

## Description

This invention relates generally to injection molding machines and, more particularly, to a valve assembly and further to a method to produce centrally apertured record discs.

U.S.—A—4,185,955 shows an injection molding machine for injecting molten plastic material under pressure through an injection sprue bushing and into the mold cavity defined by the disc-stamping dies. When the mold cavity is filled with the molten plastic material, the surrounding machine structure including the respective mold halves and the sprue bushing are cooled by a circulating liquid coolant to reduce the temperature of the molten plastic material and thereby solidify the material. In this manner, the molded record disc is quickly solidified within the mold cavity whereupon the solidified disc can be removed from the machine and the cycle restarted, thereby allowing a rapid production rate of the record discs. However, the plastic material within the sprue bushing is relatively thick compared with the plastic material within the mold cavity, whereby the plastic material within the sprue bushing takes the longest time to solidify. The cycle time for molding the record discs is therefore dependent upon the cooling time of the disc per se. Moreover, this solidified sprue material must be removed from the molded record disc, as by means of a punch assembly or the like, to yield the desired thin, substantially planar record disc including the desired central aperture.

It is an object of the present invention to provide an injection molding machine including an improved mold assembly particularly designed for use in making relatively thin, substantially planar record discs, such as video information discs, wherein the disc production rate is substantially independent of the solidification time of molten plastic material in the sprue bushing region of the injection machine.

The present invention fulfills this need by providing a valve assembly having all the features of claim 1. The invention relates also to a method to produce centrally apertured record discs having all the features of claim 8.

It is a particular advantage that the valve member remains in the closed position during solidification of the plastic material in the mold cavity to isolate the hot sprue region of the mold assembly from the mold cavity. Thus, a cooling fluid can be circulated in heat exchange relation with the material within the mold cavity to speed solidification of the plastic material therein without waiting for the plastic material within the sprue region to solidify. Since the material within the mold cavity is relatively thin, solidification occurs at a rapid rate resulting in a substantial decrease in the cycle time for a given record disc, and a corresponding substantial increase in the overall record disc production rate of the machine.

In one embodiment of the invention, the hot sprue valve assembly comprises a cylindrical

sleeve valve which is advanced into and through the mold cavity. Simultaneously, the sleeve valve molds a central aperture in the record disc prior to solidification of the plastic material. After the plastic material within the mold cavity has solidified, the mold parting line is opened and the sleeve valve is retracted whereupon an ejector pin positioned for movement along the axis of the sleeve valve is advanced to eject from the machine the relatively small partially-solidified plastic wafer in the aperture region of the disc.

In another embodiment of the invention, an ejector valve pin is positioned generally in axial alignment with the sprue bushing on the side of the mold cavity opposite the sprue bushing. When the mold cavity is filled with molten plastic material, the ejector valve pin is advanced to a first position to valve off and close the sprue bushing to further flow of plastic material into the mold cavity. After solidification of the plastic material within the mold cavity, the sprue bushing is moved axially away from the mold cavity and a punch carried about the ejector valve pin is advanced through the mold cavity to punch the central aperture in the disc. The mold parting line is then opened whereupon the ejector valve pin is advanced further to dislodge the relatively small wafer of at least partially solidified plastic material from the punch, whereupon the punch and the ejector pin are retracted to their initial positions for the next cycle and the solidified disc is removed from the machine.

Other features and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings which illustrate, by way of example, the principles of the invention.

The accompanying drawings illustrate the invention. In such drawings:

Fig. 1 is a simplified cross sectional view of an injection molding machine including a hot sprue valve assembly embodying the present invention;

Fig. 2 is an enlarged fragmented cross sectional view illustrating the hot sprue valve assembly in an open position;

Fig. 3 is an enlarged fragmented cross sectional view illustrating the valve assembly in a closed position;

Fig. 4 is an enlarged fragmented cross sectional view illustrating a subsequent position of movement of the valve assembly;

Fig. 5 is an enlarged fragmented cross sectional view illustrating the valve assembly in a further subsequent position of movement;

Fig. 6 is a simplified graphical representation illustrating operation of the hot sprue valve assembly of Figs. 1—5;

Fig. 7 is an enlarged fragmented cross sectional view illustrating an alternate embodiment of the hot sprue valve assembly of this invention;

Fig. 8 is an enlarged fragmented cross sectional view similar to Fig. 7 and illustrating a subsequent position of movement of the alternate valve assembly;

Fig. 9 is an enlarged fragmented cross sectional view illustrating a further subsequent position of movement of the valve assembly of Fig. 7; and

Fig. 10 is an enlarged fragmented cross sectional view similar to Fig. 7 illustrating a return of the valve assembly to its initial position of movement.

Referring now to the drawings, and particularly to Fig. 1 there is shown a molding apparatus 10 for use in combination with an injection molding machine (not shown) to produce a centrally apertured record disc 12, such as a video information disc.

The molding apparatus 10 comprises a first mold half 14 including a base plate 16 and a carrier plate 18, and a second mold half 20 including a base plate 22 and a carrier plate 24. The first and second mold halves 14 and 20 along with the associated base and carrier plates 16, 18 and 22, 24 are reciprocally movable toward and away from each other to open and close a relatively thin, substantially planar mold cavity 25 in which the record disc 12 is molded. More specifically, the mold halves 14 and 20 are movable between a closed position with their carrier plates 18 and 24 in abutting relation with each other as shown in Fig. 1, and an open position separated from each other as illustrated in Fig. 4. A plurality of guide pins 26, one of which is shown in Fig. 1, are received slidably within bushings 28 and 30, respectively, mounted on the two carrier plates 18 and 24 for maintaining the two mold halves 14 and 20 in close axial alignment with each other.

The carrier plates 18 and 24 of the two mold halves 14 and 20 respectively include annular plate-shaped recesses 32 and 34 facing toward each other generally in axial alignment for receiving annular platens 36 and 38, respectively. As illustrated, these platens 36 and 38 can be secured in position within the recesses 32 and 34 as by means of bolts 44, or the like. The platens 36 and 38 respectively carry disc-shaped stamping dies 40 and 42 which have a surface configuration representative of the information to be cast into the record disc 12 and cooperate with each other when the mold halves 14 and 20 are in the closed position to define the disc-shaped mold cavity 25 in which the disc 12 is injection molded. Annular rings 46 and 48 can be provided about the circumference of the mold cavity 25, and annular clamps 50 and 52 can be provided near the central axis of the mold cavity 25 for securing the stamping dies 40 and 42 in fixed positions upon their respective platens 36 and 38, all in a well-known manner.

An injector assembly 54 is carried by the base plate 16 of the first mold half 14, and this injector assembly 54 operates to supply a disc-forming melt to the mold cavity 25. More specifically, the injector assembly 54 comprises an injector gun assembly for heating plastic material to a molten state and for injecting an appropriate quantity of the molten plastic material to the mold cavity 25. This molten plastic material is injected into the

mold cavity through a flow path 55 defined by a generally cylindrical sprue bushing 56 including a nozzle 58 opening into the mold cavity 25. As illustrated, this flow path 55 is oriented generally at a right angle to the plane of the mold cavity 25, and generally in alignment with the central axis of the mold cavity.

