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(54) Title: A VALVE FOR CONTROLLING FLOW OF A MOLDING MATERIAL IN A MOLDING SYSTEM

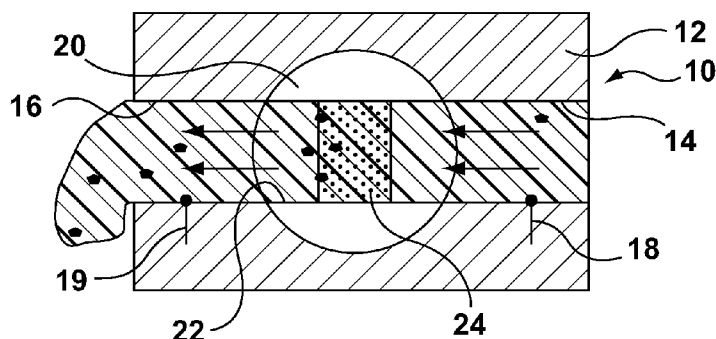


FIG. 1C

(57) Abstract: Disclosed herein, amongst other things, are a valve (10) for controlling flow of a molding material in a molding system (50) and a related method of molding involving the use thereof. The valve (10) includes a valve member (20) that is configured to cooperate with a valve body (12) for controlling the flow of the molding material through the valve (10) and a filter (24) being associated with the valve member (20) for filtering, in use, the molding material passing therethrough.

**A VALVE FOR CONTROLLING FLOW OF A MOLDING MATERIAL
IN A MOLDING SYSTEM**

TECHNICAL FIELD

Non-Limiting embodiments disclosed herein generally relate to a valve for controlling flow of a molding material in a molding system and a related method for the operation thereof.

SUMMARY OF THE INVENTION

In accordance with an aspect disclosed herein, a valve is provided for controlling flow of a molding material in a molding system. The valve includes a valve member that is configured to cooperate with a valve body for controlling the flow of the molding material through the valve and a filter being associated with the valve member for filtering, in use, the molding material passing therethrough.

In accordance with another aspect disclosed herein, a method is provided for operating a molding system having a valve for controlling flow of a molding material. The valve includes a valve member that is configured to cooperate with a valve body for controlling the flow of the molding material through the valve and a filter being associated with the valve member for filtering, in use, the molding material passing therethrough. The method broadly includes a molding cycle and a flushing cycle. The molding cycle includes positioning the valve member into a filtering orientation wherein a connecting channel is oriented to fluidly connect an upstream channel to a downstream channel in the valve body, urging the molding material to pass through the valve wherein the molding material flows through the filter in a first direction for removing contaminants entrained therewith and positioning the valve member into a blocking orientation wherein the connecting channel is oriented to fluidly isolate the upstream channel from the downstream channel wherein the molding material is blocked by the valve member from flowing from the upstream channel to the downstream channel. The flushing cycle includes positioning the valve member into a flush orientation wherein the connecting channel is oriented to fluidly connect the upstream channel to the downstream channel and urging the molding material to pass through the valve wherein the molding material flows through the filter in a second direction for flushing the contaminants from the filter.

In accordance with a further aspect disclosed herein, a controller is provided, the controller including instructions being embodied in a controller-usable memory, the instructions for directing the controller to execute the method for operating a molding system having a valve for

controlling flow of a molding material. The valve includes a valve member that is configured to cooperate with a valve body for controlling the flow of the molding material through the valve and a filter being associated with the valve member for filtering, in use, the molding material passing therethrough. The method broadly includes a molding cycle and a flushing cycle. The molding cycle includes positioning the valve member into a filtering orientation wherein a connecting channel is oriented to fluidly connect an upstream channel to a downstream channel in the valve body, urging the molding material to pass through the valve wherein the molding material flows through the filter in a first direction for removing contaminants entrained therewith, and positioning the valve member into a blocking orientation wherein the connecting channel is oriented to fluidly isolate the upstream channel from the downstream channel wherein the molding material is blocked by the valve member from flowing from the upstream channel to the downstream channel. The flushing cycle includes positioning the valve member into a flush orientation wherein the connecting channel is oriented to fluidly connect the upstream channel to the downstream channel and urging the molding material to pass through the valve wherein the molding material flows through the filter in a second direction for flushing the contaminants from the filter.

