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(54) DEVICE FOR IMPROVED SUPPLY OF MOULD PARTICLE MATERIAL TO THE HOPPER OF A FOUNDRY MACHINE FOR MOULD-MAKING

(76) Inventor: **Vagn Mogensen**, Gentofte (DK)

Correspondence Address:
STITES & HARBISON PLLC
1199 NORTH FAIRFAX STREET
SUITE 900
ALEXANDRIA, VA 22314 (US)

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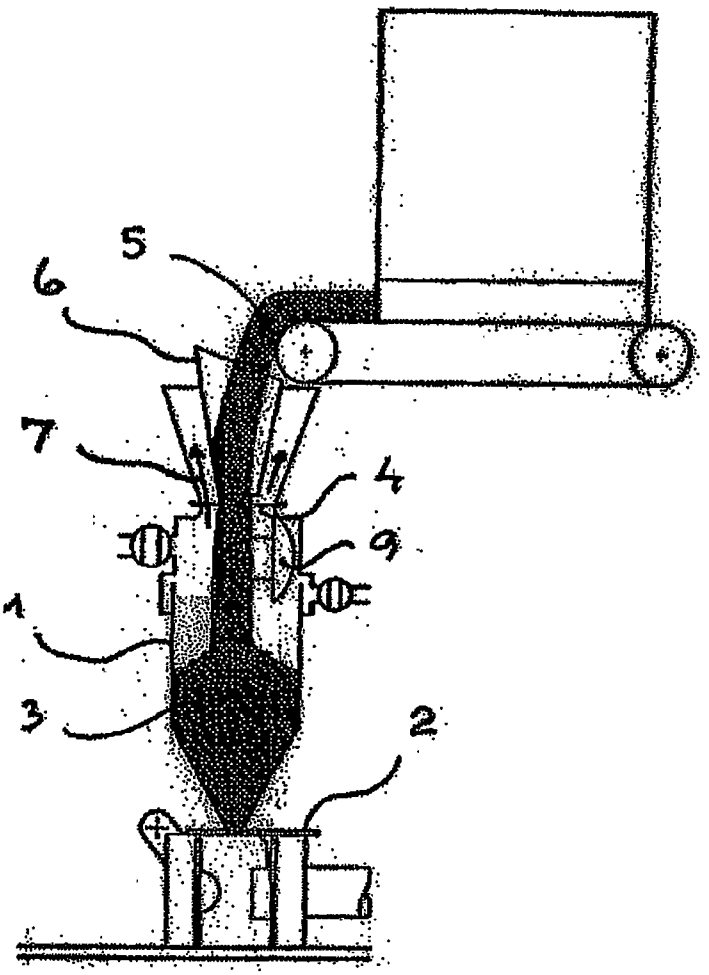
(57) **ABSTRACT**

A device for improved supply of falling particle material **(5)** into a foundry machine's hopper **(1)** through a closeable inlet opening **(4)** therein, such machine e.g. being of the "Disamatic®"-type and/or functioning accordingly, comprising:—a guiding surface **(6)** being the circumferring internal side surface of a tapering space in a surrounding structure;—the wider end of said tapering space being pointing upwards intercepting the flow **(5)** of falling material meant for said hopper **(1)**;—the narrower end of said tapering space being arranged at said inlet opening **(4)**, allowing for a stream of intercepted particle material **(5)** to substantially unhindered pass the opened said inlet opening **(4)** after leaving said narrower end face; and—said structure circumferring said tapering space outside of its guiding surface **(6)** is providing at least one opening **(@7)** relative to the opened inlet opening off said narrower end face.