The injector assembly 54 includes a cylindrical sleeve 57 extending downwardly, as illustrated in Fig. 1, through the a carrier plate 18 and the platen 36 of the first mold half 14. This sleeve 57 concentrically contains the sprue bushing 56 in the desired positional alignment with the mold cavity 25. The sleeve 57 is in turn received within a cylindrical die bushing 59 captured by the central clamp 50 for constraining the sleeve 57 and the sprue bushing 56 in alignment with respect to the platen 36 and the associated stamping die 40.

The sprue bushing 56 carries a suitable heating device, such as the annular heating coil 60 illustrated in the drawings. Thus, sprue bushing 56 and the coil 60 maintain the temperature level of the molten plastic material within the bushing flow path 55 at a desired elevated temperature as the material is injected into the mold cavity 25. In operation of the machine, the injected molten plastic material fills the mold cavity 25 and conforms to the shape of said cavity, whereby the plastic material also conforms to the specific geometry of the two stamping dies 40 and 42. When one or both of the stamping dies 40 and 42 is formed to include appropriate surface discontinuities representative of appropriate information, such as video and/or audio information, the stamping dies 40 and 42 correspondingly impart this information to the plastic material within the mold cavity 25 as that material solidifies to form the molded record disc 12.

The invention of this application comprises a hot sprue valve assembly 62 designed to valve off flow of molten plastic material through the sprue bushing 56 when the mold cavity 25 is filled with the molten plastic material. In this manner, the molten plastic material within the flow path 55 of the hot sprue bushing 56 is isolated from the mold cavity 25 whereby the plastic material within the mold cavity 25 can be solidified rapidly and substantially independently of the plastic material in the region of the sprue bushing 56. More specifically, a cooling fluid such as water can be circulated in heat exchange relation with the mold cavity 25 via an inlet 64 and through a plurality of coolant fluid flow passages 66 defined by the carrier plates 18 and 24 and their respective platens 36 and 38. This circulating coolant fluid reduces the temperature level of the plastic material within the mold cavity 25 and thereby solidifies that material rapidly to form the molded record disc 12. Of course, this coolant fluid is circulated from these passage 66 via an outlet (not shown) to an appropriate heat exchanger or the like for reduction of coolant fluid temperature and recirculation to the mold assembly 10 through the inlet 64.

The hot sprue valve assembly 62 of this invention offers significant advantages over the prior art in that it is not necessary to wait for the molten plastic material within the region of the sprue bushing 56 to solidify before the record disc 12 can be removed from the mold cavity 25. Alternately stated, it is necessary only to solidify the plastic material having a relatively small thickness within the mold cavity 25 before the solidified disc 12 can be removed from the machine and a subsequent molding cycle initiated. This significantly decreases the cycle time for producing a single record disc 12, and thereby substantially increases the overall disc production rate of the injection molding machine.

The hot sprue valve assembly 62 is illustrated in detail in Figs. 2-5. As illustrated, the valve assembly 62 comprises an elongated cylindrical sleeve valve 68 positioned on the side of the mold cavity 25 opposite the sprue bushing 56, and aligned generally on an axis common with the axis of the sprue bushing 56. The sleeve valve 68 is connected at one end as by screws 69 to a reciprocal plate 70 for movement toward and away from the sprue bushing 56 in response to operation of an air cylinder 72 coupled to the plate 70 via a piston rod 74. Importantly, the sleeve valve 68 is sized for engagement with the sprue bushing 56, and is movable between a "back" position spaced from the sprue bushing 56 as illustrated in Fig. 2, and a "forward" position in sealing engagement with the sprue bushing 56 as illustrated in Fig. 3.

The sleeve valve 68 projects slidably through matingly sized openings in the carrier plate 24 and the associated platen 38 of the second mold half 20. A stationary cylindrical valve guide 76 is secured to the base plate 22 as by a nut 77, and is concentrically received within the sleeve valve 68 for guiding the sliding movement of the sleeve valve 68. Moreover, a cylindrical die bushing 78 retained in position by the adjacent central clamp 52 functions to accurately guide movement of the sleeve valve 68.

The hot sprue valve assembly 62 also includes an ejector pin 80 carried slidably within the stationary valve guide 76 for movement along the central axis of the valve guide 76 and the sleeve valve 68. This ejector pin has its rear end secured in a suitable manner to an air cylinder 82 which operates to reciprocate the ejector pin 80 toward and away from the sprue bushing 56 independently of the sleeve valve 68. That is, the air cylinder 82 operates to move the ejector pin 80 between a "back" position retracted away from the sprue bushing 56, and a "forward" position wherein the ejector pin 80 is advanced toward the sprue bushing 56 to a position generally coinciding with the forward end of the valve guide 76.

Molten plastic material is injected under pressure by the injector assembly 54 through the sprue bushing 56 and its nozzle 58 into the mold cavity 25 whereupon the material spreads annularly to fill the mold cavity 25. When the mold cavity 25 is filled with the molten plastic material,

the sleeve valve 68 is advanced to its "forward" position for annular cooperation and engagement with the lowermost face of the sprue bushing 56, as shown in Fig. 3. This cooperation between the sleeve valve 68 and the sprue bushing 56 effectively isolates the portion of the molten plastic material within the sprue bushing 56 and within the sleeve valve 68 from the mold cavity 25. Importantly, the sleeve valve 68 is sized to correspond with the desired size of the central aperture in the disc 12, and this movement of the sleeve valve 68 functions to mold a central aperture 86 into the disc 12 prior to solidification of the plastic material within the mold cavity 25.

Concurrently with "forward" movement of the sleeve valve 68, the ejector pin 80 is moved to the reverse or "back" position as shown in Fig. 3. These simultaneous movements of the sleeve valve 68 and the ejector 80 are illustrated by the graph of Fig. 6. This movement of the ejector pin 80 produces a small cavity 88 at the upper end of the valve guide 76 into which molten plastic material displaced by the sleeve valve 68 is allowed to flow and fill. Conveniently, as illustrated in Fig. 3, this small cavity 88 at the head of the ejector pin 80 is lined by an annular undercut 90 formed in the valve guide 76, the purpose of which will be described in more detail. Moreover, the axial face of the sleeve valve 68 engaging the sprue bushing 56 desirably includes a radially inwardly presented taper, as at 84, to encourage the displaced plastic material to flow radially inwardly toward the cavity 88.

The liquid coolant is supplied to the mold halves 14 and 20 for flow through the circulating paths 66 to reduce the temperature of the molten plastic material within the mold cavity 25 and thereby solidify the record disc 12. This circulation of the liquid coolant also at least partially solidifies the plastic material circumscribed within the sleeve valve 68 to a semi-rigid state. Of course, according to this invention, the liquid coolant is not supplied to solidify the molten plastic material within the flow path 55 of the sprue bushing 56 whereby a precise separation line between the relatively small wafer 92 and the still-molten plastic material within the flow path 55 is not well defined. Nevertheless, the wafer 92 and the molten plastic material within the sprue bushing flow path 55 are isolated from the disc 12 within the mold cavity 25 to allow the disc to be rapidly solidified. Only partial solidification of the wafer 92 is necessary before the mold cavity 25 can be opened and the molded record disc 12 extracted from the machine.