These and other aspects and features of non-limiting embodiments will now become apparent to those skilled in the art upon review of the following description of specific non-limiting embodiments of the invention in conjunction with the accompanying drawings.

DETAILED DESCRIPTION OF THE DRAWINGS

The non-limiting embodiments will be more fully appreciated by reference to the accompanying drawings, in which:

FIGS. 1A-1C depicts various operational states of a valve according to a first non-limiting embodiment for controlling flow of a molding material in a molding system;

FIG. 2 depicts a schematic representation of a molding system in accordance with a non-limiting embodiment that includes the valve of FIG. 1A-1C;

FIG. 3 depicts a flow chart of a method for operating a molding system having a valve for controlling flow of a molding material therein.

The drawings are not necessarily to scale and may be illustrated by phantom lines, diagrammatic representations and fragmentary views. In certain instances, details that are not necessary for an understanding of the embodiments or that render other details difficult to perceive may have been omitted.

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DETAILED DESCRIPTION OF THE EMBODIMENT(S)

Reference will now be made in detail to various non-limiting embodiment(s) of a valve for use in a molding system. It should be understood that other non-limiting embodiment(s), modifications and equivalents will be evident to one of ordinary skill in the art in view of the non-limiting embodiment(s) disclosed herein and that these variants should be considered to be within scope of the appended claims.

Furthermore, it will be recognized by one of ordinary skill in the art that certain structural and operational details of the non-limiting embodiment(s) discussed hereafter may be modified or omitted (i.e. non-essential) altogether. In other instances, well known methods, procedures, and components have not been described in detail.

With reference to FIGS. 1A-1C, there is depicted various operational states of a valve 10 according to a first non-limiting embodiment for controlling flow of a molding material (e.g. plastic) in a molding system 50 (FIG. 3). The valve 10 broadly includes a valve body, a valve member 20 and a filter 24. The valve member 20 is configured to cooperate with a valve body 12 for controlling the flow of the molding material through the valve 10. The filter 24 is associated with the valve member 20 for filtering, in use, the molding material passing therethrough.

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In particular, the valve body 12 is configured to define an upstream channel 14 and a downstream channel 16. Furthermore, the valve body 12 defines a valve bore 13 therein that is configured to sealingly receive the valve member 20 therein and that accommodates the relative movement thereof, in use, for sake of actuating the valve between its various operational states as will be explained in detail that follows. More particularly, an outer surface of the valve member 20 is arranged, in use, in sealing engagement with an inner surface of the valve bore 13.

30

In this particular non-limiting embodiment, the valve member 20 and the valve bore 13 are both cylindrical. Alternatively, the valve member 20 and the valve bore 13 may instead be spherical. In operation the valve member 20 is rotatable, about an axis thereof, within the valve bore 13 for selectively orienting a connecting channel 22 that is defined therein relative to the upstream

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channel 14 and the downstream channel 16 that are defined in the valve body 12 for controlling the flow of the molding material therebetween. Furthermore, the filter 24 is shown to be associated with the connecting channel 22 for filtering, in use, the molding material flowing therethrough from the upstream channel 14 to the downstream channel 16. The manner in which the filter 24 is arranged in the connecting channel is not particularly limited. For example, the filter 24 may be integrally formed with the valve member 20 or otherwise retained thereto.

In operation, the valve member 20 is rotatable between:

- i) a filtering orientation, as shown with reference to FIG. 1A, wherein the connecting channel 22 is oriented to fluidly connect the upstream channel 14 to the downstream channel 16 wherein the molding material flows through the filter 24 in a first direction for removing contaminants entrained therewith;
- ii) a blocking orientation, as shown with reference to FIG. 1B, wherein the connecting channel 22 is oriented to fluidly isolate the upstream channel 14 from the downstream channel 16 wherein the molding material is blocked by the valve member 20 from flowing from the upstream channel 14 to the downstream channel 16; and
- iii) a flush orientation, as shown with reference to FIG. 1C, wherein the connecting channel 22 is oriented to fluidly connect the upstream channel 14 to the downstream channel 16 wherein the molding material flows through the filter 24 in a second direction for flushing the contaminants from the filter 24; and

The valve 10 may further include an actuator (not shown) for re-positioning (e.g. rotating) the valve member 20 relative to the valve body 12. The actuator is operatively connectable to a controller 80 (FIG. 2) for control thereof.

