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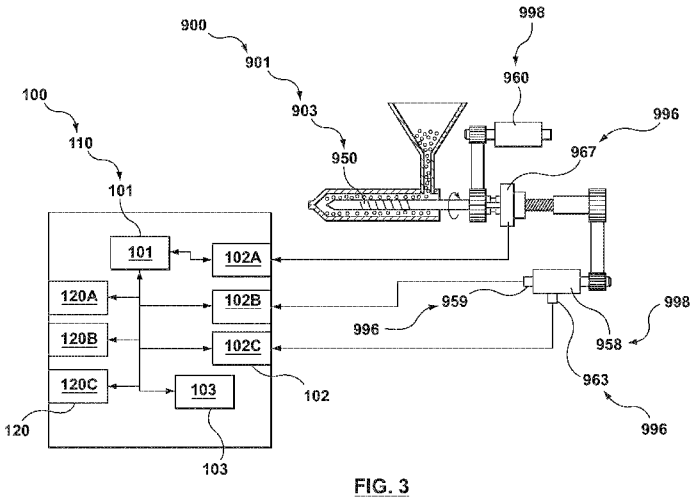


FIG. 3

(57) Abstract: A molding-system computer (100), comprising: a computing assembly (110) being configured to determine whether information indicating an operational performance of an assembly (903) of a molding system (900) is acceptable.

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MOLDING-SYSTEM COMPUTER CONFIGURED TO DETERMINE WHETHER INFORMATION INDICATING OPERATIONAL PERFORMANCE OF ASSEMBLY OF MOLDING SYSTEM IS ACCEPTABLE

BACKGROUND

United States Patent Number 5147659 (WATANABE et al.) discloses a nozzle touch apparatus for use in an injection molding machine.

United States Patent Number 5980793 (HEHL) discloses a first static sensor for determining forces arising during material preparation stage, for determination of the forces arising at a feeding means in an injection molding machine for plastic materials.

United States Patent Number 5997778 (BULGRIN) discloses an injection molding machine that uses a summed, multi-term control law to control ram velocity during the injection stroke of a molding cycle to emulate a user set velocity profile. An automatic calibration method sets no load ram speeds to duplicate user set ram speeds.

United States Patent Number 6289259 (CHOI et al.) discloses an apparatus and method for controlling a hydraulic actuator in an injection molding machine, where the hydraulic actuator moves in a linear or rotary manner to effect movement of an injection molding device, such as a mold clamp.

United States Patent Number 6695994 (BULGRIN et al.) discloses an electric injection molding machine in which a melt pressure value is provided without pressure sensing through solving one or more state equations using measured motor performance parameters such as position or velocity, and torque or current.

United States Patent Number 7806675 (MARUYAMA et al.) discloses suck back is started and a gradient of pressure is detected. Whether or not an absolute value of the detected gradient of the pressure is smaller than a reference value set in advance is determined, and it is determined that the reduction of the resin pressure has been completed when the absolute value becomes smaller than the reference value. A screw position at the time of the completion of the pressure reduction is

stored and a screw movement amount from a suck back start position to a pressure-reduction completion position is displayed on a screen.

United States Patent Number 7904196 (OKAZAKI) disclosed is a rotational angle of a motor operative to propel forward a screw in an injection molding machine is detected at an encoder.

United States Patent Publication Number 2008/0029916 (COLE) discloses a system for controlling operation of a mechanical press.

United States Patent Publication Number 2012/0007265 (SEE) discloses a feedback method that includes sending a signal from a sensor associated with a plastics melting machine to a controller, sending a signal from the controller to the pump, monitoring the pressure in the pump and sensing the position of an injection nozzle valve, and sending a signal to the injection nozzle valve instructing the valve to open or close.

SUMMARY

The inventor has researched a problem associated with known molding systems that inadvertently manufacture bad-quality molded articles or parts. After much study, the inventor believes he has arrived at an understanding of the problem and its solution, which are stated below.

It is known to calibrate and/or verify sensors used on a molding system, such as a pressure-sensor, a strain gauge, etc. The meaning of calibrate is to correlate a reading of an instrument or a sensor with the reading of a standard device in order to check the accuracy of the instrument or the sensor.

In order to resolve, at least in part, the above-noted challenges and/or issues, according to a first aspect, there is provided A molding-system computer (100), comprising: a computing assembly (110) being configured to determine whether information indicating an operational performance of an assembly (903) of a molding system (900) is acceptable.

DETAILED DESCRIPTION OF THE DRAWINGS

The non-limiting embodiments may be more fully appreciated by reference to the following detailed description of the non-limiting embodiments when taken in conjunction with the accompanying drawings, in which:

FIG. 1 depicts a first example of a molding-system computer (100);

FIG. 2 depicts a first example of a molding system (900);

FIG. 3 depicts a second example of the molding-system computer (100) for use with the first example of the molding system (900) of FIG. 2; and

FIG. 4 depicts the first example of the molding-system computer (100) of FIG. 1 for use with a second example of the molding system (900).

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

DETAILED DESCRIPTION OF THE EMBODIMENTS

Referring to FIGS. 1, 2, 3, 4, there is depicted (generally speaking) a molding-system computer (100) including (and not limited to): a computing assembly (110) configured to determine whether information indicating the operational performance of an assembly (903) of a molding system (900) is acceptable.

Referring now to FIG. 1, there is depicted the first example of the molding-system computer (100). According to the first example depicted in FIG. 1, the molding-system computer (100) includes (and is not limited to): (i) an input-interface assembly (102), and (ii) a computing assembly (110). The input-interface assembly (102) is configured to receive information indicating operational performance of an assembly (903) of the molding system (900). The computing assembly (110) is

configured to determine whether the information indicating the operational performance of the assembly (903) received by the input-interface assembly (102) is within an acceptable level of tolerance.

In accordance with an option, the input-interface assembly (102) is configured to receive the information from a sensor assembly (996) configured to indicate the operational performance of the assembly (903) of the molding system (900).

In accordance with another option, the computing assembly (110) is configured to: (i) interface with the input-interface assembly (102), and (ii) analyze the information received by the input-interface assembly (102).

In accordance with yet another option, the computing assembly (110) is configured to determine an adjustment factor to be made to the operational performance of the assembly (903) based on the analysis of the information received by the input-interface assembly (102). As well, the molding-system computer (100) further includes (and is not limited to) an output-interface assembly (120). The output-interface assembly (120) is configured to: (i) interface with the computing assembly (110), and (ii) control, based on the adjustment factor determined by the computing assembly (110), the assembly (903).