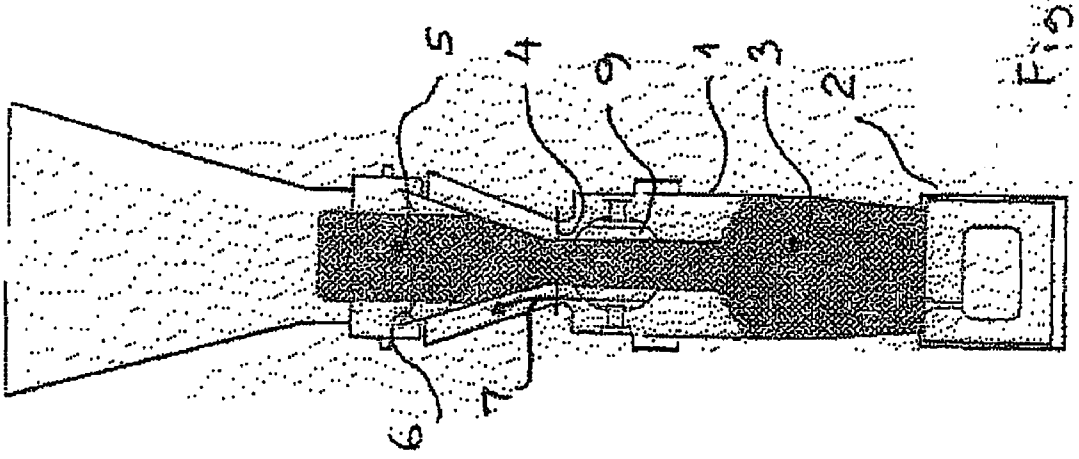


Fig. 2

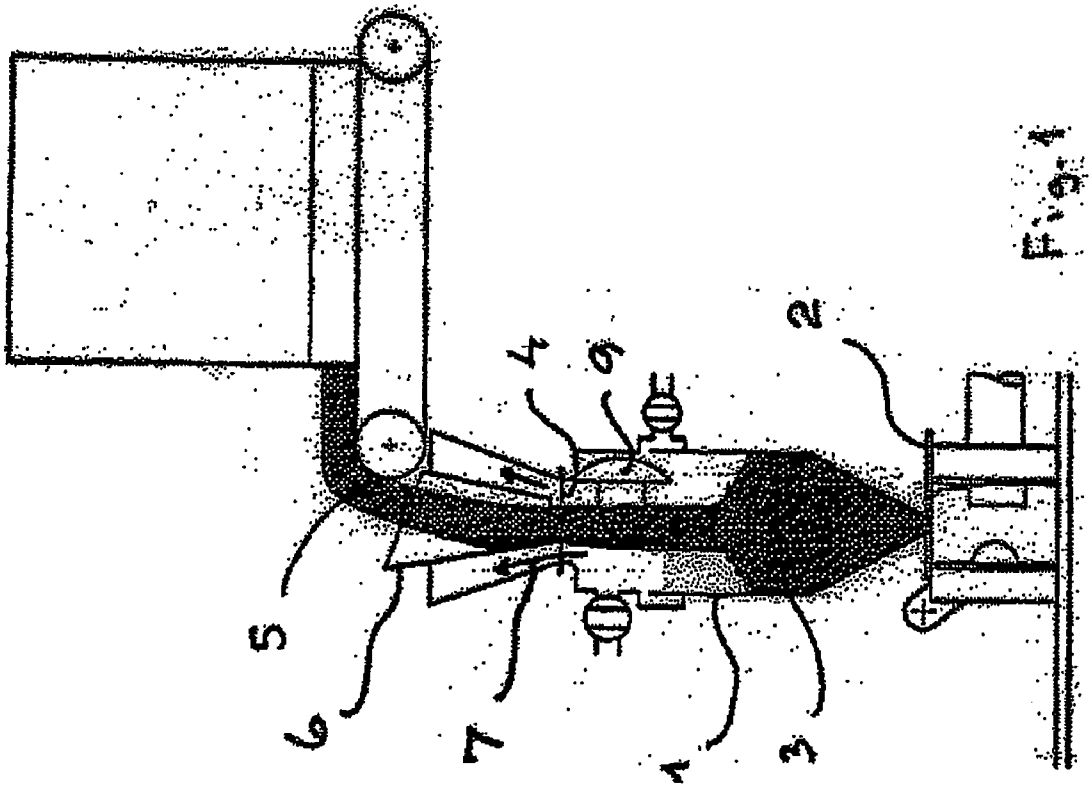


Fig. 4

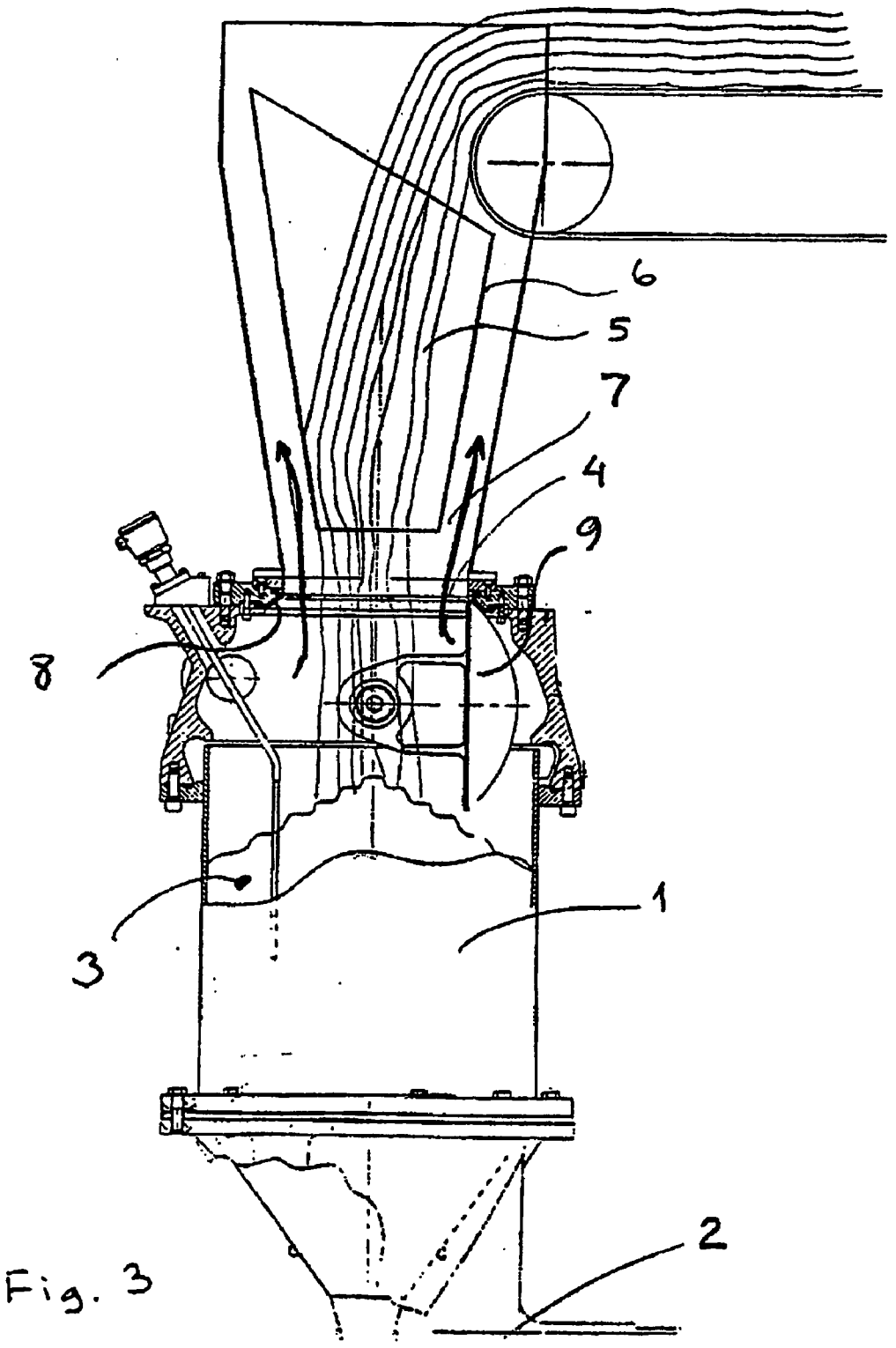


Fig. 3

DEVICE FOR IMPROVED SUPPLY OF MOULD PARTICLE MATERIAL TO THE HOPPER OF A FOUNDRY MACHINE FOR MOULD-MAKING

FIELD OF THE INVENTION

[0001] The present invention relates to a device for improved supply of mould particle material to the hopper of a foundry machine for mould-making according to the preamble of claim **1**.

BACKGROUND

[0002] The conditioned "sand" (i.e. the particle material) for foundry moulds is normally delivered to the hopper on each individual mould-making machine via gravitational fall from a conveyor system above (e.g. a belt system). Such machines normally are capable of functioning in repeated cycles of controlled sequential series of steps, each cyclus yielding a mould, that can be part(s) of one/more set(s) of moulds.

[0003] Such machines normally are furnished with the hopper designed as a pressure chamber provided with a top inlet opening for the falling "sand", that has a relatively small opening area, which is sealable by means of some type of valve function (e.g. a slide gate), as some or all of the sand from the so sealed hopper by means of pressurized gas (normally air) from a controlled driving gas system is furthered into a mould chamber, whereafter an adequate amount of sand once more is secured in the hopper, before sand once more is furthered into the mould chamber for the consecutive mould, etc. In the mould chamber the sand is pressed/squeezed to form a mould component, which after removal leaving space for the next volume of sand to be furthered in, in functional combination with mating component(s) later are poured with molten material.