The valve 10 may further include a sensor(s), such as an upstream pressure sensor 18 that is disposed in the upstream channel 14 and a downstream pressure sensor 19 that is disposed in the downstream channel 16. The sensor(s) 18, 19 being operatively connected, in use, to the controller 80 (FIG. 2) to provide an indication thereto of a pressure drop across the filter 24 that is indicative of an amount of contaminants being held therein.

With reference to FIG. 2 there is depicted a simplified schematic representation of a molding system 50 in accordance with a non-limiting embodiment that includes an injection unit 50 that is fluidly coupled to a mold 70.

The injection unit 60 broadly includes a barrel 62 within which there is disposed a screw 64 that

is rotatable and axially movable therein for sake of extruding and subsequently injecting a shot of the molding material through a machine nozzle 69 that is disposed at a downstream end of the barrel 62. As such, the screw 64 is operatively connected to a rotational actuator 68 and a linear actuator 66 that are disposed at an upstream end of the barrel 62. The valve 10 is shown to be
5 integrated into the machine nozzle 69 for sake of controlling the flow of the molding material therethrough.

Lastly, the molding system 50 is shown to include the controller 80 that is operatively connected to the rotational actuator 68, the linear actuator 66 and the valve 10, amongst other things, for
10 control thereof.

That being said, the placement of the valve 10 in the molding system 50 is not so limited and may be used anywhere along a melt distribution network (which includes the upstream channel 14, the downstream channel 16, the connecting channel 22 and further channels that are defined
15 in a melt distribution apparatus 72 that is associated with the mold 70. For example, the valve 10 could be alternatively provided in the melt distribution apparatus 72 (e.g. hot runner) such as at an outlet of an injection nozzle 74 therein that links the melt distribution network with a molding cavity 78 that is defined in the mold 70. As a further example, the valve 10 could alternatively be associated with a transfer distributor (not shown) of a two-stage injection unit (not shown) in
20 between an extruder and a shooting pot thereof.

With further reference to FIG. 3, there is depicted a flow chart of a method 30, executable by the controller 80, of operating the molding system 50 (FIG. 2) that includes the valve 10 for controlling flow of a molding material therein. The method 30 broadly includes a molding cycle
25 and a flushing cycle.

Molding Cycle:

Step 32

The molding cycle begins with a step of positioning the valve member 20 in the valve 10 into the
30 filtering orientation (FIG. 1A) wherein the connecting channel 22 is oriented to fluidly connect the upstream channel 14 to the downstream channel 16 in the valve body 12. In effect, the valve 10 is open thereby fluidly connecting the injection unit 60 (FIG. 2) with the mold 70 (FIG. 2).

Step 34

The next step involves urging the molding material to pass through the valve 10 wherein the
35 molding material flows through the filter 24 in a first direction for removing contaminants

entrained therewith. More particularly, the linear actuator 66 moves the screw 64 to inject the molding material through the melt distribution network into the closed and clamped (clamp not depicted) mold 70.

5 Step 36

The molding cycle then ends or repeats with positioning the valve member 20 into the blocking orientation (FIG. 1B) wherein the connecting channel 22 is oriented to fluidly isolate the upstream channel 14 from the downstream channel 16 wherein the molding material is blocked by the valve member 20 from flowing from the upstream channel 14 to the downstream channel 16. In effect, the valve 10 is closed thereby fluidly isolating the injection unit 60 (FIG. 2) with the mold 70 (FIG. 2). In such a state, the mold 70 may be opened for ejection of a molded article (not shown) therefrom.

Flushing Cycle:

15 Step 38

The flushing cycle begins with positioning the valve member 20 into the flush orientation (FIG. 1C) wherein the connecting channel 22 is again oriented to fluidly connect the upstream channel 14 to the downstream channel 16 but in an opposite orientation to when it is arranged for molding.