Referring now to FIGS. 2 and 3, there is depicted the first example of the molding system (900), and there is depicted the second example of the molding-system computer (100) for use with the first example of the molding system (900), respectively.

In accordance with the examples depicted in FIGS. 2 and 3, the assembly (903) includes (by way of example) a plasticizing assembly (950). The molding system (900) includes an all-electric molding system (901); that is, the molding system (900) includes or uses no hydraulic assemblies or components, so that all movable assemblies are driven or actuated by using electrical motors.

Generally speaking, the assembly (903) may include any actuator configured for use in the molding system (900). The following are merely examples of the assembly (903). The assembly (903) may include a runner system (916). The assembly (903) may include a runner-based actuator configured for use in a runner system (916). A runner system (916) may also be called a melt-distribution

assembly. The runner system (916) is configured to connect an injection unit or plasticizing assembly (950) to a mold assembly (918). The assembly (903) may include a valve-gate actuator configured for use in a runner system (916). The assembly (903) may include a mold actuator configured to actuate functions associated with a mold assembly (918). The assembly (903) may include a mold actuator configured to actuate functions associated with the mold assembly (918). The assembly (903) may include a clamp assembly (904). The assembly (903) may include a clamping assembly (912). The assembly (903) may include a clamp actuator configured for use in a clamping assembly (912).

The all-electric molding system (901) includes and is not limited to: (i) a barrel assembly (952), (ii) a non-return valve (954), and (iii) a hopper assembly (956).

The assembly (903) includes (and is not limited to): a plasticizing assembly (950). The plasticizing assembly (950) is configured to be received in the barrel assembly (952). The plasticizing assembly (950) may also be called a screw assembly. The hopper assembly (956) is configured to be connected to the barrel assembly (952). The hopper assembly (956) is configured to receive a moldable material (resin) and to feed the resin to the interior of the barrel assembly (952). The non-return valve (954) is connected to a tip of the plasticizing assembly (950) at an exit end of the barrel assembly (952). The plasticizing assembly (950) converts the moldable material into a flowable resin.

The assembly (903) includes (and is not limited to): (i) a first servo-motor assembly (958), (ii) a second servo-motor assembly (960), (iii) a first interface assembly (962), and (iv) a second interface assembly (966). The first interface assembly (962) is configured to operatively connect the plasticizing assembly (950) to the first servo-motor assembly (958). The first interface assembly (962) and the first servo-motor assembly (958) are configured to translate the plasticizing assembly (950). The second interface assembly (966) is configured to operatively connect the plasticizing assembly (950) to the second servo-motor assembly (960). The second interface assembly (966) and the second servo-motor assembly (960) are configured to rotate the plasticizing assembly (950). The first interface assembly (962) may include a ball-screw assembly (known). The second interface assembly (966) may include a belt assembly (known). The first servo-motor assembly (958) and the first interface assembly (962) are configured to translate, in operation, the plasticizing assembly (950) during an injection phase of the molding system (900). During the injection phase of the

molding system (900), flowable resin is ejected from the barrel assembly (952): (1) directly to a mold assembly (known and not depicted), or (ii) indirectly by way of a runner assembly (known and not depicted). The second servo-motor assembly (960) and the second interface assembly (966) are configured to rotate the plasticizing assembly (950) during a recovery phase of the molding system (900). During the recovery phase of the molding system (900), the plasticizing assembly (950) generates additional flowable resin in the barrel assembly (952).

The sensor assembly (996) includes (and is not limited to): (i) a pressure sensor assembly (967), (ii) an encoder-output assembly (959), and (iii) a torque-output assembly (963). The pressure sensor assembly (967) is positioned along a longitudinal axis of the plasticizing assembly (950), and is configured to provide a sensor-output signal indicating an amount of pressure applied to the plasticizing assembly (950). The encoder-output assembly (959) is configured to provide a signal indicating the rotational position of the first servo-motor assembly (958), which is proportional to the longitudinal displacement or position of the plasticizing assembly (950). The torque-output assembly (963) is configured to provide a signal indicating the amount of torque output of the first servo-motor assembly (958). It will be appreciated that the first servo-motor assembly (958) may include the encoder-output assembly (959) and the torque-output assembly (963). The encoder-output assembly (959) may be called a resolver. By way of example, the pressure sensor assembly (967) may include a load cell (digital or analog) or a strain gauge assembly (known and not depicted), or equivalent thereof, etc.

According to the example depicted in FIG. 2, the molding-system computer (100) includes (and is not limited to): (i) a processor assembly (101), (ii) a memory unit (103), (iii) an input-interface assembly (102), and (iv) an output-interface assembly (120). The processor assembly (101) is operatively connected to (and exchange signals with) the memory unit (103), the input-interface assembly (102) and to the output-interface assembly (120). The memory unit (103) is configured to tangibly include controller-executable instructions configured to direct the processor assembly (101) to execute processing tasks (computations).

Generally speaking, the controller-executable instructions are configured to: calibrate, in situ, an aspect (performance or function) of the assembly (903) of the molding system (900). Calibration includes verification of operation of the assembly (903) is within acceptable tolerance limits.

The input-interface assembly (102) includes (and is not limited to): (i) a first input port (102A), (ii) a second input port (102B), and (iii) a third input port (102C). The first input port (102A) is configured to connect to the pressure sensor assembly (967). The second input port (102B) is configured to connect to the encoder-output assembly (959). The third input port (102C) is configured to connect to the torque-output assembly (963).

According to an option, the output-interface assembly (120) includes (and is not limited to): (i) a first output port (120A), (ii) a second output port (120B), and (iii) a third output port (120C). The first output port (120A) is configured to provide the indication of the screw position of the screw of the plasticizing assembly (950). The first output port (120A) may provide an analog signal to be measured by a measuring device. The second output port (120B) is configured to provide an indication of the pressure sensor assembly (967). The pressure sensor assembly (967) may be a pressure sensor or a load sensor. The second output port (120B) may be an analog signal to be measured by a measuring device. The third output port (120C) is configured to provide an indication (example: torque) of the torque-output assembly (963). The third output port (120C) may be an analog signal to be measured by a measuring device.

