

"PISTON FOR A DIE-CASTING MACHINE"

DESCRIPTION

This utility model relates to a piston for a die-casting machine, in particular of the cold chamber
5 type. In particular, the utility model relates to a piston with a lubrication circuit suitable to facilitate the sliding of the piston in a sleeve of a press for such a die-casting machine.

A piston with lubrication circuit is described in
10 patent application WO2013001469A1.

The purpose of this invention is to propose a piston for a die-casting machine of the type described in the aforementioned patent document, but able to offer further improved performance. This purpose is achieved
15 by a piston according to claim 1.

The characteristics and advantages of the piston according to the invention will be apparent from the following description, given by way of non-limiting example, of its preferred embodiments, in accordance
20 with the accompanying figures, in which. In said drawings:

- Figure 1 shows a piston according to the invention, in a first embodiment, in a perspective view;
- 25 - Figure 2 is a side view of the piston;

- Figure 3 a is an axial section of the piston along the line A-A of Figure 2;
- Figure 3 is an enlarged view of detail V circled in Figure 3;
- 5 - Figure 4 is an axial section view of a terminal portion of the piston, with a non-return valve of the lubricating circuit mounted in a proximal position;
- Figure 4 is a view similar to the preceding, but with the non-return valve mounted in distal position;
- 10 - Figure 5 is another axial section view of the end portion of the piston;
- Figure 5a is a perspective view of a radial locking block;
- Figure 6 shows the piston inserted in a sleeve of
15 a press of a die-casting machine;
- Figure 7 represents, in perspective view, only the stem of the piston;
- Figure 8 is a side view of the stem;
- Figure 9 is an axial section of the stem along the
20 line A-A in Figure 8;
- Figure 10 is another side view of the stem;
- Figure 11 is an axial section of the stem along the line B-B in Figure 10;
- Figure 12 is a cross section of the stem along the
25 line C-C in Figure 10;

- Figure 13 is a cross section of the stem along the line D-D in Figure 10;

- Figure 14 is an axial section of only the piston head;

5 - Figure 14a is an enlarged view of detail T of Figure 14;

- Figures 15 and 15a show, in axial section, the piston head after a work cycle, respectively with the metal feedhead still attached to it and with the
10 feedhead detached; and

- Figures 16, 16a and 16b show, in perspective view, in side view and in axial section, respectively, an axial support pin of the piston head.

In the rest of the description, elements common to the
15 various embodiments of the invention will be indicated with the same reference numbers.

In addition, if not expressly stated otherwise, elements described for one piston embodiment can be present, possibly adapted according to the need, even
20 in the other piston embodiments described.

With reference to the accompanying figures, 1 indicates a piston of press of a die-casting machine, in particular of the cold chamber type. The press comprises a sleeve 400 in which the piston 1, or at
25 least a terminal molten metal thrust part, is slidingly

housed. The sleeve 400 has, formed in an upper and at one end of it, a loading mouth 401 of the molten metal, for example, aluminium. At the opposite end with respect to said loading mouth 401, the sleeve 400 has
5 splits 402 to which correspond the starting points of casting branches that flow into a die. The piston 1 is thus able to slide axially inside the sleeve 400 to push the metal fed through the loading mouth into the casting branches and thus into the die.

10 The piston 1 comprises a stem 10 that extends between a proximal end 11, or rear with respect to the direction of advancement of the piston in the sleeve, and a distal end 12, or frontal, along a piston axis X.

The piston 1 terminates with a piston head 50 that
15 extends from the distal end 12 of the stem and that has a lateral wall with at least one sealing area 52 suitable to form a seal on the wall of said sleeve 400 of the press.

The piston 1 is provided with a lubrication circuit
20 suitable to facilitate the sliding of the piston in the sleeve 400.

This lubrication circuit comprises at least one first lubrication duct 14,16,18 formed in the stem 10 and terminating in correspondence of the distal end 12 of
25 the stem.

The lubrication circuit further comprises at least one second duct 20 formed in the piston head 50. Each second duct 20 communicates fluidically with a respective first duct 14,16,18.

5 Each second duct 20 opens into the lateral wall at least in correspondence of the sealing area 52. In the case of more than one sealing areas 52,52' spaced apart axially along the piston head 50, the second duct 20 opens in correspondence of the more advanced sealing
10 area 52, i.e., closest to the distal end of the piston 1.