20 Step 40

The flushing cycle then ends with urging of the molding material to pass through the valve 10 wherein the molding material flows through the filter 24 in a second direction for flushing the contaminants from the filter 24. More particularly, the step may further include separating the machine injection unit 60 from the mold 70 whereby with subsequent injection of the molding material, as explained previously, the melt containing the flushed contaminants from the filter 24 (FIG. 1A-1C) may be purged from an outlet of the machine nozzle 69 without entering the mold 70.

30 The method 30 may further include further steps for determining when to perform the flushing cycle. For example, the method 30 may further include the steps of appreciating an indication of a pressure drop across the filter 24 that is indicative of an amount of contaminants being held therein and then performing the flushing cycle responsive to the pressure drop reaching a predetermined pressure limit. Alternatively, for example, the flushing cycle may be performed
35 responsive to a predetermined time limit (e.g. cycle count, elapsed time, etc.).

It is noted that the foregoing has outlined some of the more pertinent non-limiting embodiments. It will be clear to those skilled in the art that modifications to the disclosed non-embodiment(s) can be effected without departing from the spirit and scope thereof. As such, the described non-limiting embodiment(s) ought to be considered to be merely illustrative of some of the more prominent features and applications. Other beneficial results can be realized by applying the non-limiting embodiments in a different manner or modifying the invention in ways known to those familiar with the art. This includes the mixing and matching of features, elements and/or functions between various non-limiting embodiment(s) is expressly contemplated herein so that one of ordinary skill in the art would appreciate from this disclosure that features, elements and/or functions of one embodiment may be incorporated into another embodiment as skill in the art would appreciate from this disclosure that features, elements and/or functions of one embodiment may be incorporated into another embodiment as appropriate, unless described otherwise, above. Although the description is made for particular arrangements and methods, the intent and concept thereof may be suitable and applicable to other arrangements and applications.

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WHAT IS CLAIMED IS:

1. A valve (10) for controlling flow of a molding material in a molding system (50), comprising:

a valve member (20) that is configured to cooperate with a valve body (12) for controlling the flow of the molding material through the valve (10); and

a filter (24) being associated with the valve member (20) for filtering, in use, the molding material passing therethrough.

2. The valve (10) of claim 1, wherein:

the valve member (20) includes a connecting channel (22) defined therein, the filter (24) being associated with the connecting channel (22).

3. The valve (10) of claim 2, wherein:

the valve member (20) is arranged within a valve bore (13) that is defined in the valve body (12), wherein an outer surface of the valve member (20) is arranged, in use, in sealing engagement with an inner surface of the valve bore (13).

4. The valve (10) of claim 3, wherein:

the valve member (20) has a cylindrical cross-section, the valve member (20) being rotatable, in use, about an axis thereof, within the valve bore (13) for selectively orienting the connecting channel (22) relative to an upstream channel (14) and a downstream channel (16) that are defined in the valve body (12) for controlling the flow of the molding material therebetween.

5. The valve (10) of claim 4, wherein:

the valve member (20) is rotatable between:

a filtering orientation wherein the connecting channel (22) is oriented to fluidly connect the upstream channel (14) to the downstream channel (16) wherein the molding material flows through the filter (24) in a first direction for removing contaminants entrained therewith;

a flush orientation wherein the connecting channel (22) is oriented to fluidly connect the upstream channel (14) to the downstream channel (16) wherein the molding material flows through the filter (24) in a second direction for flushing the contaminants from the filter (24);

a blocking orientation wherein the connecting channel (22) is oriented to fluidly isolate the upstream channel (14) from the downstream channel (16) wherein the molding material is blocked by the valve member (20) from flowing from the upstream channel (14) to the downstream channel (16).

