

[54] **SLIDE CLOSURE MECHANISM FOR CASTING VESSELS FOR LIQUID METALLIC MELTS**

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[30] **Foreign Application Priority Data**

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[51] Int. Cl. **B22d 37/00**

[58] Field of Search..... **222/561, DIG. 1, 222/DIG. 7; 239/599**

[56] **References Cited**

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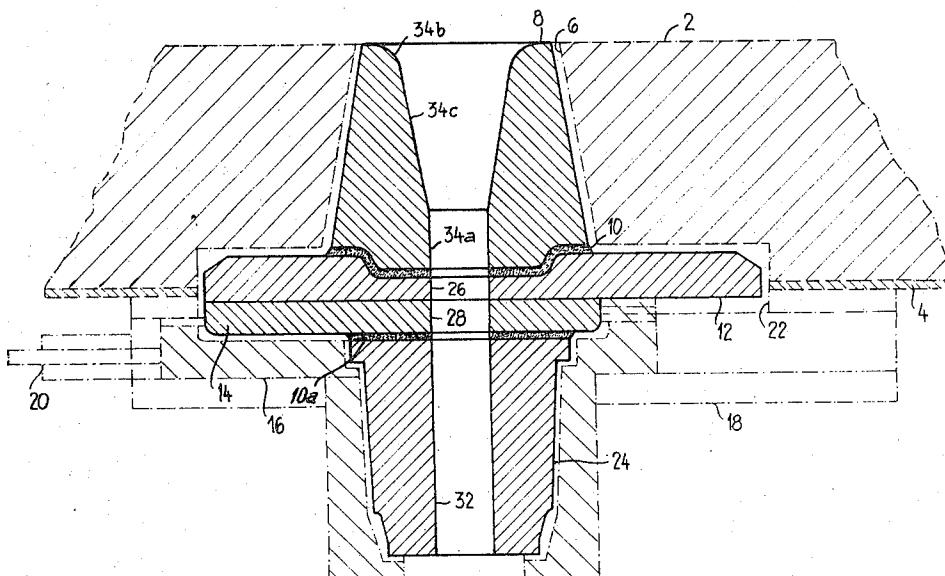
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[57] **ABSTRACT**

A slide closure mechanism for casting vessels or the like, comprising a bottom block having a melt throughflow opening provided for the casting vessel, said throughflow opening including a substantially circular-shaped inlet portion. There are further provided a base plate, a movable slide plate and a discharge member cooperating with said bottom block. The base plate, movable slide plate and discharge member each have a respective opening for passage of the melt. The opening of the base plate communicates with the interior of the casting vessel via the throughflow opening of the bottom block. The opening of the base plate and the opening of the slide plate each possess a substantially elongate cross-sectional configuration, wherein the primary direction of extension of said base plate- and slide plate- openings is substantially transverse to the direction of movement of the movable slide plate. The opening of the discharge member and the opening of the bottom block likewise possess a substantially elongate cross-sectional configuration at least at the regions thereof directly neighboring the slide plate and base plate, respectively. The discharge member- and bottom block- openings at said neighboring regions likewise possessing a primary direction of extension which is substantially parallel to the primary direction of extension of the openings of the slide plate and base plate, and the cross-sectional area of the opening of the discharge member reduces in the flow direction of the melt.