The first output port (120A) is configured to provide an output indicating position of the plasticizing assembly (950) in the barrel assembly (952). The second output port (120B) is configured to provide an output indicating the amount of torque applied to the plasticizing assembly (950). The third output port (120C) is configured to provide an output signal indicating the amount of force applied to the plasticizing assembly (950).

The pressure sensor assembly (967) is positioned at an end of the plasticizing assembly (950). The pressure sensor assembly (967) is configured to provide an output signal indicating amount of pressure that transferred from the first servo-motor assembly (958) and the first interface assembly (964) to the plasticizing assembly (950).

The molding-system computer (100) may be operatively connected to the first servo-motor assembly (958), and is configured to control operation of the first servo-motor assembly (958). The molding-system computer (100) may be connected to the second servo-motor assembly (960), and is configured to control operation of the second servo-motor assembly (960).

It will be appreciated that the molding-system computer (100) may operate under several modes of operation. A first mode of operation includes stopping the manufacturing operation of the molding system (900), and put the molding system (900) through a test cycle. A second mode of operation includes having the molding-system computer (100) operate while the molding system (900) manufactures molded articles during the various phases of the molding cycle of the molding system (900).

The first mode of operation includes (and is not limited to): operations S802, S804, S806, S808, S810, S812, S814, S816, S818, S820, and S822.

Operation S802, includes blocking exit from the barrel assembly (952). The orifice (exit portal) of the nozzle assembly attached to the exit end of the barrel assembly (952) is blocked so that the melt in the barrel assembly (952) will dead head at the exit portion of the barrel assembly (952) for the case where the melt is pushed forward by the plasticizing assembly (950).

Operation S804 includes metering a shot to the exit end of the barrel assembly (952). The plasticizing assembly (950) is pushed toward the exit end of the barrel assembly (952) to pressurize melt to a series of set loads. The shot size may be predetermined and fixed. The shot size is an amount of the melt located between the exit portal of the barrel assembly (952) and the non-return valve (954). Pressure set point value may be used and may need to measure output motor torque to verify. It is possible to use injection motor torque set point value as an option.

Operation S806 includes applying a pressure to the melt and holding the pressure that is applied. Hold for a defined time to stabilize the melt.

Operation S808 includes measuring the signals received by the first input port (102A), the second input port (102B) and the third input port (102C).

May also include comparing the measured values to threshold values (target values) determined from the capabilities of the molding system (900). For example, the screw position may be indicated in the first output port (120A), the force indicator reading may be indicated in second output port (120B), and the motor torque indicator reading may be indicated in third output port (120C).

Operation S810 includes removing the pressured applied to the melt (also known as decompressing the melt).

Operation S812 includes unblocking the exit end of the barrel assembly (952) so that the melt may be able to flow.

Operation S814 includes purging the exit end of the barrel assembly (952); that is, removing the melt form the exit end of the barrel assembly (952).

Operation S808 (optional) includes providing output signals via first output port (120A), second output port (120B), and third output port (120C) and permitting an operator to use external measurement devices.

Operation S820 includes logging (recording) the output signals that were measured to a memory unit (103) of a computing assembly (110).

Operation S822 includes comparing the output signals over time.

Operation S822 includes comparing the output signals against each other.

The following is an example of the contents of memory unit (103):

T1	T2	T3	T4	T5
A1	A2	A3	A4	A5
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5

By way of example:

T1 is a first time stamp.

A1 is a first value of the first output port (120A) measured at T1.

B1 is a first value of the second output port (120B) measured at T1.

C1 is a first value of the third output port (120C) measured at T1.

T2 is a second time stamp (occurring after T1).

A1 is a second value of the first output port (120A) measured at T2.

B1 is a second value of the second output port (120B) measured at T2.

C1 is a second value of the third output port (120C) measured at T2.

T3 is a second time stamp (occurring after T2).

A3 is a second value of the first output port (120A) measured at T3.

B3 is a second value of the second output port (120B) measured at T3.

C3 is a second value of the third output port (120C) measured at T3.

The following are examples of instructions to be executed by the molding-system computer (100) based on the contents of memory unit (103):

Test	Action
Determine whether A(i+1) – A(i) is greater than a threshold. Example: A2-A1 > 10	If yes (true), then change something or make something happen. Example: this may indicate wear of components of the actuator used to translate the screw assembly. Example: this may indicate wear of the check valve used on the screw assembly. If no (false), then go to next test.
Determine whether B(i+2) – B(i+1) is greater than a threshold. Example: B3-B2 > 20	If yes (true), then change something or make something happen, Example: may indicate failure of load cell sensor. If no (false), then go to next test.

Test	Action
Determine whether Combination of A(i+1) – A(i) (position) and C(i+2) – C(i) (torque) Example: comparison result is different than respective thresholds.	If yes (true), then change something or make something happen. Example: variation in position and change in torque may indicate a specific failure of an actuator used to translate the screw. If no (false), then go to next test.
Determine whether C(i+2) – C(i) Example: comparison result is greater than a threshold. Example: C3-C1 > 15	If yes (true), then change something or make something happen. Example: may indicate failure of the drive system. If no (false), then go to next test.

The following is another example of the contents of memory unit (103), and the possible actions taken for selected times:

T1	T2	T3	T4	T5
A1	A2	A3	A4	A5
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
No adjustment	No adjustment	First indication of possible service issue	Second indication of possible service issue	No adjustment

The above information represents an example of a diagnostic indication provided by the molding-system computer (100).

FIG. 4 depicts the first example of the molding-system computer (100) of FIG. 1 for use with a second example of the molding system (900). The molding system (900) includes an all-hydraulic molding system (905).

It will be appreciated that the all-electric molding system (901) and the all-hydraulic molding system (905) may include components that are known to persons skilled in the art, and these known components may not be described here; these known components are described, at least in part, in the following reference books (for example): (i) "*Injection Molding Handbook*" authored by OSSWALD/TURNG/GRAMANN (ISBN: 3-446-21669-2), (ii) "*Injection Molding Handbook*" authored by ROSATO AND ROSATO (ISBN: 0-412-99381-3), (iii) "*Injection Molding Systems*" 3rd Edition authored by JOHANNABER (ISBN 3-446-17733-7) and/or (iv) "*Runner and Gating Design Handbook*" authored by BEAUMONT (ISBN 1-446-22672-9).

