(57) A method of making fluid receiving plastic containers having walls with fluid circulatable channels integrally formed therein comprises the successive steps of injecting a molten thermoplastic material in a mold cavity having a channel configuration to define, in the container being mold, walls with thicker portions defining a rib configuration, injecting a pressurized gas throughout the rib configuration to displace molten material therein and to form a hollow channel therein, cooling the container being mold while maintaining gas pressure, venting the gas, removing the molded container from the mold and cutting through the hollow channel at two spaced locations to form inlet and outlet openings to the channel to thereby enable circulation of the fluid through the channel.
ABSTRACT

A method of making fluid receiving plastic containers having walls with fluid circulatable channels integrally formed therein comprises the successive steps of injecting a molten thermoplastic material in a mold cavity having a channel configuration to define, in the container being mold, walls with thicker portions defining a rib configuration, injecting a pressurized gas throughout the rib configuration to displace molten material therein and to form a hollow channel therein, cooling the container being mold while maintaining gas pressure, venting the gas, removing the molded container from the mold and cutting through the hollow channel at two spaced locations to form inlet and outlet openings to the channel to thereby enable circulation of the fluid through the channel.
TITLE OF THE INVENTION
Method of making a plastic container with integral channel.

FIELD OF THE INVENTION
The present invention relates to plastic injection molding and, more particularly, to plastic injection molding wherein a container has a hollow channel integrally formed to its walls.

BACKGROUND OF THE INVENTION
Some plastic containers are formed with an inlet orifice and an outlet orifice so that a fluid can circulate to and from the container thus allowing recirculation of the fluid to an external device. For example, in the cooling system of an internal combustion engine, a cooling water reservoir is provided and is used not only for storing an overflow of cooling water but also for insuring a recirculation of a part of the cooling water to the reservoir to thereby separate and remove air and vapor from the cooling water in the reservoir. Such reservoir tank is formed with inlet and outlet ports each adapted to connect a hose or a tube. One such tank may be found described in U.S. patent 5,111,776 issued May 12, 1992 to Matsushiro et al.

The space available to receive a reservoir tank under the hood of a vehicle is very restricted and the presence of these hoses is often encumbering.

In a degas tank such as described in U.S. patent 5,329,889 issued July 19, 1994 to Caldwell, there is shown a container having inlet and outlet ports to which is connected a series of tubes for connection to a combustion engine and a radiator. Evidently, the presence of these tubes take up an important part of the space available under the hood of a vehicle for lodging many devices.
OBJECTS OF THE INVENTION

It is an object of the present invention to provide a plastic container made of plastic material which has, integrally formed to its walls, one or more channels allowing the circulation of the container fluid, thus greatly reducing the space taken up by the hoses or tubes.

This is achieved by providing a container having walls formed of thermoplastic material by gas assisted injection molding, the walls displaying a rib configuration with a channel formed therein. The channel may extend along the inner wall and/or the outer wall of the container and has open ends located in and out of the container thus allowing for the ingress or egress of a fluid in and out of the container.

The present invention therefore relates also to a method of making such plastic containers having walls with fluid circulatable channels integrally formed therein. The method comprises the successive steps of:

injecting a molten thermoplastic material in a mold cavity having a channel configuration to define, in the container being molded, walls with thicker portions defining a rib configuration;

injecting a pressurized gas in the rib configuration to displace molten material therein and to thereby form a hollow channel therein;

cooling the container being molded while maintaining gas pressure;

venting the gas;

removing the molded container;

cutting through the hollow channel at two spaced locations to form inlet and outlet openings to the channel to thereby enable circulation of a fluid through the channel.

Other objects and further scope of applicability of the present invention will become apparent from the detailed description given
hereinafter. It should be understood, however, that this detailed description, while indicating preferred embodiments of the invention, is given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art.