[0004] An example of a machine as described above is an automatically functioning mould-making machine of the "Disamatic®"-type.

PRIOR ART

[0005] To intercept the sand falling from the conveyor system, a relevant mould-making foundry machine normally incorporates a known element with a generally funnel-shaped surface to guide the sand received to the opened top inlet opening of the machine's hopper. The known types of guiding funnels are normally of frusto-conical or frusto-pyramidal shape, the wider end face pointing upwards to offer a wide/long opening to intercept the falling sand, that can have its "delivery positions" from the conveyor system varying according to parameters as: particle material condition, shape of conveyor's delivery opening, horisontal speed component "inherited" from conveyor system, fall height, actual sand flow, etc.

[0006] The frusto-shape's smaller end face is normally adapted to present a smooth transformation of shape to the opened top inlet opening to facilitate the inflow of falling particle material and to avoid build-up caused by edge-effects during the sand inflow.

[0007] Some major problems met at known inlet-arrangements of the above type are related to the relative small inlet opening area and consist in:

[0008] first, blocking of the inlet opening during inflow of sand due to entrapment of air from the hopper during the delivery through the inlet opening: the air/gas contained in the hopper to be replaced with the corresponding volume of inflowing sand cannot easily escape from the hopper volume in a direct counterflow to the sand, and might instead create a counterpressure from the hopper causing the downcoming sand to form a plug in the inlet opening, thus at least momentarily hindering the inflow;