As illustrated in Fig. 4, once the record disc 12 has solidified, the mold halves 14 and 20 are separated for extraction of the record disc 12 from the machine. Upon initial separation of the mold halves 14 and 20, a small portion of the wafer 92 received within the valve guide undercut 90 prevents uncontrolled ejection of the wafer from the mold assembly. At the appropriate time, the ejector pin 80 is advanced to its "forward" position as illustrated in Fig. 5, to eject the small wafer

92 from the mold assembly 10. When this is achieved, the sleeve valve 68 is retracted to its "back" position and the record disc 12 is extracted in a known manner. The mold halves 14 and 20 can then be closed once again to define the mold cavity 25 and the injection molding cycle is repeated. These various latter movements of the ejector pin 80 and the sleeve valve 68 are also illustrated by the graph of Fig. 6.

The hot sprue valve assembly 62 shown and described in Figs. 1—5 is highly advantageous compared with valve assemblies and ejectors commonly found in the prior art. For example, the valve assembly 62 isolates the molten plastic material within the sprue bushing 56 from the mold cavity 25 during solidification of the material within the mold cavity. This allows the machine production rate to be governed by the solidification time of the disc 12 within the cavity 25, and not by the longer solidification time of plastic material within the region of the sprue bushing 56. This results in substantial decreases in cycle time for each record disc 12, and corresponding substantial increases in machine production rate.

The hot sprue valve assembly 62 of Fig. 1—5 is further advantageous in that the cylindrical sleeve valve 68 functions to mold the central aperture 86 into the record 12 prior to material solidification thereby eliminating the need for punching or other post-solidification formation of the central aperture. This molding technique eliminates any need to grind or otherwise machine the size and shape of the central aperture to a final size, and also prevents possible cracking of the disc 12 or the creation of small debris during punching which can become trapped within the mold cavity 25 and deleteriously affect subsequent record disc formation. Still further, the use of the sleeve valve 68 to mold the central aperture eliminates the requirement for periodic replacement of a conventional punching apparatus which can wear over a period of time.

An alternate embodiment of the invention is illustrated in Figs. 7—10, and comprises a hot sprue valve assembly 100 for use with a molding assembly 110 of an injection molding machine generally of the type described above with respect to the embodiment of Figs. 1—5. More specifically, as shown in Figs. 7 and 8, the molding apparatus 110 comprises a first mold half 114 with a base plate 116 and a carrier plate 118, and a second mold half 120 with a base plate 122 and a carrier plate 124. The two mold halves 114 and 120 are reciprocally movable toward and away from each other to open and close a relatively thin and substantially planar, disc-shaped mold cavity 125 in which a record disc 112 is molded. The two carrier plates 118 and 124 of the two mold halves 114 and 120 carry platens and stamping dies similar to those described with reference to Figs. 1—5, whereby these details are not repeated.

An injector assembly 154 is carried by the base plate 116 of the first mold half 114 for supplying molten plastic material to the mold cavity 125. As

in the previous embodiment, this injection assembly 154 includes a cylindrical sleeve 157 projecting downwardly through the carrier plate 118 in axial alignment with the central axis of the mold cavity 125. The sleeve 157 slides within the carrier plate 118 and with respect to a die bushing 159 secured in position by a central clamp 150.

A hot sprue bushing 156 is concentrically carried within the sleeve 157, and this bushing 156 defines a flow path 155 for molten plastic material from the injector assembly 154 to the mold cavity 125. A heating coil 160 or the like is carried by the sprue bushing 156 to maintain the temperature of the plastic material injected there-through, and thereby maintain that material in a molten state.

The hot sprue valve assembly 100 of Fig. 7 is provided for closing off the bushing 156 to further flow of plastic material when the mold cavity 125 is filled. This allows the portion of the plastic material within the mold cavity 125 to be solidified, as by application of a cooling liquid or the like, independently of the solidification of the plastic material with the sprue bushing flow path 155. As in the previous embodiment, this results in a substantial decrease in mold cycle time for each record disc 112, and thereby provides a corresponding substantial increase in machine production rate.

The hot sprue valve assembly 100 comprises an ejector valve pin 180 positioned on the side of the mold cavity 125 opposite the sprue bushing 156. This ejector valve pin 180 is secured to an air cylinder 182 for controlled movement between a plurality of positions for controlling flow of molten plastic material through the sprue bushing 156. Specifically, the pin 180 is axially aligned with the flow path 155 of the sprue bushing 156 and is movable in response to the air cylinder 182 toward and away from the sprue bushing 156.

The ejector valve pin 180 is slidably received within a sleeve punch 168. This sleeve punch 168 has one end secured as by a nut 177 to a reciprocal plate 170, the movement of which is controlled by a suitable air cylinder (not shown) or the like corresponding with the air cylinder 72 of Fig. 1. The opposite end of the sleeve punch 168 extends through the associated carrier plate 124 of the second mold half 120 and includes a cylindrical punch head 169 adjacent the sprue bushing 156. This punch head 169 is slidably received within a die bushing 178 which is secured in position by a central clamp 152.

In the embodiment of Figs. 7—10, the ejector valve pins 180 is advanced toward the sprue bushing 156 when the mold cavity 125 is filled with molten plastic material. Specifically, the ejector valve pin 180 includes a tapered control valve head 181 sized for engaging the sprue bushing 156 to valve off the flow path 155, as shown by the dotted line position of the ejector valve pin 180 in Fig. 7. The ejector valve pin 180 remains in this dotted line position until the plastic material within the mold cavity 125 is solidified.

As soon as the molten plastic material within the mold cavity 125 is solidified, the mold halves 114 and 120 are separated to open the mold cavity and allow extraction of the molded record disc 112 from the mold assembly 110. Importantly, however, upon initial movement of the mold halves 14 and 20, the base plate 116 and the carrier plate 118 of the first mold half 114 separate from each other, as illustrated by the space 117 in Fig. 8. This movement is effective to begin withdrawal of the sprue bushing 156 from the mold cavity 125 while the carrier plates 118 and 124 of the two mold halves 114 and 120 remain initially in abutting contact with each other. This movement is controlled by means of an appropriate latch-lock mechanism.

Concurrently with the separating of the base plate 116 and the carrier plate 118 of the first mold half 114, the sleeve punch 168 is advanced through the mold cavity 125 to punch a central aperture 186 of the desired size in the solidified record disc 112. This movement of the sleeve punch 168 is shown in Fig. 8 wherein a relatively small wafer 192 is displaced from the disc 112 to define the aperture 186. During punching, the disc 112 is tightly supported between the die bushings 159 and 178. Importantly, while the wafer 192 is at least partially solidified by virtue of the solidification of the disc 112, the plastic material within the sprue bushing flow path 155 remains substantially in a molten state. As illustrated, the conical head 181 of the ejector valve pin 180 cooperates with the advanced sleeve punch 168 to define a relatively small cavity 188 in which a portion of the wafer 192 is trapped. This prevents uncontrolled falling of the wafer 192 from the mold assembly 110 when the mold halves 114 and 120 are opened, as will be described. If desired, the sleeve punch 168 can include an annular undercut 190 about the conical pin head 181 to assist in controlling the position of the wafer 192.