5 IN THE DRAWINGS

Figure 1 is a perspective view of a plastic container of the prior art with tubes connected thereto;

Figure 2 is a perspective view of a plastic container made in accordance with the present invention;

Figure 3 is a cross-sectional view of the upper part of the container;

Figure 4 is a cross-sectional view similar to figure 3 showing another embodiment of the present invention;

Figures 5, 6 and 7 represent various configurations of the location of the channel of a container wall; and

Figure 8 is a block diagram representing the various steps of the method of the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to figure 1, there is shown a conventional tank, generally denoted 10, formed of two molded parts 12 and 14 sealed to one another by known techniques. The upper component has a spout 16 to receive a fluid, such as a coolant as used in the automotive industry, a first port 18, a second port 20. To these ports are connected tubes or hoses 22 and 24 which increase the space volume occupied by the container once installed under the hood of a vehicle.

The present invention is concerned with reducing this space volume and this is achieved by making a container, such as the one illustrated as 30 in figure 2, which includes also two parts 32 and 34 formed
of a thermoplastic material by means of the injection molding technique. Essentially, a portion of the hoses 22 and 24 of the container of figure 1 are now integral parts of the container components 32 and 34. The upper molded part 32 has a rib portion 36 which is integral with its outer wall as well as a port portion 38 extending outwardly of the wall. The lower molded part 34 has a rib portion 40 which is integral with its outer wall, and on more than one face thereof.

As can be seen in figure 3, the rib portion 36 defines a hollow channel 42 having a first orifice 44 opening in the fluid inlet 45 and a second orifice 46 at the extremity of the port portion 38.

Figure 4 illustrates another variant of a plastic container made in accordance with the present invention wherein the upper molded part 32' has a rib portion 36' defining a channel 42' and a first orifice 44' and a second orifice 46'. In this embodiment, the orifice 46' is contiguous with an orifice 50 of a rib portion 52 having a channel 54 (the opposite orifice not being shown) of the lower molded part 34'. Once parts 32' and 34' are sealingly assembled to one another, the orifices 46' and 50 continue the channel formed by channels 42' and 54.

Referring to figures 5, 6 and 7, it can be seen that the rib portions may be formed in the plane of a container wall 62 shown in figure 5 as rib 56, internally of a wall 64 such as shown in figure 6 as rib 58 or internally of a wall 66 such as shown in figure 7 as rib 60.

Figure 8 is a flow chart of the successive steps involved in practicing the method of the present invention.

In step 70, a quantity of molten plastic is injected from an injection molding machine into a mold cavity. The plastic is any
thermoplastic material with sufficient quantity to provide the mass of the part to be molded. The mold cavity has a channel configuration determined by the channel configuration that it is wished to be given to the molded part once finished. Once the plastic is injected, the channel configuration forms a rib portion in or on the wall of the molded part.

In step 72, a charge of pressurized gas is introduced into the mold once the injection of the molded plastic is substantially completed. This gas flow is maintained in sufficient time and amount to displace a controlled quantity of molten plastic material in the rib configuration where the plastic material is in a more viscous condition than in the remaining portion of the container walls. Hence, the hottest fluid plastic material is displaced by the gas thus providing a hollow interior to form the channel described above.

In step 74, the molten part is permitted to cooling to thereby solidify the material; however, the gas pressure is maintained.

In step 76, the gas is vented.

In step 78, the molded part is removed from the mold.

In step 80, there are two cutting operations performed on the plastic part thus formed and, more particularly, at two spaced locations of the rib portion thereby allowing two orifices to be made to the channel formed in the container wall. Hence, referring to figure 3, these orifices are at 44 and 46.