In an embodiment, the first lubrication duct comprises a feed duct 14 that extends longitudinally from an entrance hole 15 of the lubricant and that forms at
15 least one distribution duct 18. Each distribution duct 18 extends in a distal portion of the stem 10.

In the case of more than one distribution duct 18, they are angularly equidistant with respect to the axis X of the piston.

20 Each second lubrication duct 20 is in continuation of a respective distribution duct 18. In other words, the terminal end of each distribution duct 18 is in direct communication with the initial, or proximal, end of a corresponding second lubrication duct 20.

25 In a preferred embodiment, the entrance hole 15 of the

lubricant is formed in proximity of the proximal end 11 of the stem 10. The feed duct 14 thus extends for almost the entire length of the stem, parallel to the piston axis X and laterally with respect to an axial cooling duct, which will be described below, terminating in proximity of the distal end 12.

As can be seen in particular from Figure 3, even the distribution duct or ducts 18, formed in the distal end portion 12 of the stem 10, extend parallel to the piston axis X. The feed duct 14 and each distribution duct 18 are connected to each other by a branch duct 16, which extends from the end of the feed duct 14 in the direction transverse, or radial, with respect to the piston axis X.

Note that, in some embodiments that also provide for a single distribution duct 18, this distribution duct 18 and the feed duct 14 are not axially aligned with each other, for example due to the geometry and dimensions of the stem which do not allow to drilling a single hole, and must be fluidically connected by the branch duct 16.

In a preferred embodiment, the piston head 50 has at least one sealing ring 60 housed in a respective ring seat 62. Examples of piston head with sealing ring to which the teaching of this invention can be applied are

described in WO2007116426A1 and WO2009125437A1, in the name of the same Applicant.

The ring seat 62 is formed by an annular recess formed derived the lateral surface of the piston head. Said
5 ring seat 62 is delimited radially by a bottom 62' and axially at least by a rear rim 62a, preferably also by a front rim 62b located in proximity of the front surface 602 of the piston head 50 (Figure 14a).

In an embodiment, the bottom 62' of the seat 62 of the
10 sealing ring 60 is fluidically connected with the front surface 602 of the piston head through connection channels or holes 604 so that molten metal present in the sleeve can flow under the sealing ring 60 and, by solidifying, creates a progressive thickening that
15 causes a radial expansion of the sealing ring 60, compensating for the wear and ensuring the sealing effect over time (Figures 4 and 4a).

In an embodiment, the sealing ring 60 has a longitudinal split 60', for example in the form of a
20 step, which allows its radial expansion.

In an embodiment, each second lubrication duct 20 opens into at least the ring seat 62, under the sealing ring 60.

The pressurised lubricant is thus forced to infiltrate
25 under the sealing ring and leak out of the piston

through the interstices between the sealing ring 60 and the piston head and/or through the longitudinal split 60' of the sealing ring 60.

In particular, the pressurised lubricant is forced to
5 leak out of the piston through the interstices between the sealing ring 60 and the rims 62a,62b of the ring seat 62.

To this purpose, the sealing ring 60 is received with a certain play in the respective ring seat 62. Received
10 with play means that the sealing ring 60 is not inserted in a forced manner in the respective ring seat 62, but that between the sealing ring 60 and each rim 62a,62b of the ring seat 62 there is a certain and calibrated gap, for example equal to, or less than, 0.1
15 mm.

With this play or gap, the pressurised lubricant, for example at 200 bar, can pass between the sealing ring 60 and the rims 62a,62b of the ring seat 62.

Note that the expansion of the lubricant under the
20 sealing ring 60, along the entire circumference of the ring seat 62, is made possible and facilitated not only by the high pressure to which the lubricant is subjected, but also from the elasticity of the sealing ring 60, provided by the presence of the longitudinal
25 split 60'.

In this way, at least a twofold effect is achieved: the lubricant, leaking from the interstices between the ring and the rims of the seat, acts precisely in the area of greatest contact area between the piston and the inner surface of the sleeve, which is to say the area of the sealing ring 60; furthermore, by flowing on the bottom of the ring seat 62, the lubricant contributes to the radial expansion of the ring when this begins to wear.