Subsequent to punching of the central aperture 186, the two mold halves 114 and 120 are separated to allow for extraction of the molded record disc 112 from the mold assembly 110. As illustrated in Fig. 9, this also allows for removal of the relatively small wafer 192 in the sprue region of the central aperture 186. More specifically, the ejector valve pin 180 is advanced to a further position by means of the air cylinder 182 to push to wafer 192 from the end of the advanced sleeve punch 168. As illustrated in Fig. 10, the ejector valve pin 180 and the sleeve punch 168 are then retracted together to their initial positions to allow the wafer 192 to freely fall from the mold assembly 110. At this stage, the molded record disc 112 can be easily removed from the mold assembly 110 in a convenient manner, and the mold halves 114 and 120 can be returned to abutting engagement with each other for the next cycle of the machine.

The hot sprue valve assembly 100 of Figs. 7—10 operates to isolate the plastic material within the sprue bushing 156 from the mold cavity 125

during solidification of the record disc 112. In this manner, it is not necessary for substantial quantities of plastic material in the sprue region to solidify prior to removal of the disc 112 from the machine. Thus, the disc cycle time is governed by the solidification of plastic material within the mold cavity 125 and not by the solidification of plastic material in the sprue region. This effectively decreases the cycle time for a given record disc 112, and substantially increases the overall machine production rate.

Various modifications and improvements to the hot sprue valve assembly embodiments of this invention are believed to be apparent to one skilled in the art. Accordingly, no limitation upon the invention is intended, except as set forth in the appended claims.

### Claims

1. A valve assembly for controlling flow of molten disc-forming material through a sprue bushing (56, 156) into a disc-shaped mold cavity (25, 125) in an injection molding machine for producing centrally apertured record discs, said valve assembly comprising: valve means (62, 100) normally positioned in spaced relation with the sprue bushing (56, 156) and on a side of the mold cavity (25, 125) generally opposite the sprue bushing for allowing flow of the molten disc-forming material through the sprue bushing (56, 156) into the mold cavity, said valve means (62, 100) being movable through the mold cavity (25, 125) into bearing engagement with the sprue bushing (56, 156) for preventing flow of the molten disc-forming material through the sprue bushing into the mold cavity, said valve means (62, 100) including means (68, 168) for forming a central aperture in the record disc formed within the mold cavity (25, 125) and means (80, 100) for ejecting from the machine the portion (92, 192) of the disc-forming material displaced from said central aperture upon at least partial solidification of said portion.

2. The valve assembly of Claim 1 wherein the sprue bushing (56) has a generally cylindrical shape and defines a flow path for the molten disc-forming material, said valve means (62) including a cylindrical sleeve valve (68) for movement through the mold cavity (25) into bearing engagement with the sprue bushing (56) annularly about the flow path in the sprue bushing for preventing flow of the molten disc-forming material from the flow path into the mold cavity (25).

3. The valve assembly of Claim 1 wherein said valve means (62) comprises: a stationary cylindrical valve guide (76) positioned in spaced relation with the sprue bushing (56) on the side of the mold cavity (25) generally opposite the sprue bushing; a sleeve valve (68) concentrically received about said valve guide (76) for movement between a first position spaced from the sprue bushing (56) to allow flow of the molten disc-forming material through the sprue bushing (56) and into the mold cavity (25), and a second

(15)

As soon as the molten plastic material within the mold cavity 125 is solidified, the mold halves 114 and 120 are separated to open the mold cavity and allow extraction of the molded record disc 112 from the mold assembly 110. Importantly, however, upon initial movement of the mold halves 14 and 20, the base plate 116 and the carrier plate 118 of the first mold half 114 separate from each other, as illustrated by the space 117 in Fig. 8. This movement is effective to begin withdrawal of the sprue bushing 156 from the mold cavity 125 while the carrier plates 118 and 124 of the two mold halves 114 and 120 remain initially in abutting contact with each other. This movement is controlled by means of an appropriate latch-lock mechanism.

Concurrently with the separating of the base plate 116 and the carrier plate 118 of the first mold half 114, the sleeve punch 168 is advanced through the mold cavity 125 to punch a central aperture 186 of the desired size in the solidified record disc 112. This movement of the sleeve punch 168 is shown in Fig. 8 wherein a relatively small wafer 192 is displaced from the disc 112 to define the aperture 186. During punching, the disc 112 is tightly supported between the die bushings 159 and 178. Importantly, while the wafer 192 is at least partially solidified by virtue of the solidification of the disc 112, the plastic material within the sprue bushing flow path 155 remains substantially in a molten state. As illustrated, the conical head 181 of the ejector valve pin 180 cooperates with the advanced sleeve punch 168 to define a relatively small cavity 188 in which a portion of the wafer 192 is trapped. This prevents uncontrolled falling of the wafer 192 from the mold assembly 110 when the mold halves 114 and 120 are opened, as will be described. If desired, the sleeve punch 168 can include an annular undercut 190 about the conical pin head 181 to assist in controlling the position of the wafer 192.

Subsequent to punching of the central aperture 186, the two mold halves 114 and 120 are separated to allow for extraction of the molded record disc 112 from the mold assembly 110. As illustrated in Fig. 9, this also allows for removal of the relatively small wafer 192 in the sprue region of the central aperture 186. More specifically, the ejector valve pin 180 is advanced to a further position by means of the air cylinder 182 to push to wafer 192 from the end of the advanced sleeve punch 168. As illustrated in Fig. 10, the ejector valve pin 180 and the sleeve punch 168 are then retracted together to their initial positions to allow the wafer 192 to freely fall from the mold assembly 110. At this stage, the molded record disc 112 can be easily removed from the mold assembly 110 in a convenient manner, and the mold halves 114 and 120 can be returned to abutting engagement with each other for the next cycle of the machine.

The hot sprue valve assembly 100 of Figs. 7—10 operates to isolate the plastic material within the sprue bushing 156 from the mold cavity 125

during solidification of the record disc 112. In this manner, it is not necessary for substantial quantities of plastic material in the sprue region to solidify prior to removal of the disc 112 from the machine. Thus, the disc cycle time is governed by the solidification of plastic material within the mold cavity 125 and not by the solidification of plastic material in the sprue region. This effectively decreases the cycle time for a given record disc 112, and substantially increases the overall machine production rate.

Various modifications and improvements to the hot sprue valve assembly embodiments of this invention are believed to be apparent to one skilled in the art. Accordingly, no limitation upon the invention is intended, except as set forth in the appended claims.

### Claims

1. A valve assembly for controlling flow of molten disc-forming material through a sprue bushing (56, 156) into a disc-shaped mold cavity (25, 125) in an injection molding machine for producing centrally apertured record discs, said valve assembly comprising: valve means (62, 100) normally positioned in spaced relation with the sprue bushing (56, 156) and on a side of the mold cavity (25, 125) generally opposite the sprue bushing for allowing flow of the molten disc-forming material through the sprue bushing (56, 156) into the mold cavity, said valve means (62, 100) being movable through the mold cavity (25, 125) into bearing engagement with the sprue bushing (56, 156) for preventing flow of the molten disc-forming material through the sprue bushing into the mold cavity, said valve means (62, 100) including means (68, 168) for forming a central aperture in the record disc formed within the mold cavity (25, 125) and means (80, 100) for ejecting from the machine the portion (92, 192) of the disc-forming material displaced from said central aperture upon at least partial solidification of said portion.