The molding-system computer (100) and the molding system (900) may be sold separately. That is, the molding-system computer (100) may be sold as a retrofit item (assembly) that may be installed to an existing molding system (not depicted). In accordance with an option, it may be appreciated that the molding-system computer (100) may further include (and is not limited to): a molding system (900) configured to operatively connect with the molding-system computer (100). On the other hand, the molding-system computer (100) and the molding system (900) may be sold, to an end user, as an integrated product by one supplier.

More specifically, FIG 1 depicts an example of a schematic representation of the all-hydraulic molding system (905), and an example of a schematic representation of a molding-system computer (100). The all-hydraulic molding system (905) may also be called an injection-molding system for example. According to the example depicted in FIG. 1, the all-hydraulic molding system (905) includes (and is not limited to): (i) an extruder assembly (902), (ii) a clamp assembly (904), (iii) a runner system (916), and/or (iv) a mold assembly (918). By way of example, the extruder assembly (902) is configured, to prepare, in use, a heated, flowable resin, and is also configured to inject or to move the resin from the extruder assembly (902) toward the runner system (916). Other names for the extruder assembly (902) may include injection unit, melt-preparation assembly, etc. By way of example, the clamp assembly (904) includes (and is not limited to): (i) a stationary platen (906), (ii) a movable platen (908), (iii) a rod assembly (910), (iv) a clamping assembly (912), and/or (v) a lock assembly (914). The stationary platen (906) does not move; that is, the stationary platen (906) may be fixedly positioned relative to the ground or floor. The movable platen (908) is configured to be movable relative to the stationary platen (906). A platen-moving mechanism (not depicted but known) is connected to the movable platen (908), and the platen-moving mechanism is configured to move, in use, the movable platen (908). The rod

assembly (910) extends between the movable platen (908) and the stationary platen (906). The rod assembly (910) may have, by way of example, four rod structures positioned at the corners of the respective stationary platen (906) and the movable platen (908). The rod assembly (910) is configured to guide movement of the movable platen (908) relative to the stationary platen (906). A clamping assembly (912) is connected to the rod assembly (910). The stationary platen (906) is configured to support (or configured to position) the position of the clamping assembly (912). The lock assembly (914) is connected to the rod assembly (910), or may alternatively be connected to the movable platen (908). The lock assembly (914) is configured to selectively lock and unlock the rod assembly (910) relative to the movable platen (908). By way of example, the runner system (916) is attached to, or is supported by, the stationary platen (906). The runner system (916) includes (and is not limited to) a molding-system computer (100). The runner system (916) is configured to receive the resin from the extruder assembly (902). By way of example, the mold assembly (918) includes (and is not limited to): (i) a mold-cavity assembly (920), and (ii) a mold-core assembly (922) that is movable relative to the mold-cavity assembly (920). The mold-core assembly (922) is attached to or supported by the movable platen (908). The mold-cavity assembly (920) is attached to or supported by the runner system (916), so that the mold-core assembly (922) faces the mold-cavity assembly (920). The runner system (916) is configured to distribute the resin from the extruder assembly (902) to the mold assembly (918).

In operation, the movable platen (908) is moved toward the stationary platen (906) so that the mold-cavity assembly (920) is closed against the mold-core assembly (922), so that the mold assembly (918) may define a mold cavity configured to receive the resin from the runner system (916). The lock assembly (914) is engaged so as to lock the position of the movable platen (908) so that the movable platen (908) no longer moves relative to the stationary platen (906). The clamping assembly (912) is then engaged to apply a clamping pressure, in use, to the rod assembly (910), so that the clamping pressure then may be transferred to the mold assembly (918). The extruder assembly (902) pushes or injects, in use, the resin to the runner system (916), which then the runner system (916) distributes the resin to the mold cavity structure defined by the mold assembly (918). Once the resin in the mold assembly (918) is solidified, the clamping assembly (912) is deactivated so as to remove the clamping force from the mold assembly (918), and then the lock assembly (914) is deactivated to permit movement of the movable platen (908) away from the stationary platen (906), and then a molded article may be removed from the mold assembly (918).

It will be appreciated that the may include more than two platens. According to an example, the molding system (900) includes (and is not limited to): a third platen (not depicted), which is also called a clamping platen that is known in the art and thus is not described here in greater detail.

Additional details regarding the molding-system computer (100)

According to one option, the molding-system computer (100) includes controller-executable instructions configured to operate the molding-system computer (100) in accordance with the description provided above. The molding-system computer (100) may use computer software, or just software, which is a collection of computer programs (controller-executable instructions) and related data that provide the instructions for instructing the molding-system computer (100) what to do and how to do it. In other words, software is a conceptual entity that is a set of computer programs, procedures, and associated documentation concerned with the operation of a molding-system computer (100), also called a data-processing system. Software refers to one or more computer programs and data held in a storage assembly (a memory module) of the molding-system computer (100) for some purposes. In other words, software is a set of programs, procedures, algorithms and its documentation. Program software performs the function of the program it implements, either by directly providing instructions to computer hardware or by serving as input to another piece of software. In computing, an executable file (executable instructions) causes the molding-system computer (100) to perform indicated tasks according to encoded instructions, as opposed to a data file that must be parsed by a program to be meaningful. These instructions are machine-code instructions for a physical central processing unit. However, in a more general sense, a file containing instructions (such as bytecode) for a software interpreter may also be considered executable; even a scripting language source file may therefore be considered executable in this sense. While an executable file can be hand-coded in machine language, it is far more usual to develop software as source code in a high-level language understood by humans, or in some cases, an assembly language more complex for humans but more closely associated with machine code instructions. The high-level language is compiled into either an executable machine code file or a non-executable machine-code object file; the equivalent process on assembly language source code is called assembly code. Several object files are linked to create the executable. The same source code can be compiled to run under different operating systems, usually with minor operating-system-dependent features inserted in the source code to modify compilation according to the target. Conversion of existing source code for a different platform is called porting. Assembly-language source code and executable programs are not transportable in

this way. An executable comprises machine code for a particular processor or family of processors. Machine-code instructions for different processors are completely different and executables are totally incompatible. Some dependence on the particular hardware, such as a particular graphics card may be coded into the executable. It is usual as far as possible to remove such dependencies from executable programs designed to run on a variety of different hardware, instead installing hardware-dependent device drivers on the molding-system computer (100), which the program interacts with in a standardized way. Some operating systems designate executable files by filename extension (such as .exe) or noted alongside the file in its metadata (such as by marking an execute permission in Unix-like operating systems). Most also check that the file has a valid executable file format to safeguard against random bit sequences inadvertently being run as instructions. Modern operating systems retain control over the resources of the molding-system computer (100), requiring that individual programs make system calls to access privileged resources. Since each operating system family features its own system call architecture, executable files are generally tied to specific operating systems, or families of operating systems. There are many tools available that make executable files made for one operating system work on another one by implementing a similar or compatible application binary interface. When the binary interface of the hardware the executable was compiled for differs from the binary interface on which the executable is run, the program that does this translation is called an emulator. Different files that can execute but do not necessarily conform to a specific hardware binary interface, or instruction set, can be represented either in bytecode for Just-in-time compilation, or in source code for use in a scripting language.

