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(54) Title  
**TOOL FOR MOULDING PLASTIC ARTICLES**

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(56) Prior Art Documents  
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(57) Claim

1. A mould for moulding objects from a heated charge of plastics material fed thereto, comprising a tool body, one side of which defines a mould face, a passage through said tool body extending into said mould face and bounded by internal annular walls within said tool body, a hot drop assembly for conducting and heating said charge of plastic material fed thereto for delivery thereof to said mould face, said hot drop assembly having an elongated injector body operatively mounted within said tool body passage and having an opening therethrough for passage therethrough of said heated charge of plastics material, heater means surrounding said hot drop assembly for further heating of the heated charge of plastics material within said hot drop assembly, said hot drop assembly being spaced at least in part of its extent from said internal walls of said tool body passage to define an annular space therebetween, a cooling gas exhaust passage connected to said annular space in said tool body passage, and gas cooling means for forcing a flow of cooling gas directly into said annular space between said hot drop assembly and said internal walls and then through said cooling gas exhaust passage, to effect the internal cooling of said

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tool body by transferring heat energy from said tool body passage and from areas of said tool body surrounding said tool body passage to said cooling gas passing into said cooling gas exhaust passage to thereby lower the operating temperature of said tool body so that high heat energy emitted from the heater means of the hot drop assembly will not be conducted by said tool body to said mould face and thus damage the object being moulded.

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COMPLETE SPECIFICATION  
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Lodged:

Complete Specification Lodged:  
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Related Art:

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Complete Specification for the invention entitled:

TOOL FOR MOULDING PLASTIC ARTICLES

Our Ref : 173383  
POF Code: 1221/1695

The following statement is a full description of this invention, including  
the best method of performing it known to applicant(s):

TOOL FOR MOULDING PLASTIC ARTICLESField of Invention

This invention relates to moulding of plastics and more particularly to new and improved tools with internal fluid cooling for moulding plastic articles from charges of hot plastic materials fed to the tooling.

Background of the Invention

Prior to the present invention, tooling for moulding plastics articles from a heated supply of plastic material generally requires a cooling system so that finally finished articles are produced without degradation from heat build-up at the mould face. For example drilled lines are provided in injection-moulding tooling around the hot drop assembly fixed within the tooling so that cooling liquids flowing therethrough can transfer the high heat energy transmitted from the hot drop assembly to the tool away from the face of the tool. With such cooling the part being moulded will not be damaged or destroyed by migration of heat to the tool face from the hot drop assembly. While such prior art cooling systems are effective they require extensive, labour-intensive cross-drilling of liquid flow paths, generally in a rectilinear pattern, that require plugging at drill entrance holes. In such cooling systems, liquids such as water used as the heat transfer agent may have impurities therein that build up and restrict or block such flow paths. The cooling water may also freeze and expand in cold weather during tool storage or shipment or during power failures, so as to damage or destroy the mould. Cooling liquids are also susceptible to leaking

through the mould and may cause marginal performance or damage of the tool or damage to the moulded product. With the above in mind the present invention provides a new and improved moulding tool  
 5 for moulding articles from heated plastic material featuring improved cooling of the tool to prevent the degradation of the part moulded.

#### Summary of the Invention

The preferred embodiment of this invention  
 10 employs a hot drop assembly mounted within a bore in injection mould tooling to raise the temperature of the molten plastic to prevent premature hardening of the plastics transiting therethrough before entering the working face of the mould. Generally, this hot  
 15 drop assembly has heater elements extending around a feeder tube that conducts the heated charges of plastic material from a hot runner system through the tool body and to the mould space defined by the tool body used to retain the mould core and mould cavity.

With this invention a new and improved  
 20 cooling system is provided which eliminates the use of the bored liquid cooling passages of the prior art and the requirement for cooling liquids for heat transfer. In the present invention the hot drop  
 25 assembly is radially spaced from the walls of the tool that define the bore for the hot drop assembly and the space is advantageously used by new and improved air cooling system and structure in which chilled air is injected deeply within the mould  
 30 core closely adjacent to the hot drop assembly. This cooling air transfers the radiating high heat energy from the hot drop assembly and directly from tool

body areas surrounding the hot drop assembly so that such heat energy will not migrate through the tool body to the face of the mould to degrade or destroy the article being moulded.