5 Claims, 4 Drawing Figures



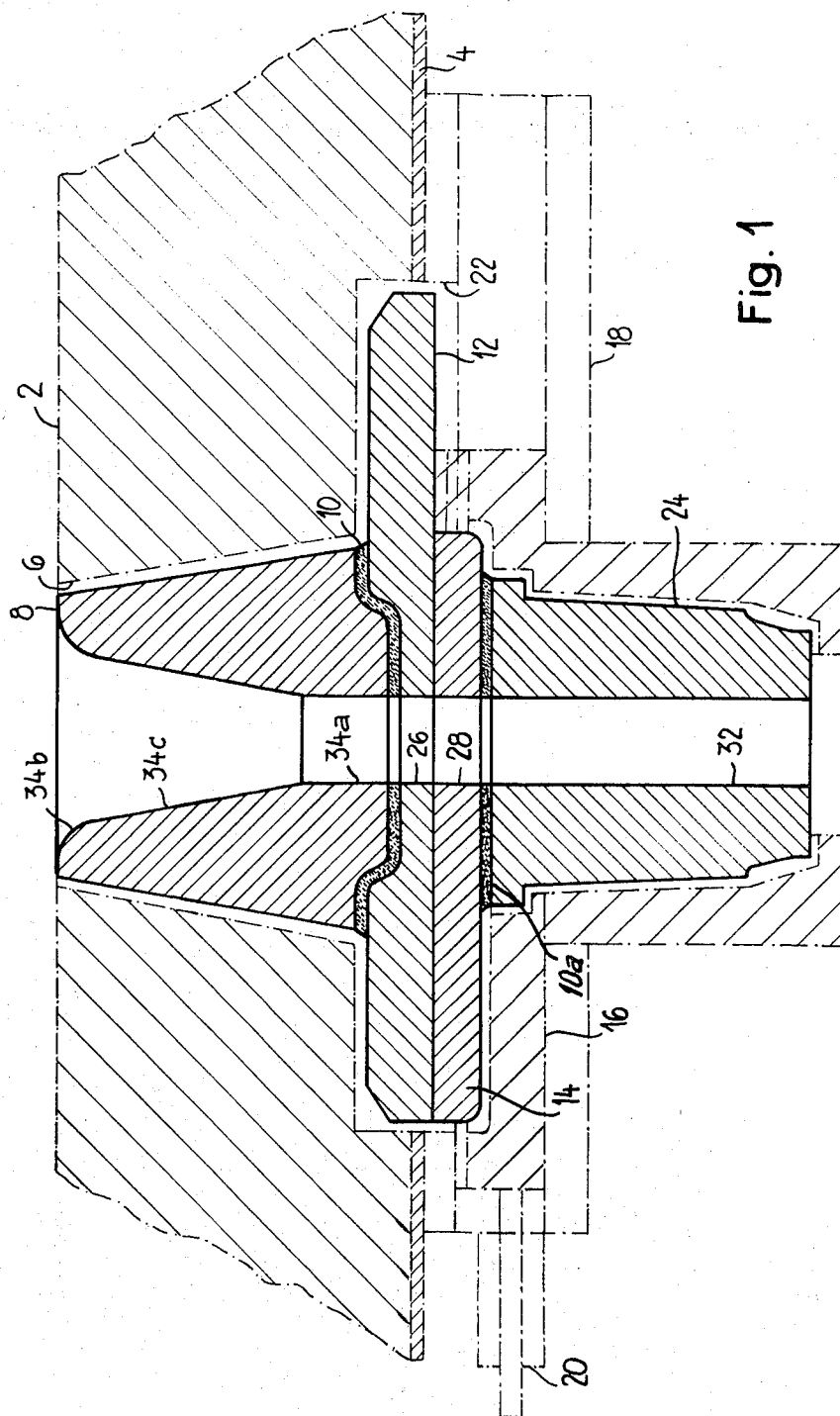


Fig. 1

Fig. 2

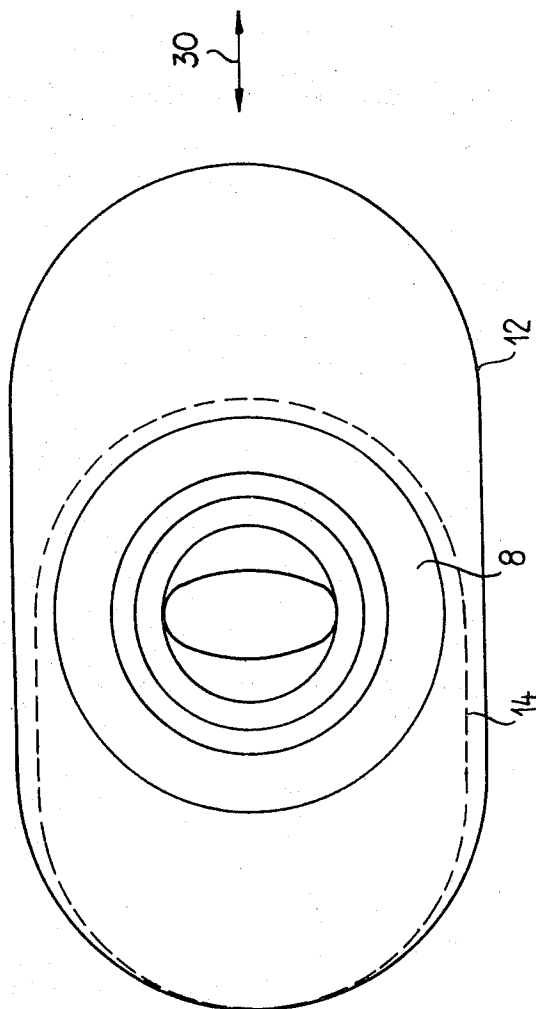


Fig. 3

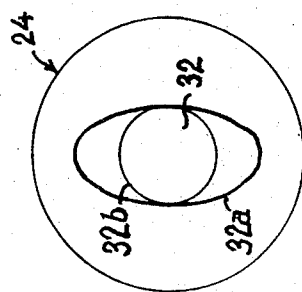
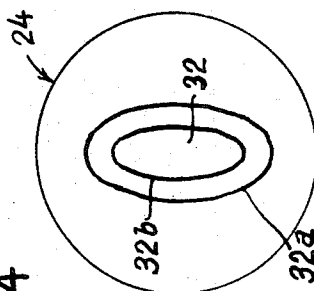


Fig. 4



SLIDE CLOSURE MECHANISM FOR CASTING VESSELS FOR LIQUID METALLIC MELTS

CROSS-REFERENCE TO RELATED CASE

This application is a continuation of our commonly assigned copending U. S. application Ser. No. 42,299, filed Jun. 1, 1970, and entitled "Slide Closure Mechanism For Casting Vessels For Liquid Metallic Melts."

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved slide closure mechanism for a casting mechanism for a casting vessel for liquid metallic melts, typically a pouring or casting ladle.

It is well-known to those versed in the art that the refractory stones or blocks of slide closure mechanisms, used for casting steel, possess a relatively short longevity. That is to say, after a relatively small number of casting operations these refractory stones have to be replaced, although the stones, especially the base plate and the slide plate, are formed of high-grade material. Since such material is very expensive and must be taken considerably into calculating when determining the operating costs of the slide closure mechanism, attempts have been made to get by with as small as possible quantity of such high-grade refractory material. In order not to impair the operational reliability of the system, it is necessary for a given slide closure construction and a predetermined through-flow cross-section having typically circular configuration, to maintain a certain minimum cross-section and superimposed surfaces or surface areas in the slide direction of the slide closure mechanism. Apart from the thickness of these stones chosen with regard to strength considerations as well as the width of such stones required for their support and guiding, the volume of such stones for a predetermined through-flow cross-section is only further governed by their extension in the slide direction which these stones or blocks must possess in order to achieve the requisite superimposed or overlying relationship in the open and closed relative positions.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide an improved slide closure mechanism for casting vessels which effectively overcomes the aforementioned drawbacks experienced with the prior art constructions.