6. The valve (10) of claim 1, further comprising:
an actuator for rotating the valve member (20) relative to the valve body (12).
7. The valve (10) of claim 1, further comprising:
a sensor (18, 19) that is operatively connected, in use, to a controller (80) to provide an indication of a pressure drop across the filter (24) that is indicative of an amount of contaminants being held therein.
8. The valve (10) of any one of claims 1 to 7, further comprising:
the valve body (12).
9. A method (30) of operating a molding system (50) having a valve (10) for controlling flow of a molding material, the valve (10) including a valve member (20) that is configured to cooperate with a valve body (12) for controlling the flow of the molding material through the valve (10) and a filter (24) being associated with the valve member (20) for filtering, in use, the molding material passing therethrough, the method (30) comprising:
a molding cycle including:
 positioning (32) the valve member (20) into a filtering orientation wherein a connecting channel (22) is oriented to fluidly connect an upstream channel (14) to a downstream channel (16) in the valve body (12);
 urging (34) the molding material to pass through the valve (10) wherein the molding material flows through the filter (24) in a first direction for removing contaminants entrained therewith;
 positioning (36) the valve member (20) into a blocking orientation wherein the connecting channel (22) is oriented to fluidly isolate the upstream channel (14) from the downstream channel (16) wherein the molding material is blocked by the valve member (20) from flowing from the upstream channel (14) to the downstream channel (16);
a flushing cycle including:
 positioning (38) the valve member (20) into a flush orientation wherein the connecting channel (22) is oriented to fluidly connect the upstream channel (14) to the downstream channel (16);
 urging (40) the molding material to pass through the valve (10) wherein the molding material flows through the filter (24) in a second direction for flushing the contaminants from the filter (24).

10. The method (30) of claim 9, further comprising:

appreciating an indication of a pressure drop across the filter (24) that is indicative of an amount of contaminants being held therein;

performing the flushing cycle responsive to the pressure drop reaching a predetermined pressure limit.

11. The method (30) of claim 9, wherein the method further comprises:

performing the flushing cycle responsive to a predetermined time limit.

12. A controller (80) including instructions being embodied in a controller-usable memory, the instructions for directing the controller (80) to execute a method (30) of operating a molding system (50) having a valve (10) for controlling flow of a molding material, the valve (10) including a valve member (20) that is configured to cooperate with a valve body (12) for controlling the flow of the molding material through the valve (10) and a filter (24) being associated with the valve member (20) for filtering, in use, the molding material passing therethrough, the method comprising:

a molding cycle including:

positioning (32) the valve member (20) into a filtering orientation wherein a connecting channel (22) is oriented to fluidly connect an upstream channel (14) to a downstream channel (16) in the valve body (12);

urging (34) the molding material to pass through the valve (10) wherein the molding material flows through the filter (24) in a first direction for removing contaminants entrained therewith;

positioning (36) the valve member (20) into a blocking orientation wherein the connecting channel (22) is oriented to fluidly isolate the upstream channel (14) from the downstream channel (16) wherein the molding material is blocked by the valve member (20) from flowing from the upstream channel (14) to the downstream channel (16);

a flushing cycle including:

positioning (38) the valve member (20) into a flush orientation wherein the connecting channel (22) is oriented to fluidly connect the upstream channel (14) to the downstream channel (16);

urging (40) the molding material to pass through the valve (10) wherein the molding material flows through the filter (24) in a second direction for flushing the contaminants from the filter (24).

13. The controller (80) of claim 12, wherein the method further comprises:
 - appreciating an indication of a pressure drop across the filter (24) that is indicative of an amount of contaminants being held therein;
 - performing the flushing cycle responsive to the pressure drop reaching a predetermined pressure limit.
14. The controller (80) of claim 12, wherein the method further comprises:
 - performing the flushing cycle responsive to a predetermined time limit.