Accordingly, it is an object of this invention to provide new and improved mould for moulding plastics articles.

According to the invention, there is provided a mould for moulding objects from a heated charge of plastics material fed thereto, comprising a tool body, one side of which defines a mould face, a passage through said tool body extending into said mould face and bounded by internal annular walls within said tool body, a hot drop assembly for conducting and heating said charge of plastic material fed thereto for delivery thereof to said mould face, said hot drop assembly having an elongated injector body operatively mounted within said tool body passage and having an opening therethrough for passage therethrough of said heated charge of plastics material, heater means surrounding said hot drop assembly for further heating of the heated charge of plastics material within said hot drop assembly, said hot drop assembly being spaced at least in part of its extent from said internal walls of said tool body passage to define an annular space therebetween, a cooling gas exhaust passage connected to said annular space in said tool body passage, and gas cooling means for forcing a flow of cooling gas directly into said annular space between said hot drop assembly and said internal walls and then through said cooling gas exhaust passage, to effect the internal cooling of said tool body by transferring heat energy from said tool body passage and from areas of said tool body surrounding said tool body passage to said cooling gas passing into said cooling gas exhaust passage to thereby lower the operating temperature of said tool body so that high heat energy emitted from the heater means of the hot drop assembly will not be conducted by said tool body to said mould face and thus damage the object being moulded.

These and other features and advantages of the



present invention will become more apparent from the following detailed description and drawing in which:

Description of the Drawing

The figure is a diagrammatic illustration with parts in cross-section of an injection mould tooling with a hot drop assembly with a cooling system provided therefor.

Detailed Description of the Drawing

Referring now in greater detail to the drawing there is shown in the Figure a two-plate mould 10 assembled for operating at a predetermined temperature range for moulding articles from molten plastics material supplied thereto from an injection moulding machine through a conventional hot runner

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system 12. The hot runner system further heats the plastics material being conducted therethrough and directs this material through a discharge opening 14 into a hot drop assembly 16 that is operatively  
5 mounted within a tool 18 of the assembled mould 10. The tool 18 includes a mould cavity 20 which may be a separate part or integral with a face of the tool. As shown, the hot drop assembly extends in a passage through tool 18 formed by bore 22 and  
10 counter-bore 24. The hot drop assembly 16 includes a feeder tube with a cylindrical main body 26 and a reduced diameter nozzle 28 that fits within the counter-bore 24 and extends to a face 30 of the tool.

That feeder tube of the hot drop assembly  
15 has a longitudinally-extending feed passage 32 therethrough with an entrance 34 in a flanged lower end 35 communicating with the discharge opening 14 of the hot runner system and with a reduced diameter ejector passage 36 which terminates in an annular  
20 opening 38 for discharging the molten plastics material being fed through the feed passage. The discharge opening 38 communicates with a channel 40 formed in the face 30 of cavity retainer tool 18 and in the face of a core retainer tool 42 of mould 10  
25 that has a core 43 separate or integral with the tool that mates with the cavity 20 to define a mould space 44 therebetween for receiving the molten plastics and for shaping the article when the plastics material cools and solidifies.

30 As illustrated, the large-diameter portion of the feeder tube is encircled with heater bands 46 which are energized through an electrical control

system not illustrated. These heater bands operate in a temperature range significantly higher than mould 10 to prevent "freeze up" of the material whilst it is being injected into the mould space.

- 5 The heater bands 46 are radially spaced from the annular wall defining the bore 22. This generally annular space generally indicated at 50 is, in usual practice, a dead space to provide insulation for reducing the transfer of heat energy from the
- 10 energized heater bands to the wall of bore 22 and the body of tool 18 and the subsequent conduction of this heat energy to tool face 30. This insulation and the water cooling passages in many moulding tools accordingly assists in preventing heat-sensitive
- 15 plastics articles in the mould from being damaged or destroyed by the high heat energy of the heater bands required to keep the molten plastics material flowing through the hot drop assembly.