According to another option, the molding-system computer (100) includes application-specific integrated circuits configured to operate the molding-system computer (100) in accordance with the description provided above. It may be appreciated that an alternative to using software (controller-executable instructions) in the molding-system computer (100) is to use an application-specific integrated circuit (ASIC), which is an integrated circuit (IC) customized for a particular use, rather than intended for general-purpose use. For example, a chip designed solely to run a cell phone is an ASIC. Some ASICs include entire 32-bit processors, memory blocks including ROM, RAM, EEPROM, Flash and other large building blocks. Such an ASIC is often termed a SoC (system-on-chip). Designers of digital ASICs use a hardware description language (HDL) to describe the functionality of ASICs. Field-programmable gate arrays (FPGA) are used for building a breadboard or prototype from standard parts; programmable logic blocks and programmable

interconnects allow the same FPGA to be used in many different applications. For smaller designs and/or lower production volumes, FPGAs may be more cost effective than an ASIC design. A field-programmable gate array (FPGA) is an integrated circuit designed to be configured by the customer or designer after manufacturing—hence field-programmable. The FPGA configuration is generally specified using a hardware description language (HDL), similar to that used for an application-specific integrated circuit (ASIC) (circuit diagrams were previously used to specify the configuration, as they were for ASICs, but this is increasingly rare). FPGAs can be used to implement any logical function that an ASIC could perform. The ability to update the functionality after shipping, partial re-configuration of the portion of the design and the low non-recurring engineering costs relative to an ASIC design offer advantages for many applications. FPGAs contain programmable logic components called logic blocks, and a hierarchy of reconfigurable interconnects that allow the blocks to be wired together—somewhat like many (changeable) logic gates that can be inter-wired in (many) different configurations. Logic blocks can be configured to perform complex combinational functions, or merely simple logic gates like AND and XOR. In most FPGAs, the logic blocks also include memory elements, which may be simple flip-flops or more complete blocks of memory. In addition to digital functions, some FPGAs have analog features. The most common analog feature is programmable slew rate and drive strength on each output pin, allowing the engineer to set slow rates on lightly loaded pins that would otherwise ring unacceptably, and to set stronger, faster rates on heavily loaded pins on high-speed channels that would otherwise run too slow. Another relatively common analog feature is differential comparators on input pins designed to be connected to differential signaling channels. A few "mixed signal FPGAs" have integrated peripheral Analog-to-Digital Converters (ADCs) and Digital-to-Analog Converters (DACs) with analog signal conditioning blocks allowing them to operate as a system-on-a-chip. Such devices blur the line between an FPGA, which carries digital ones and zeros on its internal programmable interconnect fabric, and field-programmable analog array (FPAA), which carries analog values on its internal programmable interconnect fabric.

It may be appreciated that for the purposes of this document, the phrase “includes (but is not limited to)” is equivalent to the word “comprising.” The word “comprising” is a transitional phrase or word that links the preamble of a patent claims to the specific elements set forth in the claims that define what the invention itself actually is. The transitional phrase acts as a limitation on the claim, indicating whether a similar device, method, or composition infringes the patent if the accused device (etc) contains more or fewer elements than the claim in the patent. The word

"comprising" is to be treated as an open transition, which is the broadest form of transition, as it does not limit the preamble to whatever elements are identified in the claim. As well, "an assembly" is functionally equivalent to "at least one assembly". "An assembly" is not limited to one and only one assembly. it is understood that "an assembly" and "at least one assembly" means that there is one or more instances of the assembly. It is understood that "an assembly, system, component, or entity, etc" is functionally equivalent to "at least one or more assemblies, systems, components, or entities".

It may be appreciated that the assemblies and modules described above may be connected with each other as may be required to perform desired functions and tasks that are within the scope of persons of skill in the art to make such combinations and permutations without having to describe each and every one of them in explicit terms. There is no particular assembly, components, or software code that is superior to any of the equivalents available to the art. There is no particular mode of practicing the disclosed subject matter that is superior to others, so long as the functions may be performed. It is believed that all the crucial aspects of the disclosed subject matter have been provided in this document. It is understood that the scope of the present invention is limited to the scope provided by the independent claim(s), and it is also understood that the scope of the present invention is not limited to: (i) the dependent claims, (ii) the detailed description of the non-limiting embodiments, (iii) the summary, (iv) the abstract, and/or (v) description provided outside of this document (that is, outside of the instant application as filed, as prosecuted, and/or as granted). It is understood, for the purposes of this document, the phrase "includes (and is not limited to)" is equivalent to the word "comprising." It is noted that the foregoing has outlined the non-limiting embodiments (examples). The description is made for particular non-limiting embodiments (examples). It is understood that the non-limiting embodiments are merely illustrative as examples.

CLAIMS

What is claimed is:

1. A molding-system computer (100), comprising:

a computing assembly (110) being configured to determine whether information indicating an operational performance of an assembly (903) of a molding system (900) is acceptable.

2. A molding-system computer (100), comprising:

an input-interface assembly (102) being configured to receive information indicating operational performance of an assembly (903) of a molding system (900); and

a computing assembly (110) being configured to determine whether the information indicating the operational performance of the assembly (903) received by the input-interface assembly (102) is within an acceptable level of tolerance.

3. The molding-system computer (100) of claim 2, wherein:

the input-interface assembly (102) is configured to receive the information from a sensor assembly (996) configured to indicate the operational performance of the assembly (903) of the molding system (900).

4. The molding-system computer (100) of claim 2, wherein:

the computing assembly (110) is configured to:

interface with the input-interface assembly (102), and

analyze the information received by the input-interface assembly (102).

