(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 June 2008 (19.06.2008)

PCT

(10) International Publication Number
WO 2008/071658 A2

(51) International Patent Classification:
D01D 5/098 (2006.01) *D01D 5/092* (2006.01)

(21) International Application Number: PCT/EP2007/063612

(22) International Filing Date: 10 December 2007 (10.12.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10 2006 058 403.1 12 December 2006 (12.12.2006) DE

(71) Applicant (*for all designated States except US*): **OERLIKON TEXTILE GMBH & CO. KG** [DE/DE]; Landgrafenstrasse 45, 41069 Mönchengladbach (DE).

(72) Inventors; and
(75) Inventors/Applicants (*for US only*): **HARRIS, Wiley, Scott** [US/US]; 3505 Oaks Way, Unit 303, Pompano Beach, Florida 33069 (US). **LU, Fumin** [US/US]; 7010 N.W., 81st Street, Tamarac, Florida 33321 (US). **RAVE, Henning** [DE/DE]; Walnussring 28, 24239 Achterwehr (DE). **SCHÖTTLER, Holger** [DE/DE]; St. Georges Allee 8, 23795 Klein Rönnau (DE).

(74) Agent: **KAHLHÖFER, Hermann**; Karlstrasse 76, 40210 Düsseldorf (DE).

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report*

(54) **Title:** METHOD AND DEVICE FOR MELT SPINNING AND COOLING SYNTHETIC FILAMENTS

(57) **Abstract:** The invention relates to a method and a device for melt spinning and cooling synthetic filaments. A plurality of filaments is extruded from a polymer melt by means of a plurality of nozzle holes of a spinneret and is guided, after the extrusion, into a cooling shaft for the purpose of cooling, a part of the cooling air being exhausted out of an inlet end of the cooling shaft by means of an exhaust equipment opposite to the running direction of the filaments, in order to discharge the volatile components arising during the melt spinning for preventing deposits on the spinneret plate. In order to achieve the most uniform flushing effect possible below the spinneret, the size of a suction port at the inlet end of the cooling shaft is changed according to the invention for adjusting the exhaust of the cooling air, the filaments being guided together through the suction port after the extrusion.

WO 2008/071658 A2

Method And Device For Melt Spinning And Cooling Synthetic Filaments

The invention relates to a method for melt spinning and cooling synthetic filaments according to the preamble of claim 1 and a device for implementing the method according to the preamble of claim 10.

In the production of synthetic yarns, fibers or non-woven materials, it is generally well known that a plurality of fine strand-like filaments is extruded from a polymer melt in a first step. For this purpose, the polymer melt is pressed through fine nozzle holes of a spinneret with the result that the polymer melt is discharged from the nozzle holes in the form of fine strand-like filaments. After the extrusion of the filaments, it is necessary to cool the latter for solidifying the polymer melt. For this purpose, the filaments are guided through a cooling shaft, which is coupled to a cooling air source with the result that cooling air is blown into the cooling shaft for cooling the filaments. A method and device of this type have been disclosed in the German Patent Specification DE 199 05 171 A1 by way of example.

In the method and device known from the prior art, an exhaust equipment is disposed between the spinneret and an inlet end of the cooling shaft for continuously discharging a part of the cooling air and particularly those volatile components of the filaments, which are flushed along and are recovered during the extrusion of the polymer melt. It is possible in this way to prevent or at least reduce premature deposits on the lower side of the spinneret. In the method and device known from the prior art, it is possible to substantially determine the intensity of the exhaust generally only by means of the suction power of the exhaust equipment. Thus, particularly in the case of a large number of nozzle holes, it is necessary to accordingly apply large amounts of suction energy in order to uniformly discharge the decomposition products leaving the polymer material over the entire lower side of the spinneret.

DE 39 29 961 C1 discloses a method and a device as are used, for example, for producing non-woven products. Here, the so-called monomer exhaust is combined with a suction air cooling. For the purpose of suction air cooling, that part of the cooling air, which is sucked in by the exhaust equipment, is guided along a suction stretch opposite to the running direction of the filaments. Thus the cooling air stream can be used both for flushing the preferably vaporous decomposition products and also for cooling the filament strands. However, the disadvantage of this method and this device known from the prior art is that the cooling effect and the flushing effect of the cooling air is substantially determined by the exhaust equipment.

The methods and devices known from the prior art are thus hardly suitable for generating a uniform suction flow over the entire surface of the spinneret, particularly in the case of a large number of nozzle holes and a tight cluster of nozzle holes on the lower side of the spinneret.

It is therefore the object of the invention to further improve a method for melt spinning and cooling synthetic filaments of the generic type and also a device of the generic type for implementing said method so as to ensure the most uniform possible exhaust of all the regions below the spinneret independently of the outer formation of the lower side of the spinneret.

Another aim of the invention is to design the generic method and the generic device so as to be able to use and change the suction flow of the cooling air from the cooling shaft for cooling the filaments.