- The present invention importantly utilizes
- 20 space 50 with greater effectiveness to improve the cooling of the core space 50 and tool 18 by providing for efficient heat transfer deep within the bore for transmittal of heat from the space 50 and from areas of the tool body around core 22. In accordance
- 25 with a preferred embodiment of this invention there is a pressure-regulated supply of air from a compressor 54 or other source which is fed through line 56 to an air-chiller 58 for lowering the temperature of air supplied thereto.

- 30 The air-chiller has a manifold 60 with outlets 62,64 from which copper air-transmitting chill pipes 66 and 68 respectively extend. From

outlet 62 chill pipe 66 extends through a passage 69 between a mould base plate 72 that supports cavity retainer tool 18 and a base plate 74 that supports the flanged end 35 of the hot drop assembly,

5 manifold 60 and the chiller 58. Pipe 66 makes an angular bend at 78 into bore 22 and terminates in an open air end 80 deep within the bore 22 for discharging chilled air therein. Chill pipe 68 extends beneath the manifold mounting plate 74 and

10 is routed upwardly through a vertical opening 82 therethrough and into a reverse bend to extend in passage 69 back towards the chiller. At the hot drop assembly the chiller pipe 68 bends upwardly through an opening 71 in the mould base plate and into the

15 bore 22 to a terminal end 84 that also opens deep inside the bore 22 to deliver cooling air within the mould for the internal cooling thereof. The chiller 58 has manually-operable controls 86,88 which control and vary the temperature of the cooling air and

20 the volumetric output thereof.

This forced cooling air will flow over the walls of bore 50 in paths 90, 92 leading to the bore opening and exhaust out of the mould in the passage 69 between the mould base and the manifold mounting

25 base to transmit heat energy from tool 18. This importantly lowers the temperature of the tool particularly around the hot drop assembly to eliminate the need for an internal liquid cooling system and effectively removes the high heat energy

30 near its source. This heat energy which would otherwise be transmitted from the heater coils of the hot drop assembly into the tool body and then conducted by the tool body 18 to face 30 thereof.

Accordingly the high heat energy of the hot drop assembly which may operate in a temperature range up to 260°C (500°F) will not migrate to the face of the tool which operates in a temperature range up to 93°C (200°F). With this invention, this heat energy will not degrade the moulded plastic articles whilst said articles solidify in the mould space. This cooling arrangement is such that the temperature and volume output of the chiller can be controlled through the manually-operable controls 86, 88 to optimize the cooling of the tool body 18 and usage of energy. This cooling arrangement is also adaptable to tooling made from a wide range of materials such as zinc alloy, P20 steel, and epoxy resins, and applies to a wide range of injection-type tools that inject moulding materials to a mould face.

The claims defining the invention are as follows:

1. A mould for moulding objects from a heated charge of plastics material fed thereto, comprising a tool body, one side of which defines a mould face, a passage through said tool body extending  
5 into said mould face and bounded by internal annular walls within said tool body, a hot drop assembly for conducting and heating said charge of plastic material fed thereto for delivery thereof to said mould face, said hot drop assembly having an elongated injector  
10 body operatively mounted within said tool body passage and having an opening therethrough for passage therethrough of said heated charge of plastics material, heater means surrounding said hot drop assembly for further heating of the heated charge of  
15 plastics material within said hot drop assembly, said hot drop assembly being spaced at least in part of its extent from said internal walls of said tool body passage to define an annular space therebetween, a cooling gas exhaust passage connected to said annular  
20 space in said tool body passage, and gas cooling means for forcing a flow of cooling gas directly into said annular space between said hot drop assembly and said internal walls and then through said cooling gas exhaust passage, to effect the internal cooling of said  
25 tool body by transferring heat energy from said tool body passage and from areas of said tool body surrounding said tool body passage to said cooling gas passing into said cooling gas exhaust passage to thereby lower the operating temperature of said tool  
30 body so that high heat energy emitted from the heater means of the hot drop assembly will not be conducted by said tool body to said mould face and thus damage the object being moulded.



2. A mould according to claim 1, in which said cooling gas exhaust passage extends from an entrance to said tool body passage in said tool body.