It should be noted that there are many variations of channel configurations that may be given to a container. For example, a channel may have a first orifice inside the container (as in figure 7), then have the channel extend through the wall (as in figure 5) and have second orifice on the outside face of the container wall (such as in figure 6).
Although the invention has been described above with respect with one specific form, it will be evident to a person skilled in the art that it may be modified and refined in various ways. It is therefore wished to have it understood that the present invention should not be limited in scope, except by the terms of the following claims.
CLAIMS

1. A method of making containers having walls comprising the steps of:
   injecting a molten thermoplastic material in a mold cavity having a channel configuration to define a rib portion in the walls of the container being molded;
   injecting a pressurized gas in said rib portion to displace molten material so as to form a hollow channel in said container being molded;
   cooling the container being molded while maintaining gas pressure;
   venting said gas;
   removing the molded container;
   cutting through said rib portion at two spaced locations to form inlet and outlet openings to said hollow channel to thereby enable circulation of a fluid through said channel.

2. A method of making fluid receiving containers having walls with fluid circulatable channels integrally formed to said container walls, comprising the steps of:
   injecting a molten thermoplastic material in a mold cavity having a channel configuration to define a rib portion in the walls of the container being molded;
   injecting a pressurized gas in said rib portion to displace molten material so as to form a hollow channel in said container being molded;
cooling the container being molded while maintaining
gas pressure;
venting said gas;
removing the molded container;
cutting through said rib portion at two spaced locations
to form inlet and outlet openings to said hollow channel, said locations being
internal and external of said container to thereby enable circulation of a fluid
through said channel in and out of said container.

3. A method as defined in claim 1 or 2, wherein pressure
during said gas injection is maintained to ensure the displaced plastic
material of said hollow channel to flow into a spill reservoir.

4. A method as defined in claim 1, 2 or 3, comprising the
step of delaying the gas injection to ensure full compaction of the plastic
material injected.

5. A method of making a container formed of two molded
container part having walls with a fluid circulatable channel integrally formed
to said walls each mold container part being formed by injecting a molten
thermoplastic material in a mold cavity, at least one of the mold cavities
having a channel configuration to define a rib portion in the walls of the
container part being molded;

injecting a molten thermoplastic material in a mold cavity
having a channel configuration to define a rib portion in the walls of the
container being molded;

injecting a pressurized gas in said rib portion to displace
molten material so as to form a hollow channel in said container being
molded;
cooling the container being molded while maintaining
gas pressure;
venting said gas;
removing the molded container;
cutting through said rib portion at two spaced locations
to form inlet and outlet openings to said hollow channel to thereby enable
circulation of a fluid through said channel;
sealing said molded container parts together to form and
enclosed container.

6. A method as defined in claim 5, wherein said second
container part is formed by injecting a molten thermoplastic material in a
second mold cavity having a channel configuration to define a rib portion in
the walls of the container being molded;
injecting a molten thermoplastic material in a mold cavity
having a channel configuration to define a rib portion in the walls of the
container being molded;
injecting a pressurized gas in said rib portion to displace
molten material so as to form a hollow channel in said container being
molded;
cooling the container being molded while maintaining
gas pressure;
venting said gas;
removing the molded container;
cutting through said rib portion at two spaced locations
to form inlet and outlet openings to said hollow channel to thereby enable
circulation of a fluid through said channel.
7. A method as defined in claim 6, wherein the container molded parts are placed together so as to align the channel of each molded part so that once the container parts are sealed there is a continuous fluid circulation possible between the channels of each molded part.

8. A container having walls formed of thermoplastic material by gas assisted injection molding; said walls including a rib portion defining a channel formed by gas injection; said channel extending along at least a portion of said walls of said container and having open ends for the ingress or egress of a fluid through said channel.

9. A container having walls formed of thermoplastic material by gas assisted injection molding; said walls including a rib portion defining a channel formed by gas injection; said channel extending along at least a portion of said walls in and out of said container and having open ends located in and out of said container wherein said open ends may be used for the ingress or egress of a fluid in and from said container, said fluid circulating through said channel.
INJECTING PLASTIC IN MOLD CAVITY WITH CHANNEL CONFIGURATION

INJECTING PRESSURIZED GAS IN RIB PORTION

COOLING

VENTING

REMOVING MOULDED PART

CUTTING THROUGH RIB PORTION