacuum, so that the source of vacuum would need to produce a degree of vacuum in excess of 33⅓% before flowable material could reach the top of the upwardly extending portion of the vacuum conduit, a condition which is unlikely to occur in practice.

However, as an additional safety measure in this connection, and for rapid production of vacuum conditions in the charging chamber, a vacuum reservoir may be located between the source of vacuum and the vacuum valve, said vacuum reservoir being of volume greater than the volume of the charging chamber and acting to receive any flowable material which may be sucked along the vacuum conduit and thereby prevent it from reaching the source of vacuum.

An embodiment of the invention will now be described with reference to the accompanying drawing, which is a diagrammatic sectional side elevation, showing those parts of a die casting machine to which the invention is applicable.

Referring to the drawing, the fixed die plate **10** of a die casting machine carries the usual fixed die part **11**. The movable die part which mates with the fixed die part **11** is indicated at **12**, and the said die parts **11** and **12** provide a die cavity **13** between them when in the closed condition illustrated, as well as the usual gate **14** and sprue **15**.

Mounted horizontally in the fixed die plate **10** is a

cylindrical charging chamber **16**, having slidable therein a charging plunger **17** which is shown in the drawing in its fully retracted position. A heated pot or crucible **18** for molten metal **19**, such as aluminium or zinc base alloy, is disposed below the charging chamber **16**, and a feed conduit **20** having its lower end immersed in the molten metal **19** extends upwardly from the crucible **18** to a port **21** in the bottom of the charging chamber **16**. Note that the charging plunger **17** uncovers the port **21** when in its fully retracted position, and that the plunger will obturate the port **21** during its delivery stroke.

A second port **22** is provided in the upper part of the charging chamber **16**, substantially opposite the first port **21** so that the plunger **17** acts to uncover and obturate both these ports, and this port **22** has a vacuum conduit **23** extending vertically upwardly therefrom to a height of, say, fifteen feet above the charging chamber **16**. The vacuum conduit **23** is joined to a horizontal extension **24** thereof which contains a vacuum valve **25**, whereby the vacuum conduit can be connected to or isolated from a source of vacuum such as a vacuum pump indicated at **26**.

A vacuum reservoir **27** is located between the vacuum pump and the vacuum valve, and it will be appreciated that in operating the machine the vacuum pump will operate continuously, so that when the valve **25** is closed the pump **26** continuously produces vacuum conditions in the reservoir **27** for rapidly producing a degree of vacuum in the vacuum conduit **23** when the valve **25** is opened.

With the parts of the apparatus in the positions shown in the drawings, i.e. ready for a cycle of operations to begin, said cycle commences with the opening of the vacuum valve **25**. The reservoir **27** ensures that a good degree of vacuum is produced virtually instantaneously in the vacuum conduit **23** and all spaces which are in communication therewith, viz. the feed conduit **20**, the charging chamber **16** and the die cavity **13**.

Molten metal enters the charging chamber **16** from the crucible **18** via the feed conduit **20** under the influence of the vacuum until the chamber is charged, and the end of this charging period is determined by the cutting off of the vacuum, either by closing the valve **25** or by effecting the charging stroke of the charging plunger **17** so that the plunger obturates the ports **21** and **22** before the valve **25** is closed. Thus the valve **25** may be closed either before or immediately after the plunger **17** obturates the ports **21**, **22**.

An air seal is indicated at **28**, between the piston **17** and the charging chamber **16**, and gas heating flames acting on the feed tube **20** are indicated at **29**.

The plunger **17** is provided with a projection **30** which lies between the opposed ports **21** and **22** when the plunger is in its retracted position, said projection acting to prevent the molten metal from passing directly from the feed conduit **20** to the vacuum conduit **23** in uninterrupted flow by deflecting the incoming molten metal horizontally along the chamber **16**.

It will be appreciated that the duration of the charging period during which molten metal is being sucked into the chamber **16** will ideally be of such duration that the chamber **16** is charged. The height of the vacuum conduit **23** provides a means whereby molten metal will normally be prevented from being sucked into the vacuum pump **26**, as already referred to previously, and the vacuum reservoir **27** provides a further safeguard in that it will receive any molten metal which may pass the valve **25** and thereby prevent it from reaching the pump **26**.

It will be appreciated that in accordance with normal practice in die casting machines the closing of the dies

11 and 12 will be effected by power-operated means, as also will the actuation of the plunger 17 in timed relation with the die movements. It will therefore be obvious that the vacuum valve 25 will also be power-operated, and in timed relation with the other operations of the machine, to be opened immediately after the dies have been closed and to be closed either just before or just after the plunger 17 commences its charging stroke.

While one arrangement in accordance with the present invention has been described as applied to a metal die casting machine it will be appreciated that similar principles can be applied to other types of moulding machine in which a molten or fluid metal including, for example, synthetic resinous materials is delivered to a die.

What I claim is:

In a pressure die-casting machine of the class operating by the known process of feeding a charge of molten metal by vacuum suction into a charging chamber through an inlet port in front of a retracted charging plunger and forcing the charge of molten metal into a die cavity by means of said charging plunger, the improvements providing for better and higher speed operation of the machine, and comprising the combination with said charging chamber and charging plunger of vacuum-creating

mechanism including vacuum reservoir and conduit means connected with a vacuum port in the charging chamber which is substantially opposite the molten metal inlet port for rapid creation of vacuum conditions in said chamber, and a projection on the face of the charging plunger operative to deflect molten metal entering said charging chamber through said inlet port away from said vacuum port, wherein the conduit means leading from the vacuum port to the vacuum-creating mechanism has a vertical height relevant to said charging chamber in excess of the theoretical head of the molten metal obtained with a perfect vacuum, so that the degree of vacuum induced in the chamber cannot possibly suck molten metal through said conduit means and into said mechanism.

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