10 In a preferred embodiment, wherein the bottom 62' of the seat 62 of the sealing ring is connected with the front surface 602 of the piston head through connection holes or channels 604 for an inflow of metal under the sealing ring 62, between the outlet apertures 604' of
15 said connection channels 604 in the bottom 62' of the ring seat 62 and the rear rim 62a of said seat 62, the sealing ring 60 and the ring seat 62 have interlocking or complementary coupling portions 606,608 that form a sort of labyrinth that stops the liquid metal
20 penetrated under the sealing ring 60 - and in cooling and solidification step - from reaching the portion of the ring seat 62 between said interlocking coupling portions and the rear rim 62a of the seat 62. In other words, the liquid metal that reaches the ring seat 62
25 through the connection holes or channels 604 is forced

to solidify in the front portion of the ring seat 62 between said labyrinth and the front rim 62b (or, if this front rim 62b is not provided, between the labyrinth and the front surface 602 of the piston head).

In an embodiment, the said interlocking coupling portions comprise at least one annular rib 606 that extends from the inner surface of the sealing ring 60 and a corresponding annular groove 608 formed in the ring seat 62.

In an embodiment, in the bottom 62' of the ring seat 62 is formed, in an advanced position with respect to the interlocking coupling portions, an annular channel 610 suitable to receive the metal coming from the connection channels 604.

In the embodiments described above, the second lubrication duct 20 that opens under the sealing ring 60 opens into the rear portion of the ring seat 62 between the interlocking coupling portions 606, 608 and the rear rim 62a of the ring seat 62. In this way, the second duct 20 is protected, thanks to the labyrinth formed by the interlocking coupling portions, from any obstruction caused by the penetration of the liquid metal under the sealing ring 60. Note that, while the liquid metal that penetrates under the sealing ring 60,

by virtue of its density, its pressure and the fact that it tends to cool rapidly and solidify, fails to pass beyond said labyrinth, while the lubricant has a density and pressure such as to be able to seep even
5 between the interlocking coupling portions 606,608 and reach the front interstice between the sealing ring and the front rim 62b, although most of the lubricant leaks into the interstice between the ring and the rear rim 62a, in this case finding no obstacle.

10 Since the lubricant reaches, in a targeted manner, the area of greatest friction between the piston and the sleeve, the amount of lubricant needed to ensure the appropriate slidability of the piston is significantly lower than that used in the pistons of the prior art,
15 where the lubricant fails to reach the area of the sealing ring.

Note also that, since the sealing ring 60 is positioned in proximity of the front end of the piston, the possible presence of any aspiration means for putting
20 the chamber of the sleeve under vacuum, provided in an intermediate or rear position, does not have a significant influence on the action of the lubricant.

In an embodiment, each second duct 20 has a first section 20' parallel to the piston axis X and at least
25 a second radial section 20'' opening at least in the

ring seat 62.

According to an embodiment, the piston head 50 is removably connected to the stem 10. Between stem and head are then provided sealed fluidic connection means
5 4 between each lubrication duct 14,16,18 and the respective second lubrication ducts 20.

In an embodiment, the distal end 12 of the stem 10 is flanged so as to allow an axial juxtaposition between the stem 10 and piston head 50.

10 According to one aspect of the invention, sealed fluidic connection means comprise, for the connection of each first lubrication duct with a respective lubrication duct 20, a tubular connection element 4 having a proximal portion 4' sealingly inserted in a
15 terminal portion of the first lubrication duct and a distal portion 4'' sealingly inserted in the second lubrication duct 20 and extending axially up to the vicinity of the ring seat 62.

In each of these tubular connection elements 4 is
20 sealingly housed a non-return valve 5, i.e., a one-way valve, suitable to allow the passage of the lubricating fluid towards the ring seat 62 and to stop any passage of liquid metal that should reach the area of the ring seat 62 into which the second lubrication duct 20
25 opens.

In an embodiment illustrated in Figure 4, the non-return valve 5 is positioned in, or in proximity of, the proximal portion 4' of the tubular connection element 4.

5 In an embodiment variant illustrated in Figure 4, the non-return valve 5 is positioned in the distal portion 4'' of the tubular connection element 4, for example in proximity of the distal end of such distal portion 4''.

In an embodiment, the non-return valve 5 is positioned
10 at the distal end of the first portion 20' of the second lubrication duct 20, and thus in proximity of the angle that this first portion forms with the second radial portion 20'' of the second duct 20.