Another, more specific object of the present invention relates to an improved slide closure mechanism for casting vessels or the like which is less expensive to manufacture.

The present invention is based upon the recognition that the volume of the stones or blocks can be reduced if it is possible to shorten the path through which the movable slide stone has to pass when shifting between its extreme positions.

Now, in order to implement the aforementioned objectives of the present invention, the inventive slide closure mechanism which is of the type incorporating a base plate, a movable slide plate and a discharge, with the opening of the base plate communicating via a through-flow opening of the bottom stone or block itself or a through-flow opening provided at a bottom stone sleeve member with the interior of the casting vessel, is generally manifested by the features that the

opening in the base plate and the opening in the slide plate possess a substantially elongate cross-sectional configuration, the main direction of extension of which is transverse to the slide path. Additionally, according to further important aspects of the invention, the through-flow opening of the discharge stone or block and the bottom stone or block or the bottom sleeve member likewise possess a substantially elongate cross-sectional configuration at least at the portions directly neighboring the slide plate and base plate, respectively, and the main direction of extension of these last-mentioned openings of the discharge stone and bottom stone or bottom stone sleeve member extends parallel to that of the slide plate and base plate. By virtue of the elongate configuration of the through-flow openings provided at the base plate and slide plate, it is possible to appropriately shorten the path or stroke of such slide plate, thereby decreasing any possible wear thereof which may arise, and wherein the width of the stone in a direction transverse to the slide path or track does not necessarily have to be increased. It has been found that, as a general rule, the slight overlapping or superimposition transverse to the slide track, which is provided by virtue of the elongate, especially oval or elliptical cross-sectional configuration for the same through-flow cross-section, is generally quite sufficient.