2. The valve assembly of Claim 1 wherein the sprue bushing (56) has a generally cylindrical shape and defines a flow path for the molten disc-forming material, said valve means (62) including a cylindrical sleeve valve (68) for movement through the mold cavity (25) into bearing engagement with the sprue bushing (56) annularly about the flow path in the sprue bushing for preventing flow of the molten disc-forming material from the flow path into the mold cavity (25).

3. The valve assembly of Claim 1 wherein said valve means (62) comprises: a stationary cylindrical valve guide (76) positioned in spaced relation with the sprue bushing (56) on the side of the mold cavity (25) generally opposite the sprue bushing; a sleeve valve (68) concentrically received about said valve guide (76) for movement between a first position spaced from the sprue bushing (56) to allow flow of the molten disc-forming material through the sprue bushing (56) and into the mold cavity (25), and a second



position projecting through the mold cavity (25) into bearing engagement with the sprue bushing (56) to prevent flow of the molten disc-forming material through the sprue bushing (56) and into the mold cavity (25), said sleeve valve (68) being movable to said second position prior to solidification of the disc-forming material to mold an aperture in the record disc formed in the mold cavity; and an ejector pin (80) carried concentrically within said valve guide (76) for movement along its own axis between a position retracted from the mold cavity (25) when said sleeve valve (68) is moved to said second position for cooperating with said valve guide (76) to define a relatively small recess (88) to accommodate disc-forming material displaced by said sleeve valve (68), and a position advanced toward the mold cavity (25) after at least partial solidification of said portion (92) of the disc-forming material displaced from said aperture to eject said portion (92) from the machine.

4. The valve assembly of Claim 1 wherein the sprue bushing (156) has a generally cylindrical shape and defines a flow path for the molten disc-forming material, said valve means (100) comprising an ejector valve pin (180) for movement through the mold cavity (125) to a seated position upon the sprue bushing (156) to close the sprue bushing flow path and thereby prevent flow of molten disc-forming material into the mold cavity (125).

5. The valve assembly of Claim 4 wherein the sprue bushing flow path is oriented generally at a right angle to the plane of the disc-forming mold cavity (125) and communicates with the mold cavity generally at the central axis thereof, said ejector valve pin (180) being oriented for movement toward and away from the sprue bushing (156) substantially along its own axis and substantially along the axis of the sprue bushing flow path, said ejector valve pin (180) including at one end a valve head (181) shaped for seating engagement with the sprue bushing (156) to close the sprue bushing flow path.

6. The valve assembly of Claim 4 wherein said means (161) for forming said aperture in the disc comprises a sleeve punch concentrically carried about said ejector valve pin (180) for movement along the axis thereof toward and away from the mold cavity (125), said sleeve punch including a punch head (169) for movement into and through the mold cavity (125) after solidification of the disc-forming material therein for punching said aperture in the disc, said sleeve punch being movable to a retracted position when said ejector valve pin (180) is positioned to allow flow of the molten disc-forming material into the mold cavity (125) and prior to solidification of the disc-forming material.

7. The valve assembly of Claim 6 wherein the machine includes first (114) and second (120) mold halves movable between a closed position to define the mold cavity (125) and an open position to allow extraction of a molded disc from the molded cavity, said valve assembly and the

sprue bushing (156) being carried respectively by said first and second mold halves, and wherein said ejector valve pin (180) is movable from a retracted position spaced from the sprue bushing (156) when said mold halves (114, 120) are in said closed position to allow flow of the molten disc-forming material into the mold cavity (125) to a first advanced position in bearing engagement with the sprue bushing (156) to prevent further flow of the disc-forming material into the mold cavity (125), and to a second and further advanced position when said mold halves (114, 120) are in said open position to eject said portion (92) of the disc-forming material displaced from said aperture by said sleeve punch.

8. A method for producing centrally apertured record discs in an injection molding machine including a generally disc-shaped mold cavity (25, 125) and a sprue bushing (56, 156) for flow of molten disc-forming material into the mold cavity, comprising the steps of: positioning valve means (62, 100) in a normal position in spaced relation with the sprue bushing (56, 156) on the side of the mold cavity (25, 125) opposite the sprue bushing for allowing flow of the molten disc-forming material through the sprue bushing (56, 156) into the mold cavity and filling the mold cavity, moving the valve means (62, 100) through the mold cavity (25, 125) into bearing engagement with the sprue bushing (56, 156) prior to the solidification of the disc-forming material to prevent further flow of the molten disc-forming material through the sprue bushing (56, 156) and to form an aperture in the record disc formed in the mold cavity (25, 125); and ejecting from the machine the portion (92, 192) of the disc-forming material displaced from the aperture upon at least partial solidification of said portion.

9. The method as claimed in Claim 8, wherein said valve means (62) is a sleeve valve (68) and further comprising the steps of positioning an ejector pin (80) concentrically within the sleeve valve (68) in a normal position advanced toward the mold cavity (25); and retracting the ejector pin (80) from the mold cavity (25) substantially simultaneously with said step of moving the valve means (62) to accommodate disc-forming material displaced by the sleeve valve (68), and wherein said ejecting step includes returning the ejector pin (80) to its normal position to eject from the machine the portion (92) of the disc-forming material displaced from the aperture.

10. The method as claimed in Claim 8, wherein said valve means (100) includes an ejector valve pin (180) and a sleeve punch concentrically about the ejector valve pin (180) in a normal position on the side of the mold cavity opposite the sprue bushing (156), wherein said step of moving the valve means (100) includes: advancing the ejector valve pin (180) through the mold cavity (125) prior to solidification of the disc-forming material therein into bearing engagement with the sprue bushing (156) to prevent further flow of molten disc-forming material through the sprue bushing (156) into the mold cavity (125); allowing the disc-



forming material within the mold cavity (125) to solidify; withdrawing the sprue bushing (156) in a direction away from the mold cavity (125); and advancing the sleeve punch into and through the mold cavity (125) to punch an aperture in the solidified disc, and wherein said ejecting step includes advancing the ejector valve pin (180) to a further advanced position to dislodge from the punch the portion (192) of the disc-forming material displaced from the aperture.

#### Revendications

1. Assemblage de clapet pour contrôler l'écoulement d'une matière fondue formant un disque à travers une traversée de canal de coulée (56, 156) dans une cavité (25, 125) d'un moule en forme de disque dans une machine à mouler par injection pour la production de disques à ouverture centrale, ledit assemblage de clapet comprenant: un moyen formant clapet (62, 100) normalement placé en relation espacée avec la traversée (56, 156) du canal de coulée et d'un côté de la cavité du moule (25, 125) généralement opposé à la traversée du canal de coulée pour permettre l'écoulement de la matière fondue formant le disque à travers la traversée du canal de coulée (56, 156) dans la cavité du moule, ledit moyen formant clapet (62, 100) étant mobile à travers la cavité du moule (25, 125) en engagement d'appui avec la traversée (56, 156) du canal de coulée pour empêcher l'écoulement de la matière fondue formant le disque à travers la traversée du canal de coulée dans la cavité du moule, ledit moyen formant clapet (62, 100) comprenant un moyen (68, 168) pour former une ouverture centrale dans le disque formé dans la cavité du moule (25, 125) et un moyen (80, 180) pour l'éjection de la machine de la partie (92, 192) de la matière formant le disque déplacée de ladite ouverture centrale lors d'une solidification au moins partielle de ladite partie.