5. The molding-system computer (100) of claim 2, wherein:

the computing assembly (110) is configured to determine an adjustment factor to be made to the operational performance of the assembly (903) based on an analysis of the information received by the input-interface assembly (102).

6. The molding-system computer (100) of claim 2, further comprising:

an output-interface assembly (120) configured to:

interface with the computing assembly (110), and

control, based on an adjustment factor determined by the computing assembly (110), the assembly (903).

7. The molding-system computer (100) of claim 2, wherein:

the assembly (903) includes:

a plasticizing assembly (950).

8. The molding-system computer (100) of claim 2, wherein:

the molding system (900) includes:

an all-electric molding system (901).

9. The molding-system computer (100) of claim 2, wherein:

the assembly (903) includes any actuator configured for use in the molding system (900).

10. The molding-system computer (100) of claim 2, further comprising:

a processor assembly (101),

a memory unit (103),

the input-interface assembly (102), and

an output-interface assembly (120),

the processor assembly (101) is operatively connected to the memory unit (103), the input-interface assembly (102) and to the output-interface assembly (120) the memory unit (103) is configured to tangibly include controller-executable instructions configured to direct the processor assembly (101) to execute the controller-executable instructions configured to: calibrate, in situ, an aspect of the assembly (903) of the molding system (900).

11. The molding-system computer (100) of claim 2, wherein:

the input-interface assembly (102) includes:

a first input port (102A),

a second input port (102B), and

a third input port (102C),

the first input port (102A) is configured to connect to a pressure sensor assembly (967), the second input port (102B) is configured to connect to an encoder-output assembly (959), and the third input port (102C) is configured to connect to a torque-output assembly (963).

12. The molding-system computer (100) of claim 2, further comprising:

an output-interface assembly (120) including:

a first output port (120A),

a second output port (120B), and

a third output port (120C),

the first output port (120A) is configured to provide an indication of a screw position of a plasticizing assembly (950), the second output port (120B) is configured to provide the indication of a pressure sensor assembly (967), and the third output port (120C) is configured to provide the indication of a torque-output assembly (963).

13. The molding-system computer (100) of claim 2, further comprising:

a first output port (120A) configured to provide an output indicating position of a plasticizing assembly (950) in a barrel assembly (952),

a second output port (120B) configured to provide the output indicating an amount of torque applied to the plasticizing assembly (950), and

a third output port (120C) configured to provide an output signal indicating an amount of force applied to the plasticizing assembly (950).

14. The molding-system computer (100) of claim 2, wherein:

the molding-system computer (100) operates under modes of operation,

a first mode of operation includes stopping a manufacturing operation of the molding system (900), and put the molding system (900) through a test cycle,

a second mode of operation includes having the molding-system computer (100) operate while the molding system (900) manufactures molded articles during phases of a molding cycle of the molding system (900).