In an embodiment, the extension of the distal portion
15 4'' of the tubular connection element 4 is greater with respect to the extension of the proximal portion 4'.

The presence of an elongated distal portion 4'' allows positioning the non-return valve 5 as close as possible to the ring seat 62, so as to stop any entrance of the
20 molten metal as soon as it penetrates into the second lubrication duct 20, or closer to the end of the stem.

The positioning of the non-return valve 5 towards the distal end of the tubular connection element 4 facilitates maintenance, since the smaller the distance
25 between the valve and the exit hole of the lubrication circuit, the narrower the lubricant accumulation

chamber in the case of obstruction of the exit hole and the smaller the leaks, and one has more control of the amount of lubricant.

In an embodiment, the tubular connection elements 4 are
5 inserted with calibrated interference in the lubrication ducts.

In an embodiment, each portion, proximal and distal, of each tubular connection element 4 is provided with an annular sealing element 61 that cooperates with the
10 surface of the respective duct.

In an embodiment, the piston head 50 comprises a fitted hollow outer body 64, for example in the manner of a cap, on an axial support pin 66.

In an embodiment, the axial support pin 66 has a
15 proximal, or rear, end 67 that is inserted into a corresponding axial recess 68 formed in the distal end 12 of the stem 10.

Advantageously, between the hollow outer body 64 and pin 66 there is no play, at least between the
20 respective lateral walls. In other words, the hollow outer body 64 cannot have radial movements with respect to the pin 66. Similarly, even the proximal end 67 of the pin 66 is inserted with calibrated interference, i.e., without play, in the corresponding axial recess
25 68.

Such an embodiment solution allows obtaining and maintaining over time a perfect coaxiality between the piston head and the stem. In other words, the support pin 66, penetrating partially into the stem, serves as
5 guide and axial support means for the piston head 50.

In one embodiment, illustrated in particular in Figures 5 and 5a, the piston head 50 and the stem 10 are fixed to the support pin 66 by means of radial blocks 69.

Each radial block 69 of the piston head 50 passes
10 through the lateral wall of the piston head and is inserted, for example with slight play, in a respective head block seat 691 formed in the front portion of the support pin 66.

Each radial block 69 of the stem 10 passes through the
15 lateral wall of the stem that delimits the axial recess 68 and is inserted, for example with slight play, in a respective stem block seat 68 formed in the rear portion of the support pin 66.

Each radial block 69 is provided with a threaded hole
20 69' in order to be extracted from its seat, for example by means of a dedicated screw extractor.

As illustrated in Figure 1, the radial blocks of the stem are locked in position by means of a block containment bush 694 fitted on the stem. For example,
25 this bush 694 is made to slide over the blocks and

fixed in position by means of a screw 694'.

The radial blocks of the piston head can be held in the respective seats by means of a similar bush 696 fitted on the piston head 50 and that, as in the illustrated
5 embodiment, can also perform the function of the second sealing ring at the same time.

The use of these radial blocks 69 for the assembly of the stem and the piston head to the support pin 66 ensures a precise and always constant axial positioning
10 among these three components of the piston. Moreover, the operations of assembly and disassembly of the piston, for example to perform maintenance, are simplified and made very fast.

In an embodiment variant, the flanged distal end 12 of
15 the stem 10 and the adjacent end of the piston head 50 are connected to each other by means of axial screws.

In an embodiment, the piston head 50 is made of steel and delimits a front seat 502 open at least frontally, in which a copper alloy insert 504 is inserted.

20 In an embodiment, the copper alloy insert 504 has a substantially cylindrical shape, with a slightly convex front surface 504'.

This insert 504 improves the heat exchange between the alloy of which the feedhead is formed and the cooling
25 fluid that, as will be described below, is made to

circulate in the piston. Thanks to this insert 504, which has a higher thermal conductivity than steel, the feedhead cools more quickly thus preventing bursting, reducing cycle times and also reducing the temperature
5 of the piston.

The copper alloy insert 504 replaces the central part of the front wall of the steel piston head, i.e., the part more subject to breakage due to thermal fatigue cracks and from work. It follows that the piston has a
10 longer life. Moreover, the insert can be replaced when worn.

In an embodiment, the copper alloy insert 504 rests against the distal end of the axial support pin 66, and thus cannot retract during use.

