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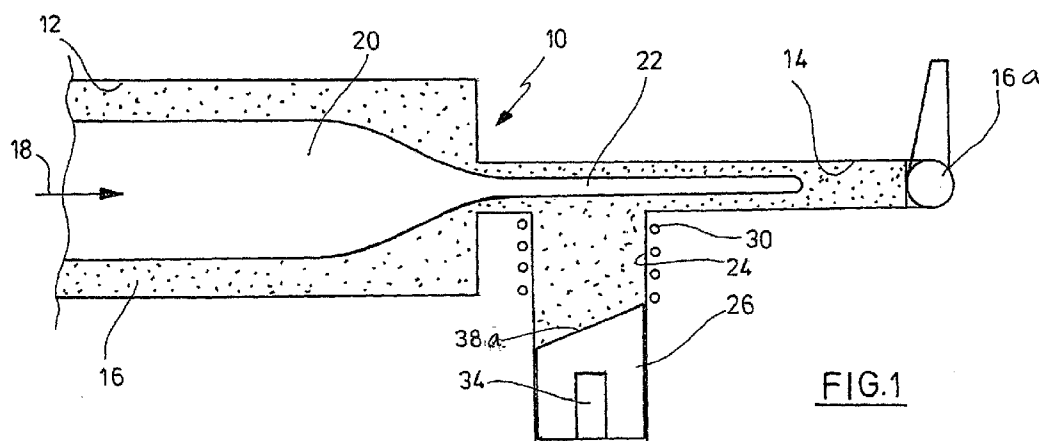
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(54) Title: METHOD FOR INJECTION MOLDING OF HOLLOW ARTICLES OF PLASTIC MATERIAL



(57) Abstract: An injection molding method to manufacture hollow plastic parts, whereby at least one plastic part's hollow is shaped by evacuating an internal portion of the flowable material of an injection mold's cavity (12) using a pressurized gas and a gate of said mold (10) and thereupon the molded article's aperture so made shall be sealed off, characterized in that, following said flowable material's being removed from a blind duct (24) into a gate branched to it and after being partly forced back into said hollow, said molded article shall be ejected from the injection mold (10).

METHOD FOR INJECTION MOLDING OF HOLLOW ARTICLES OF PLASTIC MATERIAL

The present invention relates to an injection molding method for plastic,
5 hollow molded articles.

Moreover the present invention also relates to an injection mold to make
hollow molded articles.

The manufacture of molded plastic articles using injection molding is
common state of the art. Moreover it is known to make hollow molded articles
10 in a manner that following introduction of the flowable plastic into the injection
mold cavity, pressurized gas shall be applied that shall evacuate a portion of
the flowable plastic from the mold cavity through the runner duct.

After it has been removed from the injection mold, the molded articles
comprises two apertures leading to the mold cavity, one aperture being
15 constituted by the gas nozzle and the other by the hollow duct in the sprue
which must be severed from the molded article.. If such a molded article must
be processed further, in particular in electroplating equipment, to fitted with
metal coating(s), said apertures must be mandatorily sealed. Sealing the gas
intake aperture raises no problems because a specific, geometric structure is
20 involved and therefore an appropriate stopper may be used. On the other
hand problems are encountered with the other aperture. The latter case
inevitably entails further processing steps to seal the hollow molded articles
against fluid leakage.

The objective of the present invention is to create a method
25 implementing full sealing of a hollow, injection molded article without entailing
additional finishing or resort to a further injection molding implement.

In the method of the present invention, a specific quantity of flowable plastic is moved, by a power-driven plunger from a blind duct communicating with the runner duct into this runner duct. In this manner, the plastic in the blind duct moves into the runner duct in the sprue and partly back into the molded article's hollow. In this manner, the molded article's aperture is sealed off completely.

Accordingly, the method of the present invention allows sealing the molded article's cavity aperture in one step jointly with the making of the part in the injection mold.

It is known that the runner duct must be removed from the molded article. In one embodiment mode of the present invention, the molded article's runner duct is separated from it using the plunger.