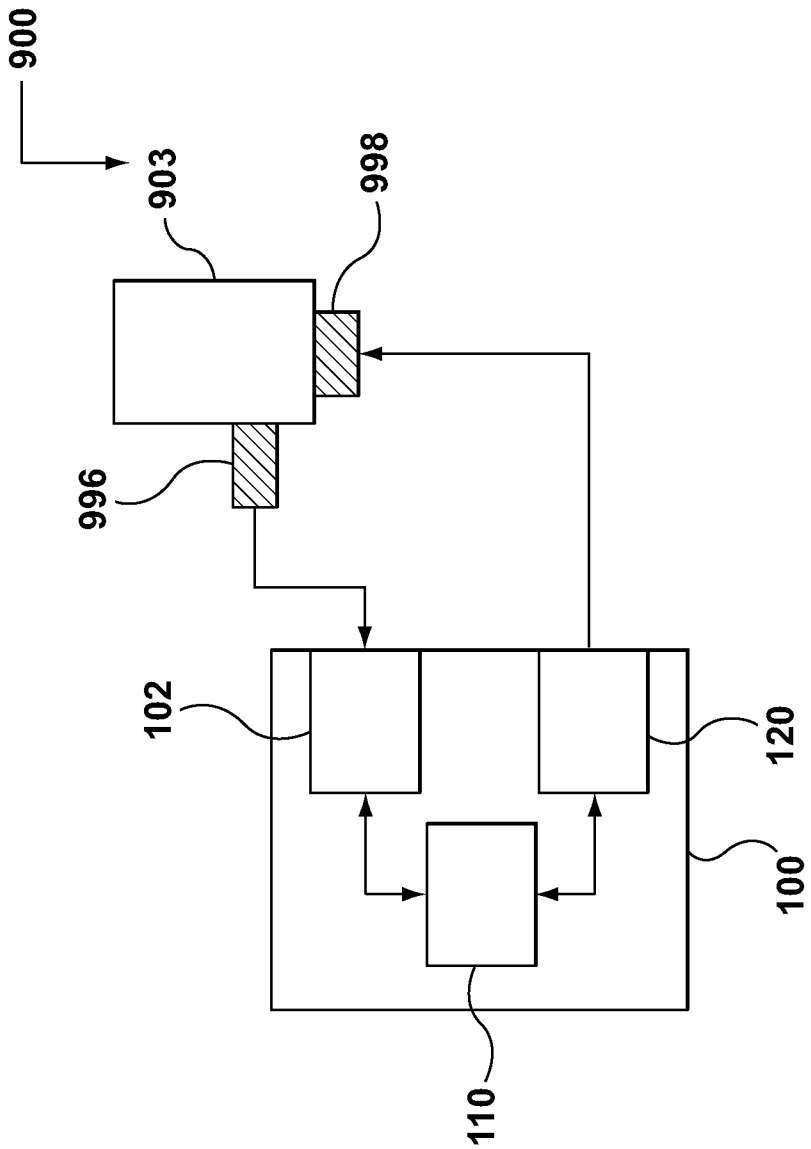


FIG. 1

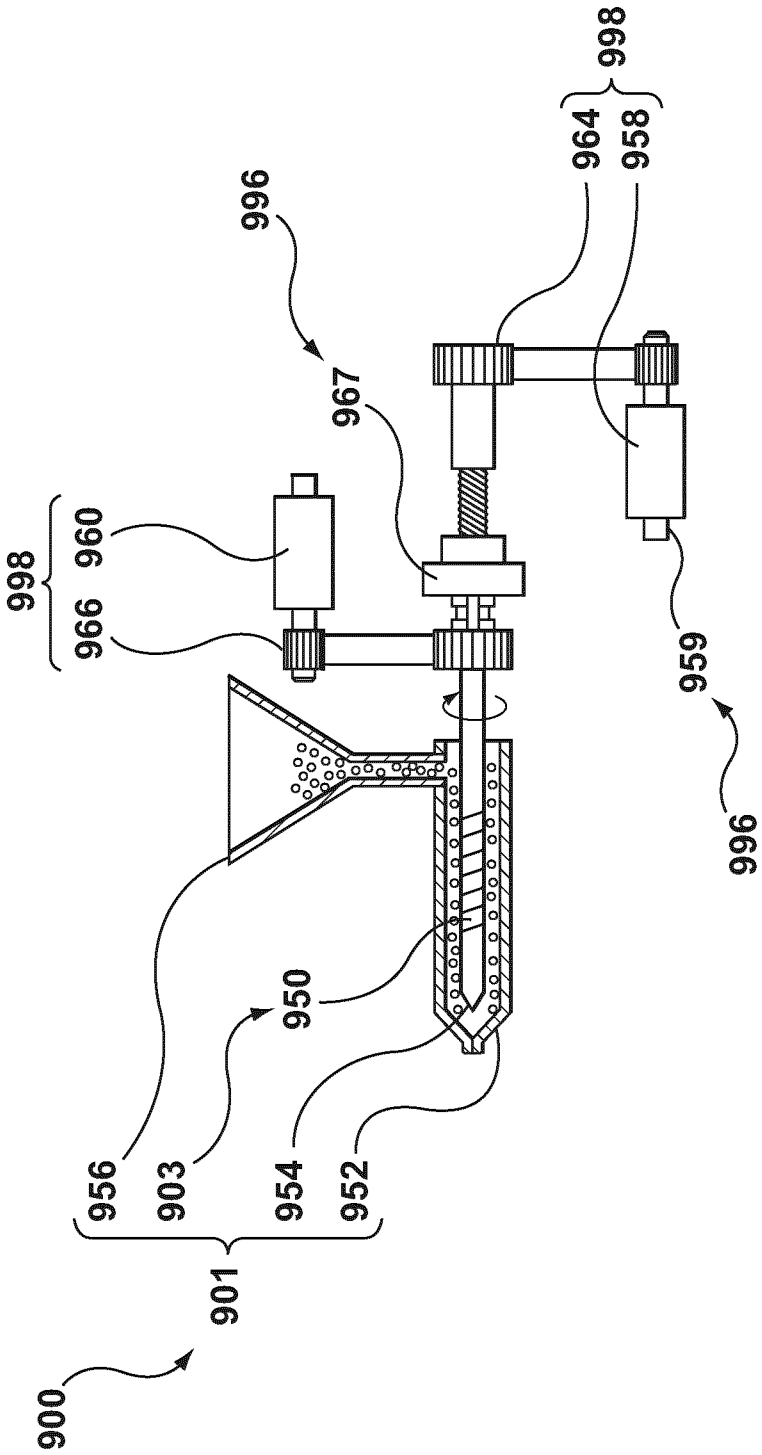

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FIG. 2

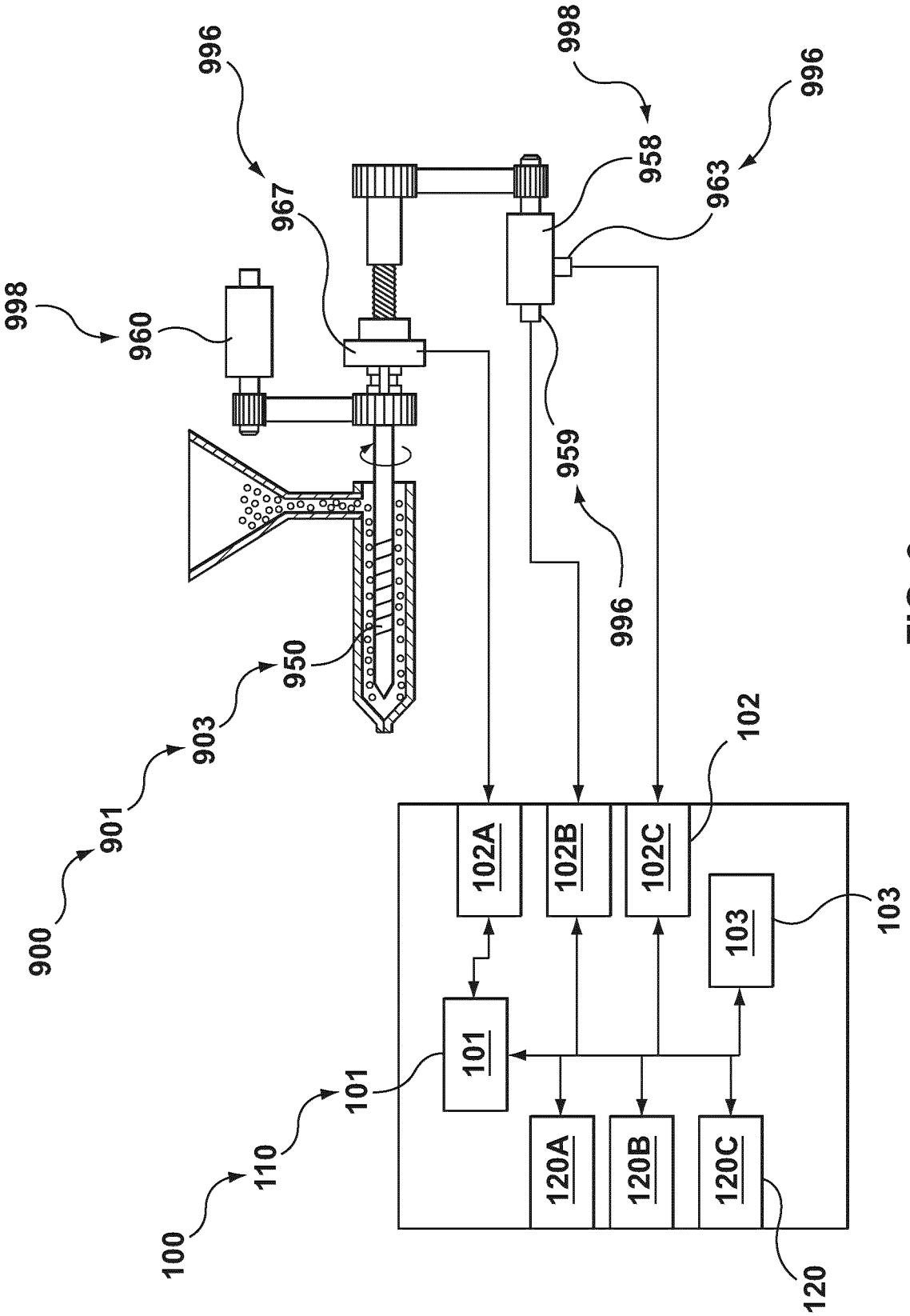

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120C
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FIG. 3