[0009] second, during effective inflow of sand the distribution of the inflown sand in the hopper can be very uneven through the hopper's horisontal section, e.g. due to the "pulsing" type of supply following consecutive blockings of the inlet opening; the pulsing also often results in compactness of the settled delivered sand varying through the height in the hopper causing problems with later effective control of the furthering into the machine's mould chamber;

[0010] third, undesired deposition of particle material in the sealing area of the valve/slide gate function closing the hopper inlet opening resulting in excessive wear of sealing components and problematical sealing off that opening;

[0011] fourth, undesired spread and deposition of particle material, that has been transported to the surroundings via the replaced gas escaping from the hopper; such material particles causing non-intended wear on moving elements elsewhere and disturbing/polluting the environment in the foundry—if not caught by a ventilation system, which then is additionally stressed, especially in the filtering section, from this extra load of fines; and

[0012] fifth, especially in the case of fast, automatic machines, e.g. functioning according to the "Disamatic®"-principle, the unnecessary prolonged duration of the inflow of the sand, e.g. due to blocking/pulsing, can severely compromise the mould production rate, as the overall machine cyclus might be slowed down by waiting for sand to have flown into the hopper, before the subsequent steps (closing of inlet opening and performing admittance of pressurized gas to further sand from the hopper into the mould chamber) are controlled to happen.