In order that the material within the blind duct be sufficiently flowable, the plunger or the blind duct may be heated, for instance, by an appropriate electrical heater.

The injection molding equipment of the present invention to manufacture a hollow molded article comprises a blind duct which is connected to the runner duct comparatively close to the mold cavity. The bottom of the blind duct is constituted by the plunger which -- as already mentioned -- is driven by a power element. Illustratively this power element is a pneumatic or hydraulic cylinder. When manufacturing the injection molded article of the invention, the runner duct and the blind duct are filled up with a flowable material. A pressurized gas is introduced and an internal region of the flowable material within the mold cavity is removed through the runner duct, as a result of which a hollow duct of more or less pronounced length is constituted in that runner duct and extends through the blind duct and beyond. When the plunger is used to force the material out of the blind duct into the runner duct, part of said material migrates toward the mold cavity, sealing said cavity's

aperture at the junction with the runner duct. The said aperture is completely sealed off in this manner, and as a result, even after ejecting the molded article and severing the runner duct, the mold cavity shall be impermeably sealed.

5 In one embodiment mode of the present invention, the plunger surface facing the runner duct is oblique relative to the mold cavity. In this manner more material is forced toward the mold cavity than in the opposite direction in what remains of the runner duct.

10 In another embodiment mode of the present invention, the plunger may be a cutting or severing tool to separate the runner duct from the molded article. Appropriately recesses complementary to the plunger shape may be constituted in the runner duct wall on the side opposite the blind duct to receive the plunger when it forces material out of the blind duct and as applicable also separates the runner duct.

The invention is elucidated below in relation to the appended drawings.

15 **Fig. 1** schematically shows manufacturing a molded article in an injection mold, following evacuation of a middle zone using compressed gas, and

Fig. 2 shows the configuration of Fig. 1 after a portion of the evacuated material has been forced back into the mold cavity.

20 Figs. 1 and 2 show an injection mold 10. Said mold illustratively is constituted by two mold halves which are selectively joined to each other to define a mold cavity 12 or to be moved apart in order to eject a molded article. The mold cavity 12 communicates with a runner duct 14 leading to a sprue 16a. Illustratively this sprue 16a communicates with an extruder from which
25 flowable plastic is injected through the sprue 16a into the mold cavity 12 In Fig. 2, the injected material is denoted by 16. In a gas internal pressure procedure, pressurized gas is introduced through a so-called (omitted) gas needle into the

mold cavity 12 as indicated by the arrow 18. In this manner, partly set material 16 is evacuated from the mold cavity 12 and forced back into the duct 14. In this manner, a hollow 20 of the molded part is constituted which extends into the duct 14 by means of a hollow channel 22.

5 Near the mold cavity 12, the duct 14 communicates with a transverse duct. It is sealed off by a plunger 26 to define a blind duct 24. The plunger 26 is driven by a power element and, as indicated in Fig. 2, it can be adjusted toward the duct 14 as indicated by the arrow 28.

10 The blind duct 24 may be heated by an electric heater 30. Moreover, the plunger 26 may be fitted with a heater element 34 to raise the temperature of the plunger 26.

15 The blind duct 24 is filled with flowable material 16 during injection molding. When the plunger 26 is operated as indicated in Fig. 2, the flowable material is forced out of the blind duct 24 and toward the duct 14 and, as a result, it is displaced along both sides of this duct 14 as illustrated at 36 and 38, respectively. The plunger 26 is fitted with an end face 38a, oblique to the mold cavity 12, so that, when said plunger is actuated, more flowable material 16 is displaced toward the mold cavity 12 than in the opposite direction. In this manner a lug or stopper 40 is formed in the molded article's aperture -- that
20 was formed by the introduction of gas -- which completely seals said cavity off duct 14.

25 The duct 14 too can be separated from the molded article using the plunger 26. Appropriately the duct 14 may be fitted with a recess 42 (shown in dashed lines) which is complementary to the plunger 26 and situated in the wall opposite the blind duct 24.

 Alternatively the duct 14 may be terminated conventionally, in which case a rupturing site 44 would be shaped into it.