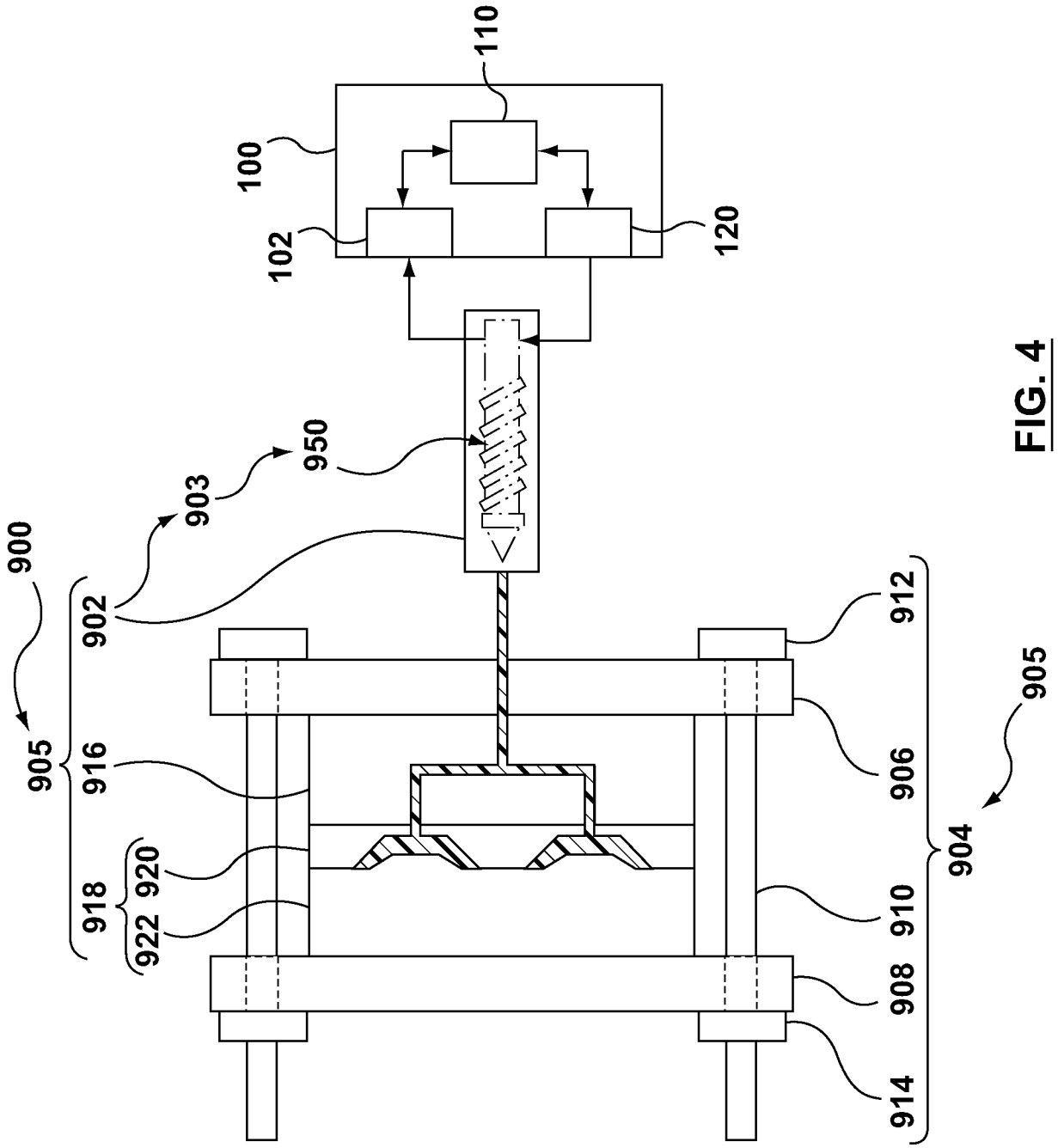

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FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2013/050166

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***B29C 45/76*** (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)
B29C 45 (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)
Canadian Patents Database, EPOQUE (TXTEN, EPODOC)
keywords: "injection mo(u)lding", diagnostic, tolerance, acceptable, computer, computing, input, output

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US2007294121A1, (GALT, J.R. et al.) 20 December 2007 (20-12-2007) * the whole document *	1-14
X	US5316707A, (STANCIU, V.V. et al) 31 May 1994 (31-05-1994) * the whole document *	1-14

[ ] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"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)

"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

"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

"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 April 2013 (29-04-2013)	07 May 2013 (07-05-2013)

Name and mailing address of the ISA/CA	Authorized officer
Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Pierre Cuerrier (819) 997-4379

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2013/050166

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
US2007294121A1	20 December 2007 (20-12-2007)	CA2653178A1	21 December 2007 (21-12-2007)
		CA2653178C	11 October 2011 (11-10-2011)
		CN101472724A	01 July 2009 (01-07-2009)
		CN101472724B	04 July 2012 (04-07-2012)
		CN102672932A	19 September 2012 (19-09-2012)
		DE202007019440U1	23 July 2012 (23-07-2012)
		EP2035208A1	18 March 2009 (18-03-2009)
		EP2035208A4	01 July 2009 (01-07-2009)
		EP2035208B1	15 August 2012 (15-08-2012)
		TW200809665A	16 February 2008 (16-02-2008)
		TWI351347B	01 November 2011 (01-11-2011)
		US2007294093A1	20 December 2007 (20-12-2007)
		WO2007143811A1	21 December 2007 (21-12-2007)
		WO2007143855A1	21 December 2007 (21-12-2007)
US5316707A	31 May 1994 (31-05-1994)	None	