SUMMARY OF THE INVENTION

[0013] The main object of the present invention is therefore to provide a device to improve the supply of falling particle material into a foundry machine's hopper through the inlet opening by overcoming the problems described above.

[0014] Other objects of the present invention will appear from the description to follow and from the dependent claims.

[0015] The device for improved sand supply according to the main aspect of the present invention therefore possesses the following characterizing features:

[0016] the device being an at least meta-stable guiding surface being the circumferring internal side(s)

surface(s) of a frusto-conical/-pyramidal/funnel-shaped tapering space in a structure;

[0017] the wider, open end face of said tapering space being pointing upwards intercepting a possible flow of falling material particles meant for said hopper;

[0018] the narrower, open end face of said tapering space being arranged at said inlet opening of the foundry machine's hopper, allowing for a possible stream of intercepted particle material to substantially unhindered pass the opened said inlet opening after leaving said narrower end face; and

[0019] said structure circumferring said tapering space outside of its said guiding surface and facing a possibly existing frusto-shaped guiding surface for falling particle material to said machine's hopper, is allowing for at least one upstream of escaping air/gas being replaced with a stream of particle material flowing down into said hopper through said narrower end, to leave the hopper volume without intermixing with said counterflowing stream of particle material in said opened inlet opening, by providing at least one opening relative to the opened inlet opening off said narrower, open end face,

[0020] as practical tests surprisingly has evidenced, that the overall flow rate of the downstreaming sand is not compromised, even though some of the area of the opened inlet opening by means of the inventive device is reserved as one or more passages dedicated to the upstreaming replaced air from the hopper. Thus absence of blocking/pulsing, even compactness and speedy operation are the achieved major benefits.

[0021] Preferably, the structure is substantially made of sheet material, as such material inherently is offering a smooth guiding surface, hindering local build-ups.

[0022] Preferably, the tapered space is positioned approximately vertically, centrally to the opened said inlet opening, as such placement normally is best suited for all-round mould production, due to the provision of a substantially ring-shape opening at the edge of the opened inlet opening for the counterflowing escaping gas from the hopper cushioning the opening seals from particles.

[0023] Preferably, the at least meta-stable guiding surface is of/lined with a smooth and low-friction material, e.g. a PTFE-composite, thus offering improved avoidance of local build-up/blocking of particle material(s) of difficult-to-handle composition and/or condition.

[0024] Preferably, the structure is controlled movable up and down in a sequence related to the opening/closing of said inlet opening, thus better being able to intercept the falling stream of sand by approaching a delivery source, especially at the beginning of a delivery phase.

[0025] Preferably, the structure partly is temporarily positioned below said opened inlet opening, thus better protecting the seals against particle deposition and offering possibility to better control the dispensing of sand in the hopper.

[0026] Preferably, the structure is pivotable in a substantial vertical plane, thus being able to better "follow" the falling stream of sand to intercept.

[0027] Preferably, the structure is pivotable in a substantial vertical plane escaping physical contact with the element(s) closing the inlet opening and vice versa, thus in some cases permitting prolonged filling of the hopper during the start of the closing of the inlet opening to further minimize cycle-time. The narrower end of the structure might be optimized profilated and positioned accordingly, so the last particle material slides the side of the guiding surface farthest form the nearest edge of the inlet opening closing member.

[0028] Preferably, the structure is comprising exitating means, e.g. vibrating means, to further facilitate the flow of particle material over the guiding surface to avoid deposition.