15 In an embodiment, in the lateral wall that delimits the insert seat 502 is formed an undercut 502' in which it axially engages an annular relief 506 formed in the rear part of the insert 504, as illustrated in the enlarged view of Figure 3a. The interaction between the
20 undercut and the annular relief prevents the insert from coming off frontally.

According to another aspect of the invention, the connection channels or holes 604 open in an annular peripheral portion 612 of the front surface of the
25 front wall 602 of the piston head. This annular peripheral portion 612 of the front surface is inclined

with respect to a frontal plane orthogonal to the piston axis X. In particular, the annular peripheral portion is inclined so as to be facing the piston axis X. For example, such inclination forms an angle α between 10° and 55°, preferably between 20° and 30°, still more preferably equal to 25° (Figure 14a).

Figures 15 and 15a show how the shape of the piston head 50 determines the shape of the metal feedhead 500 that remains attached to the front wall 602 of the head 50 when the metal solidifies at the end of the thrust phase of the piston, and how this shape of the head facilitates the detachment of the feedhead 500.

During the ejection of the feedhead from the sleeve (Figures 15 and 15a), thanks to the presence of the undercut created by the inclined annular peripheral portion 612a, because of the decrease in temperature, and thus the shrinkage of the feedhead, the vibrations that are created for the movement of the piston and the front wall of the sleeve during the step of accompanying the feedhead, and the force impressed by the machine, the metal feedhead 500 is broken precisely near the entrance opening of the connection channels or holes 604 (Figure 15a).

This effect is further amplified, giving a convex shape to the central portion 614 of the front surface of the

piston head. This convexity can be made in the front wall 602 of the steel piston head or, as described above, using for the central part of the front wall, a copper alloy insert 504 having a convex front surface 504'.

Moreover, in the case of the connection holes 604, the inclination of the peripheral annular portion 612 allows obtaining a perfectly circular shape of the hole, instead of an oval shape as occurs with a surface orthogonal to the piston axis X.

According to a further aspect of the invention, one among the flanged distal end 12 of the stem 10 and the flanged end of the piston head 50 is provided with a centring pin 700 that fits into a corresponding blind hole 702 formed in the other of said flanged ends. In this way, in the assembly phase of the piston, stem 10 and head 50 are more easily assembled in a predetermined mutual angular position, preventing breakage or cutting of the O-ring 61.

In an embodiment, in the stem 10 and the piston head 50 is formed a cooling circuit suitable to circulate a cooling fluid inside the piston head.

In an embodiment, the stem 10 and the pin 66 have respective and aligned axial cooling holes 70,72 in which a delivery tube 74 of a cooling fluid is

inserted. Said delivery tube 74 communicates with the outside through an entrance hole 80 of the cooling fluid, for example formed radially in the stem in proximity of the proximal end 11, and opens onto the front surface 76 of the axial pin 66. Said front surface 76 is scored by a plurality of radial cooling ducts 77.

These radial cooling channels 77 communicate with a plurality of annular cooling channels 78, in turn in communication with each other for example thorough splits 78', or with a single helical cooling channel, formed in the outer side surface of the axial pin 66. These cooling channels 78 thus circulate the cooling fluid to and around the entire outer surface of the axial pin 66 in contact with the hollow outer body 76, cooling it. The rearmost cooling channel 78 communicates with a return duct 83 terminating with an exit hole 84 of the cooling fluid, formed in the stem.

In an embodiment, this return duct 83 is formed by an annular gap between the axial cooling hole 70,72 and the delivery tube 74 of the cooling fluid. For example, the return duct 83 communicates with the cooling channel 78 through one or more radial holes 82 formed in the axial pin 66.

Note that, in a preferred embodiment, the longitudinal

lubrication holes 14 and cooling holes 70 formed in the stem 10 are obtained by machining performed from the rear side of the stem 10. Therefore, in order to close such holes on said side, the proximal end 11 of the
5 stem 10 comprises a plug 90.

Therefore, the utility model thus conceived achieves the predefined purposes.

Obviously, it may even assume, in its practical embodiment, forms and configurations different from
10 that illustrated above without, for this reason, departing from the present scope of protection.

Moreover, all the details may be replaced by technically equivalent elements and the dimensions, forms and materials used may be any according to the
15 needs.