A further advantage of the elongate cross-section of the through-flow openings provided at both plate-shaped stones or blocks, which continues towards the top also at the bottom stone sleeve and towards the bottom at the discharge sleeve, resides in the resulting compact emerging casting jet. This phenomenon apparently is attributable to the fact that the elongate configuration of these openings, that is to say, a shape which deviates from the circular shape, opposes any tendency of the emerging casting metal jet to spin or twist.

Still a further significant advantage of the elongate cross-sectional configuration of the openings under consideration also resides in the improved control characteristics of the slide since the through-flow varies approximately proportionally to the control path.

In the case of slide closure mechanisms where the discharge or discharge sleeve is moved along together with the slide stone or block, the cast jet experiences a displacement during the control movements of the slide stone, rendering more difficult the casting of metal into molds having a small cross-section. By virtue of the reduction of the slide path, improved operation is also achieved under these conditions.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings showing an exemplary embodiment of inventive slide closure mechanism, and wherein:

FIG. 1 is an axial sectional view through a preferred embodiment of inventive slide closure mechanism in its open position, with only the components thereof formed of refractory material being shown in full lines;

FIG. 2 is a plan view of the slide closure mechanism depicted in FIG. 1;

FIG. 3 is a plan view of a modified form of discharge wherein the opening thereof at the inlet side possesses

a substantially elliptical or oval cross-sectional configuration and at the outlet side a substantially circular-shaped configuration; and

FIG. 4 is a plan view of a variant form of discharge member wherein the opening thereof possesses the same cross-sectional shape over its entire length, but wherein the cross-sectional area of such opening reduces in the flow direction of the melt between the inlet side and the outlet side thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, in FIG. 1 reference numeral 2 designates the bottom stone or block of a casting or pouring ladle, by way of example, and denoted generally by reference character 4. The bottom stone or block 2 has a downwardly widening conical bore or opening 6 in which there is secured by mortar or plaster, or some other suitable material, the bottom stone sleeve member 8. Bottom stone 2 and bottom stone sleeve member 8 consist of refractory material, yet because of the greater thermal stresses or load experienced by the bottom block sleeve member 8 such is formed of a more high-grade material. The bottom block or stone sleeve member 8 bears against a base plate 12 possessing a substantially oval shape in plan, as best shown by referring to FIG. 2. The same type of oval plan configuration is also possessed by a slide plate member 14 which cooperates with this base plate 12 to form the slide closure. The slide plate member 14 is inserted in a slide portion 16 displaceably guided in a slide housing 18 and actuated through the agency of any suitable drive mechanism 20. This slide housing 18, secured to the bottom of the casting ladle in any suitable well-known manner, also possesses a likewise oval recess 22 rendering possible the introduction of the base plate 12 into an appropriately configured recess provided at the underside of the casting ladle 4.

A discharge member or stone 24 merges with the slide plate member 14, as shown, and is likewise embedded in mortar and supported at the slide portion 16 and displaceable together therewith. In FIG. 1 there is shown the use of a layer of mortar 10a for connecting the discharge 24 with the slide plate 14.

As will be best observed by referring to FIG. 2, the base plate 12 and the slide plate member 14 each possess a respective through-flow opening 26 and 28, having a cross-section which deviates from the circular shape. This cross-sectional configuration of the through flow openings 26 and 28 can be substantially oval or elliptical, wherein the longer main or major axis of each such opening extends transversely with respect to the direction of movement of the slide portion 16 and the slide plate member 14. This direction of movement is designated in FIG. 2 by the double-headed arrow 30. This oval or substantially oval cross-sectional configuration also continues for the through-flow opening 32 of the discharge member 24; the through-flow opening portion 34a of the bottom stone sleeve member 8 likewise possessing such a substantially oval cross-sectional shape. Bottom stone sleeve member 8 also has an inlet opening 34b which is substantially circular in cross-section and which merges via the opening of the through-flow intermediate portion 34c with the oval or elliptical cross-sectional shape opening 34a of the lowermost portion of this sleeve member 8.