2. Assemblage de clapet selon la revendication 1, où la traversée (56) pour le canal de coulée a une forme généralement cylindrique et définit un trajet d'écoulement pour la matière fondue formant le disque, ledit moyen formant clapet (62) comprenant une soupape à chemise cylindrique (68) pour un mouvement à travers la cavité (25) du moule en engagement d'appui avec la traversée (56) du canal de coulée en anneau autour du trajet d'écoulement dans la traversée du canal de coulée pour empêcher l'écoulement de la matière fondue formant le disque du trajet d'écoulement dans la cavité (25) du moule.

3. Assemblage de clapet de la revendication 1, où ledit moyen formant soupape (62) comprend: un guide de soupape cylindrique stationnaire (76) placé en relation espacée avec la traversée (56) du canal de coulée du côté de la cavité (25) du moule généralement opposé à la traversée du canal de coulée; une soupape à chemise (68) reçue concentriquement autour dudit guide (76) de soupape pour un mouvement entre une première position espacée de la traversée (56) du canal de

coulée pour permettre l'écoulement de la matière fondue de formation du disque à travers la traversée (56) du canal de coulée et dans la cavité (25) du moule et une seconde position faisant saillie à travers la cavité (25) du moule en engagement d'appui avec la traversée (56) du canal de coulée pour empêcher l'écoulement de la matière fondue formant le disque à travers la traversée (56) du canal de coulée et dans la cavité (25) du moule, ladite soupape à chemise (68) étant mobile à ladite seconde position avant solidification de la matière formant le disque pour mouler une ouverture dans le disque formé dans la cavité du moule; et un pointeau d'éjecteur (80) porté concentriquement dans ledit guide (76) de soupape pour un mouvement le long de son propre axe entre une position retirée de la cavité (25) du moule lorsque ladite soupape à chemise (68) est déplacée à sa seconde position pour coopérer avec ledit guide (76) de la soupape pour définir un relativement petit évidement (88) pour recevoir la matière de formation du disque déplacée par ladite soupape à chemise (68) et une position avancée vers la cavité (25) du moule après une solidification au moins partielle de ladite partie (92) de la matière formant le disque déplacée de ladite ouverture pour éjecter ladite partie (92) de la machine.

4. Assemblage de clapet de la revendication 1, où la traversée (156) du canal de coulée a une forme généralement cylindrique et définit un trajet d'écoulement pour la matière fondue de formation du disque, ledit moyen formant soupape (100) comprenant un pointeau de soupape d'éjecteur (180) pour un mouvement à travers la cavité (125) du moule à une position assise sur la traversée (156) du canal de coulée pour fermer le trajet d'écoulement dans la traversée du canal de coulée et ainsi empêcher l'écoulement de la matière fondue formant le disque dans la cavité (125) du moule.

5. Assemblage de clapet de la revendication 4, où le trajet d'écoulement de la traversée du canal de coulée est orienté généralement à un angle droit avec le plan de la cavité (125) du moule formant le disque et communique avec la cavité du moule généralement en son axe central, ledit pointeau de soupape d'éjecteur (180) étant orienté pour un mouvement vers et au loin de la traversée (156) du canal de coulée sensiblement le long de son propre axe et sensiblement le long de l'axe du trajet d'écoulement de la traversée du canal de coulée, ledit pointeau (180) de soupape d'éjecteur ayant à une extrémité une tête de soupape (181) configurée pour un engagement d'assise avec la traversée (156) du canal de coulée pour fermer le trajet d'écoulement de la traversée du canal de coulée.

6. Assemblage de clapet de la revendication 4, où ledit moyen (168) pour former ladite ouverture dans le disque comprend un poinçon à manchon porté concentriquement autour dudit pointeau (180) de soupape d'éjecteur pour un mouvement le long de son axe vers et au loin de la cavité (125) du moule, ledit poinçon à manchon ayant une tête



(18)

de poinçon (169) pour un mouvement dans et à travers la cavité (125) du moule après solidification de la matière de formation du disque pour percer ladite ouverture dans le disque, ledit poinçon à manchon étant mobile à une position retirée lorsque ledit pointeau de soupape d'éjecteur (180) est placé pour permettre l'écoulement de la matière fondue de formation du disque dans la cavité (125) du moule et avant solidification de la matière de formation du disque.

7. Assemblage de clapet de la revendication 6, où la machine comprend des première (114) et seconde (120) moitiés de moule mobiles entre une position fermée pour définir la cavité (125) du moule et une position ouverte pour permettre l'extraction d'un disque moulé de la cavité moulée, ledit assemblage de clapet et la traversée (156) du canal de coulée étant portés respectivement par lesdites première et seconde moitiés du moule et où ledit pointeau de soupape d'éjecteur (180) est mobile d'une position retirée espacée de la traversée (156) du canal de coulée lorsque lesdites moitiés (114, 120) du moule sont dans ladite position fermée pour permettre l'écoulement de la matière fondue de formation du disque dans la cavité (125) du moule à une première position avancée en engagement d'assise avec la traversée du canal de coulée (156) pour empêcher un plus ample écoulement de la matière de formation du disque dans la cavité (125) du moule et à une seconde et autre position avancée lorsque lesdites moitiés (114, 120) du moule sont dans ladite position ouverte pour éjecter ladite partie (192) de la matière formant le disque déplacée de ladite ouverture par ledit poinçon à manchon.

8. Méthode de production de disques à ouverture centrale dans une machine à mouler par injection comprenant une cavité du moule (25, 125) généralement en forme de disque et une traversée (56, 156) du canal de coulée pour l'écoulement de la matière fondue de formation du disque dans la cavité du moule, comprenant les étapes de: placer un moyen formant soupape (62, 100) en une position normale en relation espacée avec la traversée (56, 156) du canal de coulé du côté de la cavité (25, 125) du moule opposé à la traversée du canal de coulée pour permettre l'écoulement de la matière fondue de formation du disque à travers la traversée (56, 156) du canal de coulée dans la cavité du moule et remplissant la cavité du moule, de déplacer le moyen formant soupape (62, 100) à travers la cavité (25, 125) du moule en engagement d'appui avec la traversée (56, 156) du canal de coulée avant la solidification de la matière de formation du disque pour empêcher un plus ample écoulement de la matière fondue de formation du disque à travers la traversée (56, 156) du canal de coulée et de former une ouverture dans le disque formé dans la cavité (25, 125) du moule et d'éjecter, de la machine, la partie (92, 192) de la matière de formation du disque déplacée de l'ouverture lors d'au moins une solidification partielle de ladite partie.