1 / 3

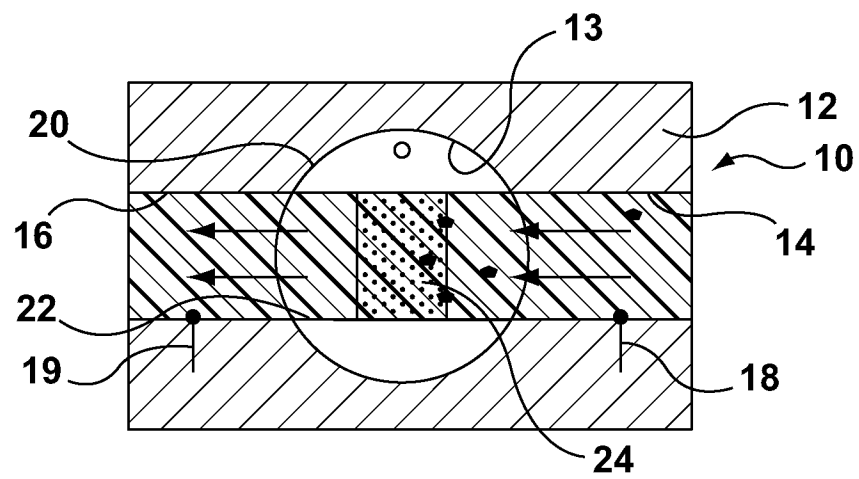


FIG. 1A

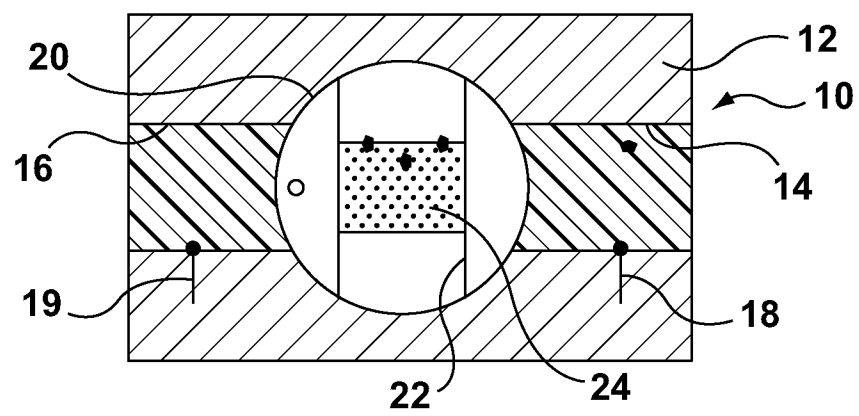


FIG. 1B