This through-flow opening of the bottom block formed by the portions 34b, 34c, 34a can therefore narrow in the flow direction of the melt, and such narrowing of said throughflow opening can be realized by reducing the length of that one axis of the circular-shaped inlet opening or portion 34b of the throughflow opening which is situated in a plane containing the shorter axis of the substantially elliptical or oval cross-sectional configured opening 34a of the bottom block at the interface region neighboring the base plate.

The cross-section of the through-flow opening portion 34a preferably narrows uniformly until merging with the through-flow opening 32 of the discharge 24, for instance in that the longer and shorter i.e., major and minor axes of the elliptical cross-sectional shaped openings continuously decrease.

In accordance with an alternative embodiment of the invention it is also possible to construct the through-flow opening 32 at the discharge 24 in such a way that its oval, rectangular-shaped or elliptical cross-section at the inlet, that is to say, directly at the interface or point merging with the through-flow opening 28 of the slide plate member 14 transforms into a circular or approximately circular cross-sectional shape at the outlet, and specifically, in such a manner that the cross-sectional area remains constant or reduces. For instance, in FIG. 3 there is illustrated a discharge member 24 wherein the through-flow opening 32 thereof possesses at the inlet side 32a substantially elliptical or oval cross-sectional configuration and wherein the outlet portion at the outlet side 32b thereof possesses a substantially circular-shaped configuration. On the other hand, FIG. 4 illustrates a further variant of such discharge member 24 wherein the through-flow 32 thereof possesses the same cross-sectional shape over its entire length, and in this instance will be seen to possess a substantially elliptical or oval cross-sectional configuration both at the inlet side 32a as well as at the outlet side 32b thereof, yet the cross-sectional area of such opening 32 of the discharge member 24 reduces in the flow direction of the melt between the aforesaid inlet side 32a and outlet side 32b inasmuch as both the major and minor axes of the elliptical or oval shaped opening 32 reduce in the direction of the outlet side 32b, as shown. Moreover, it is also conceivable to construct the through-flow openings so as to possess a triangular configuration, for instance similar to an isosceles triangle, the altitude of which is smaller than the base extending transverse to the slide direction.

The inventive configuration of slide closure mechanism and the concepts of the invention can also be utilized for slide closures of a type wherein the movable slide plate is displaced between two stationary plates, that is to say, between the base plate and a stationary slide plate supported in the slide housing and rigidly connected with the discharge.

Furthermore, the slide closure mechanism of the invention can also be constructed as a rotary slide closure or as a slide closure mechanism having pivotable slide plate. It will be recalled that it was previously explained that the bottom stone or a bottom stone sleeve member could be equipped with a through-flow opening which communicates the opening of the base plate with the interior of the casting vessel. Hence, the expression "bottom stone or block equipped with a through-flow opening" as used herein, or analogous expressions, are intended to convey broadly both possibilities and there-

fore are not utilized in any limiting sense but in the broader sense herein denoted.

Additionally, by way of completeness, it is here mentioned that the opening 26 of the base plate 12 and/or the opening 28 of the slide plate 14 can be offset in the direction of the slide path, that is the direction of displacement of the slide member, with respect to the geometric center of the plan surface of such respective plates.

It should be apparent from the foregoing detailed description, that the objects set forth at the outset to the specification have been successfully achieved. ACCORDINGLY,

What is claimed is:

1. A slide closure mechanism for casting vessels or the like, comprising a bottom block having a melt throughflow opening provided for the casting vessel, said throughflow opening including a substantially circular-shaped inlet portion, a base plate, a movable slide plate movable in two directions and a discharge member cooperating with said bottom block, said base plate, movable slide plate and discharge member each having a respective opening for passage of the melt, said opening of said base plate communicating with the interior of the casting vessel via said throughflow opening of said bottom block, said opening of said base plate and said opening of said slide plate each possessing a substantially elongate cross-sectional configuration, the primary direction of extension of said base plate and slide plate openings is substantially transverse to the directions of movement of said movable slide plate, said opening of said discharge member and said opening of said bottom block likewise possessing a substantially elongate cross-sectional configuration at least at the interface regions thereof directly neighboring said slide plate and base plate, respectively, said discharge member and bottom block openings at said neighboring regions likewise possessing a primary direction of extension which is substantially parallel to said primary direction of extension of said openings of said slide plate and base plate, the cross-sectional area of said opening of said discharge member reducing in the flow direction of the melt, said throughflow opening of said bottom block being defined by a bottom block sleeve member carried by said bottom block and possessing said circular-shaped inlet portion, said elongate cross-sectional configuration of said throughflow opening of said bottom block having two axes of different length, said throughflow opening narrowing in the flow direction of the melt, and wherein narrowing of said throughflow opening is realized by reducing the length of that one axis of the circular-shaped inlet portion of the throughflow opening which is situated in a plane containing the shorter axis of said substantially elongate cross-sectional configured opening of said bottom block at the region neighboring said base plate.

2. A slide closure mechanism for casting vessels or the like, comprising a bottom block having a melt throughflow opening provided for the casting vessel, said throughflow opening including a substantially circular-shaped inlet portion, a base plate, a movable slide plate movable in two directions and a discharge member cooperating with said bottom block, said base plate, movable slide plate and discharge member each having a respective opening for passage of the melt, said opening of said base plate communicating with the interior of the casting vessel via said throughflow open-

ing of said bottom block, said opening of said base plate and said opening of said slide plate each possessing a substantially elongate cross-sectional configuration, wherein the primary direction of extension of said base plate and slide plate openings is substantially transverse to the directions of movement of said movable slide plate, said opening of said discharge member and said opening of said bottom block likewise possessing a substantially elongate cross-sectional configuration at least at the interface regions thereof directly neighboring said slide plate and base plate, respectively, said discharge member and bottom block openings at said neighboring regions likewise possessing a primary direction of extension which is substantially parallel to said primary direction of extension of said openings of said slide plate and base plate, the cross-sectional area of said opening of said discharge member reducing in the flow direction of the melt, said opening of said discharge member possessing the same cross-sectional shape over its entire length, and both axes of said opening of the discharge member possessing said substantially elongate cross-sectional configuration at least at the interface region thereof neighboring said slide plate simultaneously reducing in the flow direction of the melt.

3. The slide closure mechanism as defined in claim 2, further including means for rigidly connecting said discharge member with said movable slide plate.

4. A slide closure mechanism for casting vessels or the like, comprising a bottom block equipped with a melt through-flow opening provided for the casting vessel, said bottom block throughflow opening including an inlet portion and an outlet portion, said throughflow opening possessing a substantially circular-shaped cross-sectional configuration at the region of said inlet portion, the length of at least one of the axes of said throughflow opening reducing in the flow direction of the melt in the direction of said outlet portion, to thereby define a substantially elliptical-shaped throughflow opening at the region of said outlet portion, a base plate, a movable slide plate movable in two directions and a discharge member cooperating with said bottom block, said base plate, movable slide plate and discharge member each having a respective opening for passage of the melt, said opening of said base plate communicating with the interior of the casting vessel via said throughflow opening of said bottom block, said opening of said base plate and said opening of said slide plate each possessing a substantially elliptical cross-sectional configuration, wherein the major axis of said elliptical-shaped openings of said base plate and slide plate extend in a direction which is substantially transverse to the directions of movement of said movable slide plate, said opening of said discharge member likewise possessing a substantially elliptical cross-sectional configuration at least at the region thereof directly neighboring said slide plate, said respective elliptical-shaped openings of said discharge member and bottom block likewise possessing a major axis which extends substantially parallel with respect to the respective major axis of each of said elliptical-shaped openings of said slide plate and base plate, said discharge member having an outlet portion approaching a circular-shaped configuration, the cross-sectional area of said opening of said discharge member reducing in the flow direction of the melt, and wherein the cross-sectional area of the opening of the discharge member

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reduces in the flow direction of the melt by virtue of the fact that the major axis thereof decreases in size in the direction of the outlet portion approaching said circular-shaped configuration.

5. The slide closure mechanism as defined in claim 4, 5

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wherein the decrease of the major axis of the opening of the discharge member is a function of the increasing distance from the interface between the discharge member and the slide plate.

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