9. Méthode de la revendication 8, où ledit

moyen formant clapet (62) est une soupape à chemise (68) et comprenant de plus les étapes de placer un pointeau d'éjecteur (80) concentriquement dans la soupape à chemise (68) en une position normale avancée vers la cavité (25) du moule, et de retirer le pointeau d'éjecteur (80) de la cavité (25) du moule sensiblement simultanément avec ladite étape de déplacer ledit moyen formant soupape (62) pour tenir compte de la matière de formation du disque déplacée par ladite soupape à chemise (68) et où ladite étape d'éjection consiste à ramener le pointeau d'éjecteur (80) à sa position normale pour éjecter de la machine la partie (92) de la matière de formation du disque déplacée de l'ouverture.

10. Méthode de la revendication 8, où ledit moyen formant soupape (100) comprend un pointeau (180) de soupape d'éjecteur et un poinçon à manchon concentriquement autour du pointeau (180) de soupape d'éjecteur en une position normale sur le côté de la cavité du moule qui est opposé à la traversée (156) du canal de coulée, où ladite étape de déplacer le moyen formant soupape (100) consiste à: faire avancer le pointeau (180) de la soupape d'éjecteur à travers la cavité (125) du moule avant solidification de la matière de formation du disque en engagement d'appui avec la traversée (156) du canal de coulée pour empêcher un plus ample écoulement de la matière fondue de formation du disque à travers la traversée (156) du canal de coulée dans la cavité (125) du moule, de permettre à la matière de formation du disque dans la cavité (125) du moule de se solidifier; de retirer la traversée (156) du canal de coulée dans une direction au loin de la cavité (125) du moule et de faire avancer le poinçon à manchon dans et à travers la cavité (125) du moule pour perforer une ouverture dans le disque solidifié, et où ladite étape d'éjection consiste à faire avancer le pointeau 180 de la soupape d'éjecteur à une position plus avancée pour déloger, du poinçon, la partie (192) de la matière de formation du disque déplacée de l'ouverture.

#### Patentansprüche

1. Ventilanordnung zur Steuerung der Strömung eines geschmolzenen, zur Formung einer Platte dienenden Materials durch eine Angußkanalhülse (56, 156) in einem scheibenförmigen Formenhohlraum (25, 125) in einer Spritzgießmaschine zur Herstellung von Aufzeichnungsplatten mit einer Mittelöffnung, wobei die Ventilanordnung enthält: Ventilvorrichtungen (62, 100), die normalerweise in einem Abstand zu der Angußkanalhülse (56, 156) und auf einer Seite des Formenhohlraums (25, 125) im allgemeinen gegenüber der Angußkanalhülse liegen, um die Strömung des geschmolzenen Materials zur Formung der Platte durch die Angußkanalhülse (56, 156) in den Formenhohlraum zu erlauben, wobei die Ventilvorrichtungen (62, 100) durch den Formenhohlraum (25, 125) bis zur Berührung mit der Angußkanalhülse (56, 156) bewegbar sind,



um die Strömung des geschmolzenen Materials zur Formung der Platte durch die Angußkanalhülse in den Formenhohlraum zu verhindern, wobei die besagten Ventilvorrichtungen (62, 100) Vorrichtungen (68, 168) zur Formung einer Mittelöffnung in der Aufzeichnungsplatte enthalten, die innerhalb des Formenhohlraums (25, 125) geformt wird, und Vorrichtungen (80, 180) zum Auswerfen des Teils (92, 192) des zur Formung der Platte eingesetzten Materials aus der Maschine, der von der besagten Mittelöffnung nach mindestens teilweiser Erstarrung des besagten Teils entfernt wird.

2. Die Ventilanordnung nach Anspruch 1, bei der die Angußkanalhülse (56) eine im allgemeinen zylindrische Form aufweist und einen Strömungspfad für das geschmolzene zur Formung der Platte verwendete Material definiert, wobei die Ventilvorrichtungen (62) ein zylindrisches Schiebeventil (68) enthalten, das durch den Formenhohlraum (25) bis zur Berührung mit der Angußkanalhülse (56) ringförmig um den Strömungspfad in der Angußkanalhülse verschoben werden kann, um die Strömung des geschmolzenen Materials zur Formung der Platte aus dem Strömungspfad in den Formenhohlraum (25) zu verhindern.

3. Die Ventilanordnung nach Anspruch 1, bei der die besagte Ventilvorrichtung (62) enthält: eine stationär zylindrische Ventilfehrung (76), die in einem Abstand von der Angußkanalhülse (56) auf der Seite des Formenhohlraums (25) angeordnet ist, die im allgemeinen der Angußkanalhülse gegenüberliegt; ein Schiebeventil (68), das konzentrisch um die besagte Ventilfehrung (76) angeordnet ist, so daß eine Bewegung möglich ist zwischen einer ersten Stellung mit einem Abstand von der Angußkanalhülse (56), um die Strömung des geschmolzenen Materials zur Formung der Platte durch die Angußkanalhülse (56) in den Formenhohlraum (25) zu erlauben, und einer zweiten Stellung, in der es sich durch den Formenhohlraum (25) bis zur Berührung mit der Angußkanalhülse (56) erstreckt, um die Strömung des geschmolzenen Materials zur Formung der Platte durch die Angußkanalhülse (56) in den Formenhohlraum (25) zu verhindern, wobei das besagte Schiebeventil (68) vor der Erstarrung des zur Formung der Platte dienenden Materials in die besagte zweite Stellung verschoben werden kann, um eine Öffnung in der Aufzeichnungsplatte zu formen, die im Formenhohlraum ausgebildet wird; und einen Auswurfstab (80), der konzentrisch innerhalb der besagten Ventilfehrung (56) angeordnet ist und sich längs seiner eigenen Achse zwischen einer Stellung bewegen kann, die aus dem Formenhohlraum (25) zurückgezogen ist, wenn das besagte Schiebeventil (68) in die besagte zweite Stellung bewegt wurde, um mit der besagten Ventilfehrung (76) eine relativ kleine Vertiefung (88) zu definieren, die das von dem besagten Schiebeventil (68) verdrängte, zur Formung der Platte verwendete Material aufnimmt und eine in Richtung auf den Formenhohlraum (25) vorgeschobene Stellung nach minde-

stens teilweise Erstarrung des besagten Teils (92) des zur Formung der Platte verwendeten Materials, der aus der besagten Öffnung verdrängt wurde, um den besagten Teil (92) aus der Maschine auszuwerfen.

4. Die Ventilanordnung nach Anspruch 1, in der die Angußkanalhülse (156) eine im allgemeinen zylindrische Form aufweist und einen Strömungspfad für das geschmolzene zur Formung der Platte verwendete Material definiert, wobei die besagten Ventilvorrichtungen (100) einen Auswurfventilstab (180) enthalten, der durch den Formenhohlraum (125) zu einer die Angußkanalhülse (156) berührenden Stellung verschoben werden kann, um den Strömungspfad der Angußkanalhülse zu sperren und dadurch die Strömung von geschmolzenem zur Formung der Platte verwendeten Materials in den Formenhohlraum (125) zu verhindern.