[0029] Preferably, the device is comprising motive and/or detection means controlled by/communicating with said machine and/or a conveying system supplying said falling particle material. So, the movements might be optimized to save time, resulting in higher overall production rate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] A non-limitative example of the present invention will hereinafter be described in more detail with reference to the accompanying drawing, wherefrom:

[0031] **FIG. 1** depicts a side elevated, highly schematic, vertical section of an embodiment of the inventive device on top of a hopper of a mould-making foundry machine, being supplied with particle material from a supply system above;

[0032] **FIG. 2** depicts the same as **FIG. 1**, but as seen from the left side of **FIG. 1**; and

[0033] **FIG. 3** depicts, partly in section, some further illustrative details of the inventive device and of the hopper and of the sand supply system as in **FIG. 1** to further clarify the invention.

DESCRIPTION OF A PREFERRED INVENTIVE EMBODIMENT

[0034] Re. **FIG. 1** is shown the hopper **1** of a mould-making foundry machine, of whose lower parts only the chamber **2** for forming the mould by relatively approaching the two opposed movable end walls fitted with pattern plates, thus squeezing the intermediate particle material to be a relatively stable block, is schematically indicated. The machine generally being of the commonly known "Disamatic®"-type and functioning accordingly.

[0035] Also re. **FIG. 2** the hopper **1** bottom part is not conical, but merges in the mould chamber **2** ceiling by a slit across the pressing directions. The step of supplying sand **3** to the hopper is shown, as the hopper **1** has already been partly filled with sand **3**, which has passed the opened inlet opening **4**, while more sand **5** is downstreaming as a falling jet from a supply system above, which has not been further referenced to, but can be seen depicted as a belt-type conveying system, the movement of the belt, at least of on/off-type, being controlled according to the demand for further material according to communication to/from a controlling system also controlling the foundry machine below. Right now the conditioned particle material mixture (the "sand") **5** is rolled off the conveyor band to the left in **FIG. 1** and is falling as a stream driven by gravity, but also still

moving according to a horisontal velocity component inherited from the movement with the band. Conforming the belt speed, the sand **5** thus will take a direction downwards more or less off-center the opened inlet opening **4**.

[**0036**] In the figures, the inventive device **6** is shown as made of sheet material following a frusto-conical shape, the lower, narrower end pointing to the center of the inlet opening, thus defining an effectively smaller outlet opening at the lower edge of the guiding surface for the downstreaming sand internally of the structure of the inventive device. The wider end of the guiding surface is pointing substantially upwards to catch the falling sand by intercepting the stream **5** from the supply system. Ability to rock or swing the wider opening of the guiding surface in a substantially vertical plane following the directions of movement of the belt offers a better ability to intercept the stream of falling sand **5** as this "covers" an elongated area depending of the actual speeds of the belt.

[**0037**] As best seen from **FIG. 3** the falling sand **5** is from the narrower end of the guiding surface passing the opened inlet opening **4** as a concentrated, centered jet or beam of falling material. This beam is guided by the inventive device **6** to leave a circular opening at **7** near the edge of the inlet opening to allow for the unhindered counterflowing escape of gas form the hopper, that is driven out as the volume is being occupied from sand **3**. The escaping counterflowing upstream of gas/air from the hopper **3** is symbolised by the arrows as at **7**, clearly showing the non-interference of the two counterstreams of sand and air respectively faciltating the entrance of sand into the hopper without blocking the inlet opening and the exit of gas from the hopper without carrying out intermixed fines from the particle material **5** to disturb/pollute the surroundings/environment. As best seen and understood from **FIG. 3** the escaping counterflowing upstream of gas/air is also cushioning the circumferential seal **8** and the domed sealing body **9** of such exemplarily shown dome valve for sealing the inlet opening, thus hindering deposition of particle material at the sealing faces and resulting excessive wear of these components.