CLAIMS

1. Piston for a die-casting machine, in particular of the cold chamber type, where the machine comprises a press with a sleeve in which the piston is slidably housed, the piston comprising:
 - a stem that extends between a proximal end and a distal end along a piston axis;
 - a piston head connected in a removable manner to the distal end of the stem and that is provided with at least one sealing ring housed in a respective ring seat formed in a lateral wall of the head to create the sleeve on the wall of the press sleeve, the sealing ring being interrupted longitudinally by a longitudinal split which allows radial expansion of the sealing ring; and
 - a lubrication circuit suitable to facilitate the sliding of the piston in the sleeve and comprising:
 - at least one first lubrication duct formed in the stem and terminating in correspondence of the distal end of the stem, and
 - at least a second duct formed in the piston head, fluidically communicating with the first duct and opening into the ring seat, below the sealing ring, the second duct being covered by the sealing ring, in such a way that the lubricant leaks from the piston head through interstices between the sealing ring and the piston head and/or through the longitudinal split, wherein each first lubrication duct is sealingly and fluidically connected to the respective second lubrication duct by means of a tubular connection element having a proximal portion sealingly inserted in a terminal portion of the first lubrication duct and a distal portion sealingly inserted in the second lubrication duct and extending axially up to the vicinity of the ring seat, in each of the tubular connection elements being sealingly housed a non-return valve suitable to stop the passage of liquid metal coming from the ring seat, wherein said non-return valve (5) is positioned in proximity of the distal end (4") of the tubular connection element (4).
2. Piston according to claim 1, wherein the interstices comprise at least an interstice between the sealing ring and a rear rim of the ring seat that posteriorly delimits the ring seat.
3. Piston according to any of the preceding claims, wherein a bottom of the ring seat is connected with a front surface of the piston head through connection channels or holes for an inflow of metal under the sealing ring.

4. Piston according to the preceding claim, wherein between outlet apertures of the connection channels or holes in the bottom of the ring seat and the rear rim of the seat, the sealing ring and the ring seat have interlocking coupling portions suitable to stop the passage of the liquid metal that penetrated under the sealing ring.
5. Piston according to any one of claims 2-4, wherein the second lubrication duct opens into a rear portion of the ring seat between the interlocking coupling portions and the rear rim of the ring seat.
6. Piston according to any one of the preceding claims, wherein the first lubrication ducts comprise a feed duct that extends longitudinally from an entrance hole of the lubricant and that forms at least one distribution duct that extends parallel to the piston axis in a distal portion of the stem, each second lubrication duct being in continuation of the distribution duct.
7. Piston according to any of the preceding claims, wherein each second duct has a first section parallel to the piston axis and at least a second radial section opening into the ring seat.
8. Piston according to the preceding claim, wherein a distal portion of the tubular connection element extends until in proximity of the second radial section.
9. Piston according to any of the preceding claims, wherein the piston head is made of steel and delimits a front seat open at least frontally, in which a copper alloy insert is inserted.
10. Piston according to the preceding claim, wherein the piston head comprises a hollow outer body fitted with absence of play on an axial support pin, and wherein the copper insert rests against the distal end of the axial support pin.
11. Piston according to claim 9 or 10, wherein, in a front wall of the piston head, is formed an undercut in which it axially engages an annular relief formed in a rear part of the copper insert.

12. Piston according to any of claims 10 or 11, wherein the piston head and the stem are fixed to the axial support pin by means of radial blocks.

13. Piston according to any one of claims 3 to 12, wherein the connection channels or holes open into an annular peripheral portion of a front surface of the front wall of the piston head, the annular peripheral portion of the front surface being inclined with respect to a frontal plane orthogonal to the piston axis (X) in such a way as to be facing the piston axis (X), the inclination forming an angle (α) comprised between 10° and 55° , preferably between 20° and 30° , even more preferably equal to 25° .

14. Piston according to the preceding claim, wherein the annular peripheral portion delimits a central portion of the front surface of the piston head, the central portion being convex.

15. Piston according to any of the preceding claims, wherein, in the stem and the piston head is formed a cooling circuit suitable to circulate a cooling fluid inside the piston head.

16. Piston according to the preceding claim, wherein the stem and the axial support pin have an axial cooling hole in which is inserted a delivery tube of a cooling fluid opening on to a front surface of the axial support pin of the head, the front surface being in fluidic communication with a plurality of annular cooling channels formed in an outer lateral surface of the axial support pin.