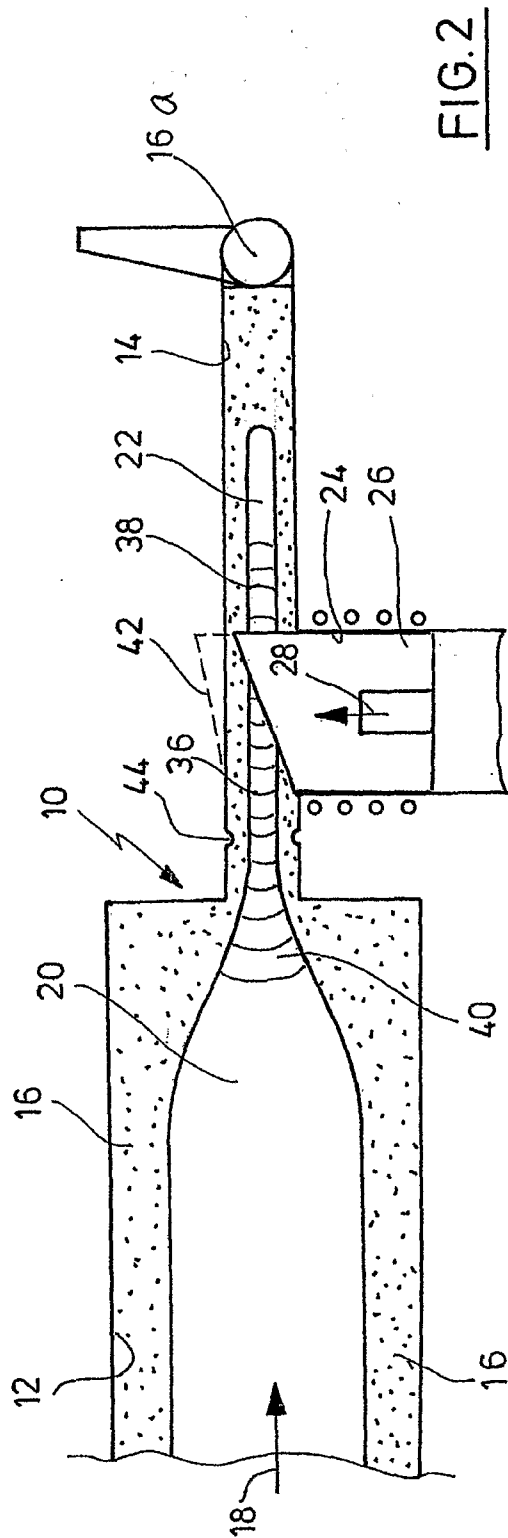
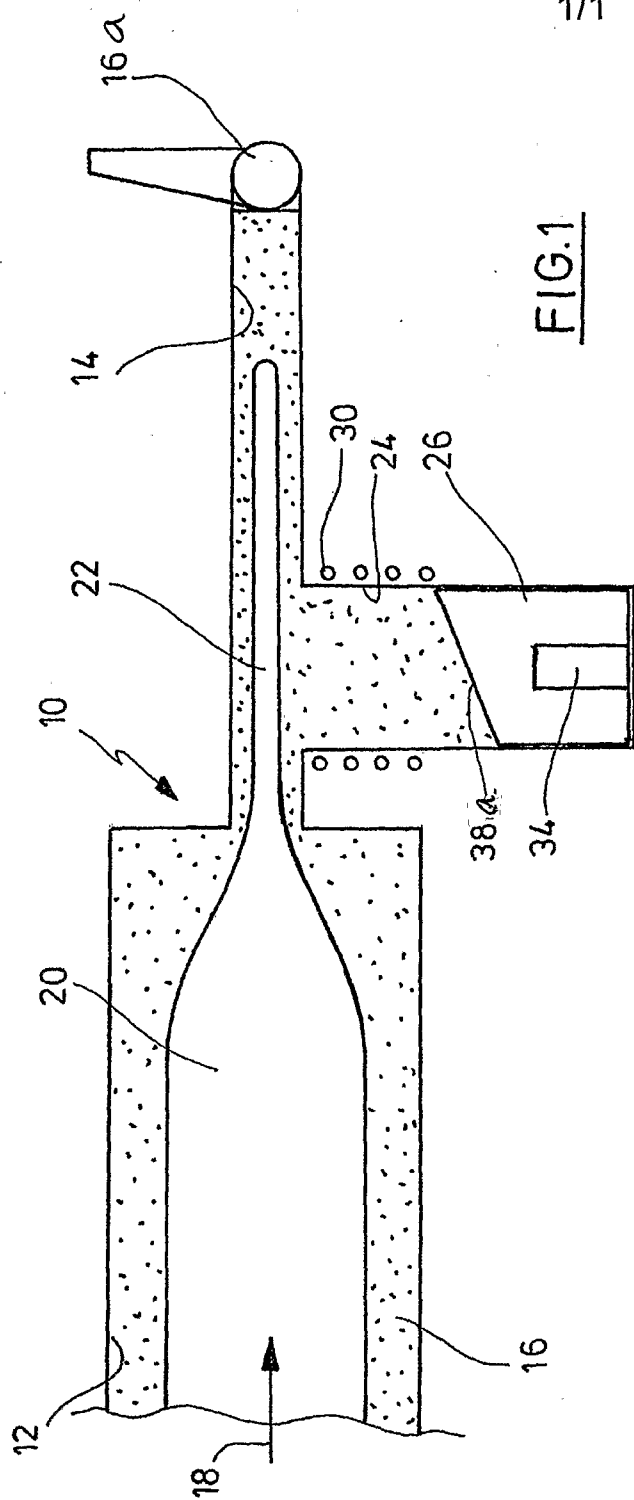
CLAIMS