5 3. A mould according to claim 1 or 2, in which an air-chiller is provided for supplying cooling air for said annular space in the tool body, and there are tubular feed pipes for transmitting said cooling air from said air-chiller to said annular space.

10 4. A mould substantially as hereinbefore particularly described, with reference to the accompanying drawing.

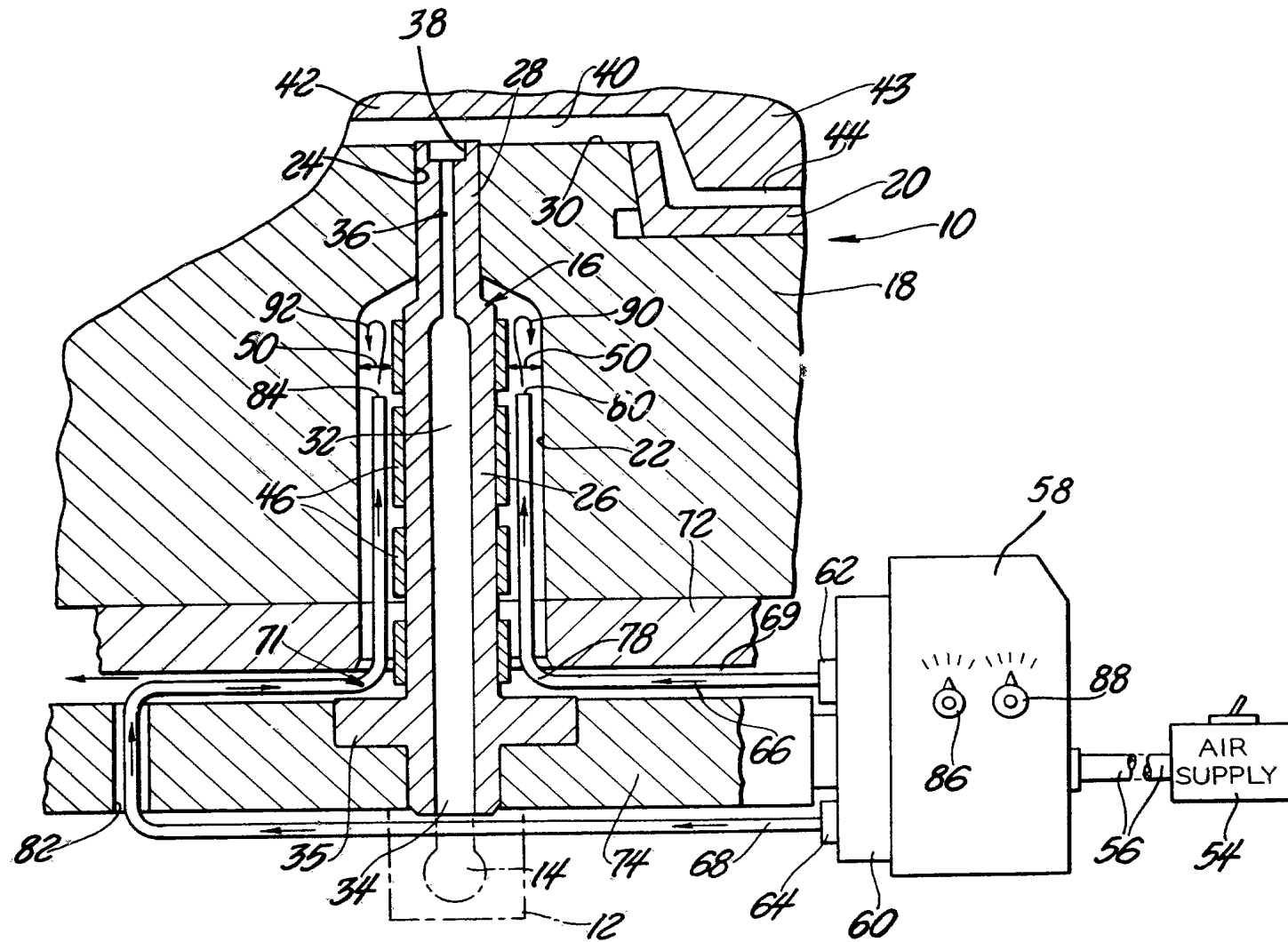
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