[**0038**] Means for bracketing at least some structure of the inventive device to the other stationary components preferably of the foundry machine, but possibly also to the sand supply system and/or a present ventilating system, is not shown, as such brackets, etc present no major challenge to a person skilled in the art to craft/design/manufacture. The possible means to raise/lower/pivot and/or vibrate the guiding surface of the inventive device **6** are also of evident character for the skilled person to understand and execute and will thus be treated no further here.

[**0039**] Even though the narrower opening of the "delivering" end of the guiding surface of the device **6** according to the present invention has a smaller area than the opening of the inlet opening **4**, hitherto used comparatively "unrestricted", a more even distributed and speedier supply of the required volume of sand to the hopper is achieved, by the beneficial function of the device according to the present invention. The resulting improvement in overall effective cycle time for the mould-making system is also making retrofitting of the inventive device **6** relevant to existing foundry machines, not presently being equipped with such device **6**.

[**0040**] The above detailed explanation of an embodiment of the present invention was given as an illustrative example only, the full scope of the present invention being set forth in the appended claims.

List. Reference Numbers in Figures and Claims

[**0041**] **1** hopper

[**0042**] **2** mould chamber

[**0043**] **3** sand, particle material, in hopper

[**0044**] **4** inlet opening

[**0045**] **5** falling sand

[**0046**] **6** inventive device

[**0047**] **7** place, point, at air escape opening(s)

[**0048**] **8** circumferential seal

[**0049**] **9** domed body of valve

1. Apparatus for improved supply of particle foundry mould material. **(3,5)** into a foundry machine's hopper **(1)** through an inlet opening **(4)** therein, said apparatus comprising

a delivery device such as a belt conveyor for delivering the material portion-wise in controlled amounts to

a guiding surface positioned to guide the material from the delivery device to the inlet opening **(4)** of the hopper **(1)**,

said inlet opening **(4)** being closable by a valve **(9)** in order to allow furthering of the material out of the hopper **(1)** and into a mould chamber **(2)** by means of pressurized gas introduced into the hopper **(1)** above the material after closing of the inlet opening **(4)**, and

said guiding surface being formed as an at least partially mechanically stable tapering funnel-like surface with its broad opening pointing upwards to intercept falling material received from the delivery device, and its narrow opening positioned and dimensioned to deliver the material in a stream into the opening **(4)** of the hopper **(1)**, leaving an interspace between the opening **(4)** and the stream of material, said interspace allowing air to escape from the hopper **(1)** in counterstream with the material without intermixing, and

said broad and narrow openings of said guiding surface **(6)** being open and unobstructed at all times, in order to allow free flow of the material.

2. The apparatus according to claim 1, characterized in,

said guiding surface **(6)** being substantially of sheet material.

3. The apparatus according to claim 1 or **2**, characterized in,

said tapered funnel-like surface being positioned approximately vertically, centrally to the opened said inlet opening **(4)**.

4. The apparatus according to one or more of the preceding claims, characterized in,

said at least partially mechanically stable guiding surface **(6)** being of/lined with a smooth and low-friction material, e.g. a PTFE-composite.

5. The apparatus according to one or more of the preceding claims, characterized in,

said guiding surface (**6**) being controlled movable up and down in a sequence related to the opening/closing of said inlet opening (**4**).

6. The apparatus according to one or more of the preceding claims, characterized in,

said guiding surface (**6**) partly being temporarily positioned below said opened inlet opening (**4**).

7. The apparatus according to one or more of the preceding claims, characterized in,

said guiding surface (**6**) being pivotable in a substantial vertical plane.

8. The apparatus according to claims **6** and **7**, characterized in,

said guiding surface (**6**) being pivotable in a substantial vertical plane escaping physical contact with the element(s) closing said inlet opening and vice versa.

9. The apparatus according to one or more of the preceding claims, characterized in,

said guiding surface (**6**) comprising exitating means.

10. The apparatus according to one or more of the preceding claims, characterized in,

the apparatus comprising motive and detection means controlled by/communicating with said machine and/or a conveying system supplying said falling particle material (**5**).

* * * * *