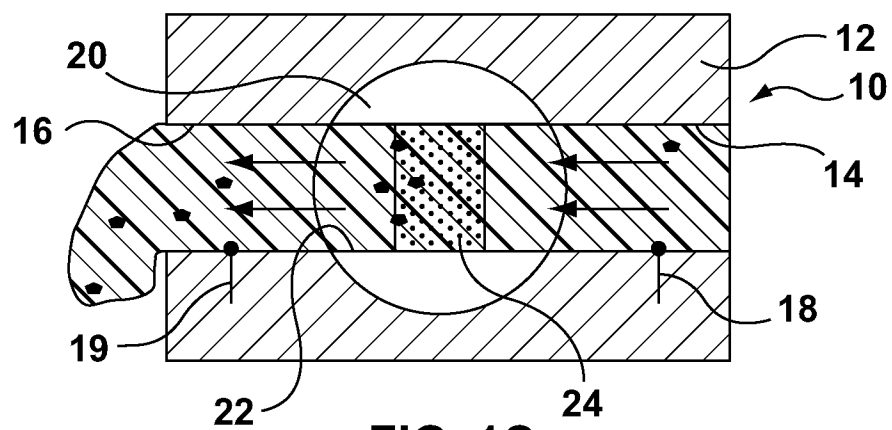


FIG. 1C

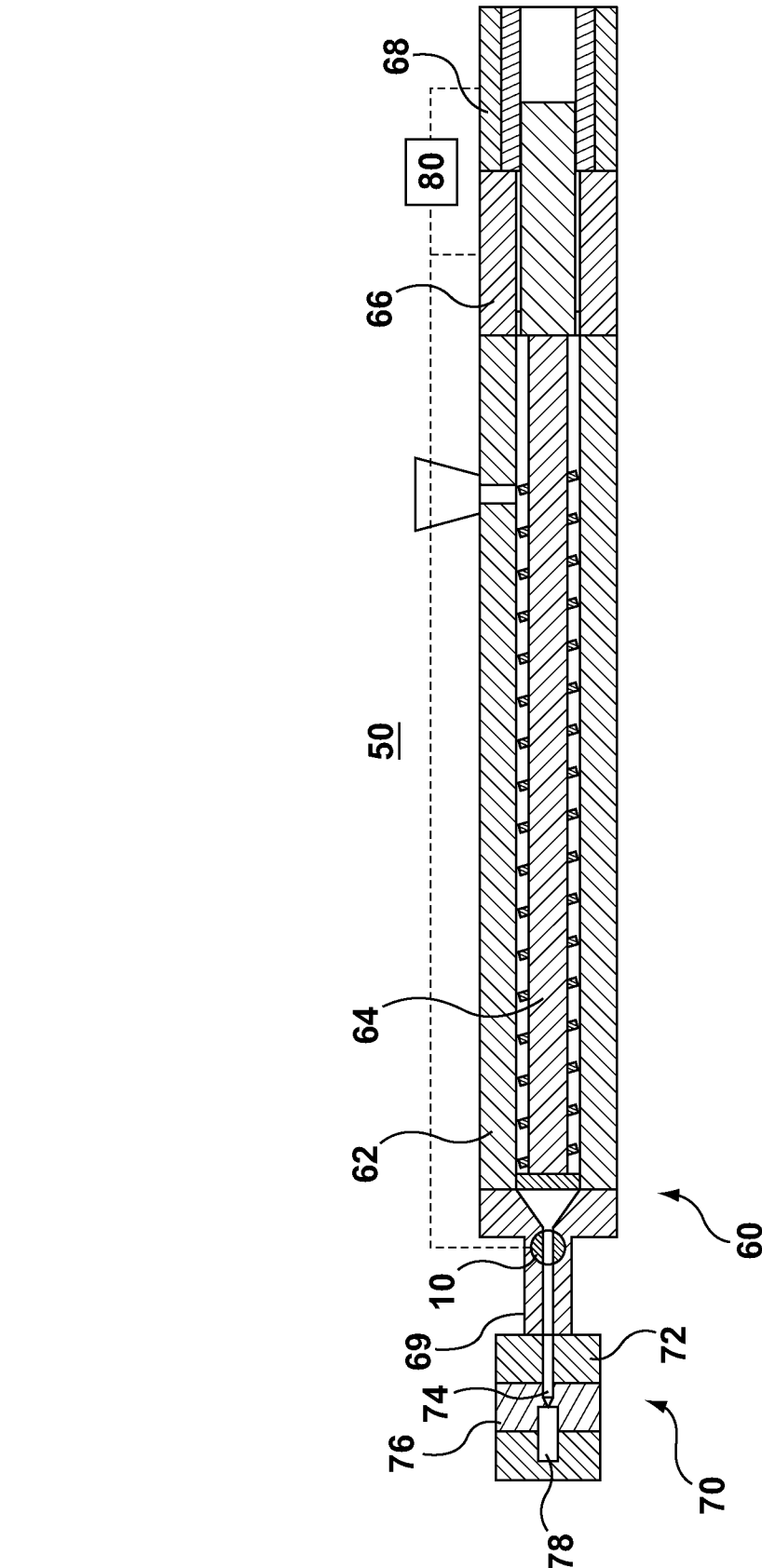
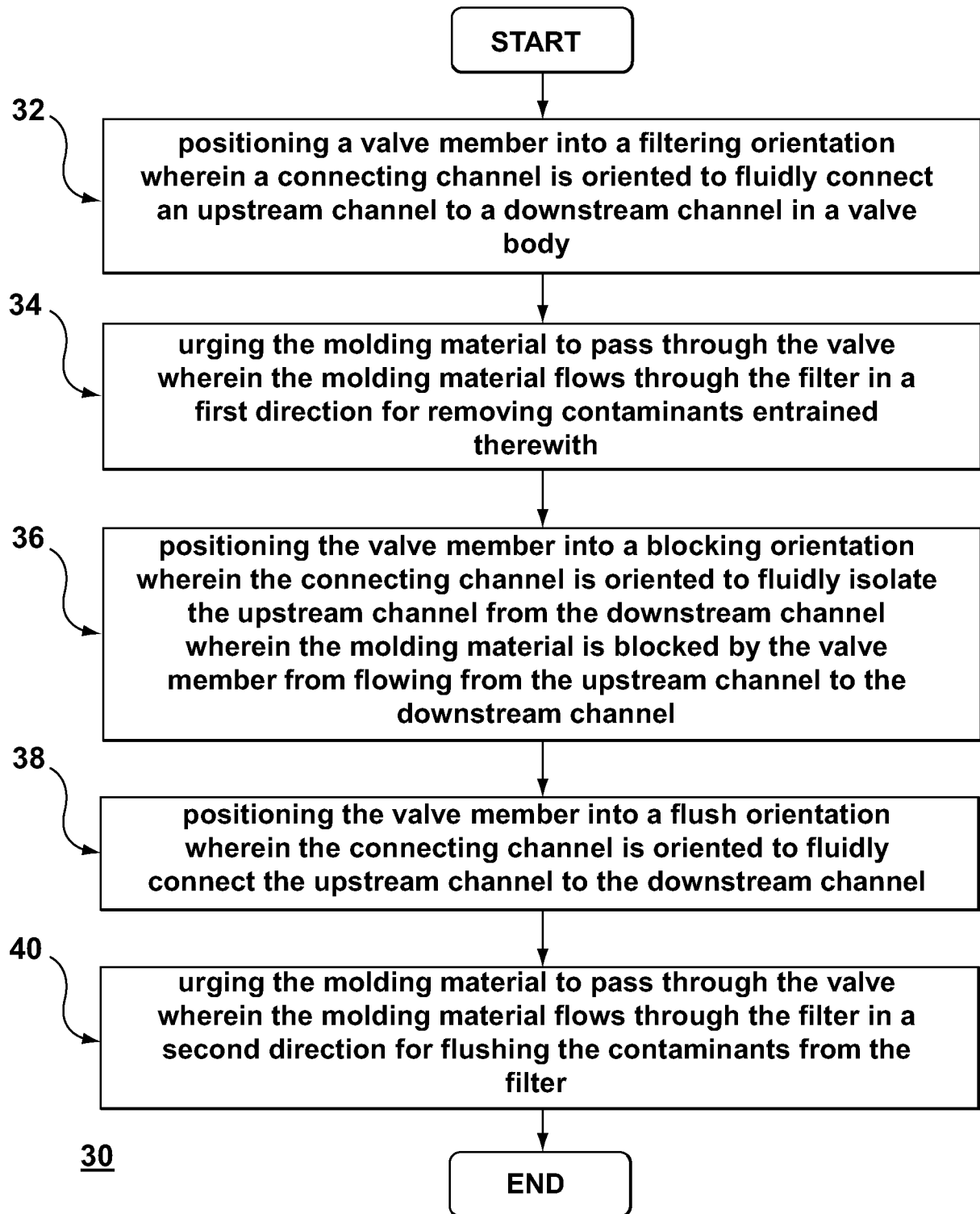