5. Die Ventilanordnung nach Anspruch 4, in der der Strömungspfad der Angußkanalhülse unter einem im wesentlichen rechten Winkel zur Ebene des zur Formung der Platte verwendeten Formenhohlraums (125) verläuft und mit dem Formenhohlraum im wesentlichen an dessen Mittelachse kommuniziert, wobei der Auswurfventilstab (180) so angeordnet ist, daß er sich im wesentlichen längs seiner eigenen Achse und im wesentlichen längs der Achse des Strömungspfades der Angußkanalhülse auf die Angußkanalhülse (156) zu und von ihr wegbewegt, wobei der Auswurfventilstab (180) an einem Ende einen Ventilkopf (181) enthält, der so geformt ist, daß er die Angußkanalhülse (156) berührt, um den Strömungspfad der Angußkanalhülse zu sperren.

6. Die Ventilanordnung nach Anspruch 4, bei der die besagten Vorrichtungen (168) zum Formen der besagten Öffnung in der Platte eine Muffenstanze enthalten, die konzentrisch um den besagten Auswurfventilstab (180) angeordnet ist und längs dessen Achse auf den Formenhohlraum (125) zu und davon weg bewegt werden kann, wobei die besagte Muffenstanze einen Stanzkopf (169) enthält, der in und durch den Formenhohlraum (125) nach der Erstarrung des zur Formung der Platte verwendeten Materials verschoben werden kann, um die besagte Öffnung in der Platte auszustanzen, und wobei die besagte Muffenstanze in eine zurückgezogene Stellung bewegt werden kann, wenn der besagte Auswurfventilstab (180) so positioniert ist, daß er die Strömung des geschmolzenen, zur Formung der Platte verwendeten Materials in den Formenhohlraum (125) erlaubt und vor der Erstarrung des zur Formung der Platte verwendeten Materials.

7. Die Ventilanordnung nach Anspruch 6, bei der die Maschine erste (114) und zweite (120) Formhälften enthält, die zwischen einer geschlossenen Stellung zur Definition des Formenhohlraums (125) und einer offenen Stellung verschoben werden können, um die Entnahme der der geformten Platte aus dem Formenhohlraum zu erlauben, wobei die Ventilanordnung und die Angußkanalhülse (156) von der ersten bzw. der



20

zweiten Formhälfte gehalten werden und wobei der besagte Auswurfventilstab (180) bewegt werden kann von einer zurückgezogenen Stellung mit einem Abstand von der Angußkanalhülse (156), wenn die besagten Formhälften (114, 120) die besagte geschlossene Stellung einnehmen, um die Strömung des geschmolzenen zur Formung der Platte verwendeten Materials in den Formenhohlraum (125) zu erlauben zu einer ersten vorgeschobenen Stellung, bei der die Angußkanalhülse (156) berührt wird, um die weitere Strömung des zur Formung der Platte verwendeten Materials in den Formenhohlraum (125) zu verhindern, und zu einer zweiten und weiter vorgeschobenen Stellung, wenn die besagten Formhälften (114, 120) die besagte offene Stellung einnehmen, um den besagten Teil (192) des zur Formung der Platte verwendeten Materials auszuwerfen, der von der besagten Öffnung durch die besagte Muffenstanze verschoben wurde.

8. Ein Verfahren zur Herstellung von Aufzeichnungsplatten mit Mittelöffnungen in einer Spritzgießmaschine, die einen im allgemeinen scheibenförmigen Formenhohlraum (25, 125) und eine Angußkanalhülse (56, 156) enthält, mit dem das geschmolzene zur Formung der Platte verwendete Material in den Formenhohlraum strömt, in dem die Verfahrensschritte enthalten sind: Positionieren von Ventilvorrichtungen (62, 100) in einer Normalstellung mit einem Abstand zur Angußkanalhülse (56, 156) von der Seite des Formenhohlraums (25, 125) gegenüber der Angußkanalhülse, um eine Strömung des geschmolzenen zur Formung der Platte verwendeten Materials durch die Angußkanalhülse (56, 156) in den Formenhohlraum zu erlauben und den Formenhohlraum aufzufüllen, Verschieben der Ventilvorrichtungen (62, 100) durch den Formenhohlraum (25, 125) bis zur Berührung mit der Angußkanalhülse (56, 156) vor der Erstarrung des zur Formung der Platte verwendeten Materials, um eine weitere Strömung des geschmolzenen zur Formung der Platte verwendeten Materials durch die Angußkanalhülse (56, 156) zu verhindern und um eine Öffnung in der Aufzeichnungsplatte zu formen, die in dem Formenhohlraum (25, 125) ausgebildet wird; und Auswerfen aus der Maschine des Teils (92, 192) des zur Formung der Platte verwendeten Materials, der von der Öffnung nach mindestens teil-

weiser Erstarrung des besagten Teils verschoben wird.

9. Das Verfahren nach Anspruch 8, bei dem die besagten Ventilvorrichtungen (62) ein Schiebeventil (68) sind und in dem weiter die Schritte enthalten sind des Positionierens eines Auswurfstabs (80) konzentrisch innerhalb des Schiebeventils (68) in einer Normalstellung, die bezüglich des Formenhohlraums (25) vorgeschoben ist; und Zurückziehen des Auswurfstabs (80) aus dem Formenhohlraum (25) im wesentlichen gleichzeitig mit dem besagten Schritt des Verschiebens der Ventilvorrichtungen (62) zum Unterbringen des zur Formung der Platte verwendeten Materials, das durch das Schiebeventil (68) verdrängt wurde, und wobei der besagte Auswurfschritt die Rückführung des Auswurfstabs (80) in seine Normalstellung enthält, um aus der Maschine den Teil (92) des zur Formung der Platte verwendeten Materials auszuwerfen, der durch die Öffnung verschoben ist.

10. Das Verfahren nach Anspruch 8, bei dem die besagten Ventilvorrichtungen (100) einen Auswurfventilstab (180) enthalten, und eine Muffenstanze, die konzentrisch um den Auswurfventilstab (180) in einer Normalstellung auf der Seite des Formenhohlraums angeordnet ist, die der Angußkanalhülse (156) gegenüberliegt, wobei der besagte Schritt des Verschiebens der Ventilvorrichtung (100) enthält: Verschieben des Auswurfventilstabs (180) durch den Formenhohlraum (125) vor der Erstarrung des zur Formung der Platte verwendeten Materials bis zur Berührung mit der Angußkanalhülse (156), um die weitere Strömung von geschmolzenem zur Formung der Platte verwendeten Materials durch die Angußkanalhülse (156) in den Formenhohlraum (125) zu verhindern; Warten, bis das zur Formung der Platte verwendete Material innerhalb des Formenhohlraums (125) erstarrt; Zurückziehen der Angußkanalhülse (156) in eine Richtung von dem Formenhohlraum (125) weg; und Verschieben der Muffenstanze in und durch den Formenhohlraum (125) zum Stanzen einer Öffnung in die erstarrte Platte und wobei der besagte Auswurfschritt das Verschieben des Auswurfventilstabs (180) zu einer weiteren vorgeschobenen Stellung enthält, um aus der Stanze den Teil (192) des zur Formung der Platte verwendeten Materials zu entfernen, der von der Öffnung verschoben wurde.



\* C L M S \*