1. A method for injection molding of a hollow part of plastic material, whereby a cavity of the hollow part is shaped by evacuating an internal portion of the flowable plastic material in a cavity of an injection mold by using pressurized gas whereby the material is pressed into a runner duct of the mold,
characterized in that
after pressing the material into the runner duct, the material is partially forced back into the cavity of the hollow part by means of a power actuated plunger located in a blind channel which is connected to the runner duct.
2. A method of claim 1, wherein a lug formed by the forced back material is separated from the part by means of the plunger.
3. A method of claim 1 or 2, wherein the plunger and/or the blind channel is heated.
4. A method of claim 1, wherein the lug of the part is formed with a breaking point.
5. An injection mould for the manufacture of an article having at least one hollow space, comprising
a preferably split injection tool having at least one cavity, the cavity being connected to a casting channel through which plasticized mass is pressed into the mould cavity, and
a gas passage through which gas under pressure is supplied into the mould cavity to remove an inner portion of the plasticized mass from the mould cavity through the casting channel,

characterized in that
adjacent to the mould cavity (12), a blind channel (24) is formed
connected to the casting channel (14), the bottom of the blind channel being
formed by a plunger (26) within the blind channel and the plunger (26) being
actuatable by power means to move the plunger towards the casting channel
(14).

6. The injection mould of claim 5, wherein a surface of the plunger facing the casting channel (14) is inclined relative to the casting channel (14).
7. The injection mould of claim 5 or 6, wherein the plunger (26) includes electrical heating means (34).
8. The injection mould of claim 5, wherein electrical heating means (30) are associated with the blind channel (24).
9. The injection mould of claim 6, wherein the plunger (26) is formed as a cutting or separating tool.
10. The injection mould of claim 9, wherein the wall of the casting channel (14) opposite to the blind channel (24) has a recess (42) complementary to the shape of the plunger (26) for receiving the associated plunger's portion upon its movement into the casting channel (24).

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INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2007/004123

A. CLASSIFICATION OF SUBJECT MATTER

INV. B29C45/17 B29C45/38 B29C45/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	abstract; figures 1-8	1-5, 7-9
X	JP 09 272138 A (MUSASHI KAKO KK) 21 October 1997 (1997-10-21)	1-5, 7-9
Y	abstract; figures 1-7	1-5, 7-9
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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G document member of the same patent family

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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

International application No

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