FIG. 2

3 / 3

**FIG. 3**

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2013/050429

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **B29C 45/23** (2006.01) , **B29C 45/24** (2006.01) , **F16K 29/00** (2006.01) , **F16K 51/00** (2006.01) , **F16L 55/24** (2006.01)

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)

IPC: **B29C 45** (2006.01), **F16K 29/00** (2006.01), **F16K 51/00** (2006.01), **F16L 55/24** (2006.01)

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

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

EPOQUE (EPODOC and X-FULL), CPD with key words, such as: inject* , extru* , plunger, shoot* pot, nozzle* , valve* , filter* , rotat* valve* and rotary valve*.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2010/148478 A1 (CRAIG, D. D. et al.) 29 December 2010 (29-12-2010) *whole document*	1-14
A	US 2009/0121394 A1 (WAGNER, M. S.) 14 May 2009 (14-05-2009) *whole document*	1-14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

04 July 2013 (07-07-2013)

Date of mailing of the international search report

23 August 2013 (23-08-2013)

Name and mailing address of the ISA/CA
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2013/050429

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
WO 2010148478 A1	29 December 2010 (29-12-2010)	CA2763829A1 CN102458791A EP2445695A1 EP2445695A4 US2012082753A1	29 December 2010 (29-12-2010) 16 May 2012 (16-05-2012) 02 May 2012 (02-05-2012) 05 December 2012 (05-12-2012) 05 April 2012 (05-04-2012)
US 2009/0121394 A1	14 May 2009 (14-05-2009)	US2009121394A1 US7754134B2	14 May 2009 (14-05-2009) 13 July 2010 (13-07-2010)