This objective is attained according to the invention by means of a method having the characteristics set forth in claim 1 and a device having the characteristics set forth in claim 10.

Advantageous refinements of the invention have been defined by the features and combinations of the features set forth in the respective dependent clauses.

The special advantage of the invention is that it enables an exhaust of the cooling air for removing decomposition products of the polymer material, said exhaust being adapted to the spinneret, the filament arrangement and the filament density. The exhaust of the cooling air is adjusted advantageously by changing the size of a suction port at the inlet end of the cooling shaft. The suction port firstly forms the inlet to the cooling shaft, through which the filaments are guided together after the extrusion. Secondly, the suction port forms the suction cross-section, which is decisive for the backflow of the cooling air and through which the part of the cooling air flows out of the cooling shaft against the running direction of the filaments towards the exhaust. The suction port thus enables the backflow of the cooling air to be influenced in such a way that it is possible to influence both the cooling effect on the filaments and also the flushing effect within the filament bundle.

In order to provide the simplest possible and reproducible opportunity of adjustment for changing the suction port, the suction port at the inlet end of the cooling shaft is determined by one or more moveable shielding means, which are guided into one of several operating positions for selecting the size of the suction port, according to an advantageous refinement of the method according to the invention. The filaments guided in the form of a filament group with an enveloping [sic] determine a minimum size of the suction port in order to carry out the extrusion and the melt spinning of the filaments without any problems. In this respect, each distance formed between the free edges of the shielding means and the outer filaments of the filament group can be advantageously reduced or increased using the shielding means. It is thus possible, for example, to adjust the smallest possible distance between the shielding means and the outer filaments in the case of a high filament density, so that the cooling air sucked in by the exhaust equipment leads to an intensive penetration of the filament group.

In contrast, in the case of small number of filaments, and low filament density, a larger distance can be adjusted between the shielding means and the outer filaments of the filament group.

In the case of a large plurality of simultaneously extruded filaments, it is particularly advantageous to use that variant of the inventive method in which two cooling air streams are blown into the cooling shaft through two blow walls for cooling the filaments, the blow walls being located opposite to one another in the cooling shaft and the cooling air being exhausted by means of two suction channels arranged upstream of the blow walls. This variant of the inventive method has proved to be useful particularly in the production of non-woven materials. Here the filament group is preferably extruded in the form of a filament curtain through spinnerets having nozzle holes arranged in a row, the filaments being cooled within the filament curtain by the cooling air streams from both the longitudinal sides of the filament curtain. The part of the cooling air, which is sucked out of the cooling shaft, is discharged through mutually opposing suction channels, which are arranged directly upstream of the blow walls outside the cooling shaft.

Here that variant of the inventive method is particularly preferable in which both the cooling air streams are blown in symmetrically towards the plurality of the filaments guided in the form of a filament curtain, the suction port extending between two mutually opposing shielding plates and the shielding plates being displaced by means of a pushing movement transversely to the filaments for selecting the size of the cross-section of the suction port. The cooling air, which is blown into the cooling shaft by means of the blow walls, can thus be recirculated out of the suction port in the inlet region of the cooling shaft by means of the suction effect with a high degree of penetration of the filament group. Both the cooling effect and also the flushing effect for discharging the volatile components thus cover the entire filament group and particularly even the entire lower regions of the spinneret so as to reduce deposits substantially.

In order to improve particularly the cooling effect on the filaments brought about by the backflowing cooling air, it is possible according to an advantageous refinement of the method according to the invention, to change the length of a suction stretch formed between the suction port and the spinneret. The backflow of the cooling air, said backflow acting on the filaments, helps eliminate the jacket-like protective cover forming on the filaments during their progressive movement. This particularly leads to an intensive cooling of the filaments within the cooling shaft.

The cooling shaft is preferably adjusted in height in the running direction of the filaments or opposite to the running direction of the filaments for changing the length of the suction stretch.

In order to enable the most adaptive cooling of the filament strands, that refinement of the method according to the invention is preferably used in which one of several operating positions of the blow walls is selected, the blow wall being moved towards the filaments or away from the filaments for changing the operating position. It is thus possible to change particularly the distances formed between the blow wall and the filaments so as to be able to adjust particularly the incident flow ratios between the cooling air and the filaments. It is thus possible, for example, to guide the filaments having a relatively thick filament denier at a short distance from the blow wall so as to be able to use an intensive incident flow of the cooling air for cooling the filaments. The suction port can be adapted to the respective positions of the blow walls so as to enable high flexibility for cooling the filaments with the simultaneous discharge of the monomers in the region of the spinneret. It is thus possible to optimally extrude and cool both filaments having thick filament deniers and also filaments having fine filament deniers while maintaining equally long cooling stretches.

When cooling the filaments guided in a filament curtain, it has proved to be useful if the cooling air is guided together with the filaments at an outlet end of the cooling shaft by means of a blast opening having a discharge cross-section of selectable size. It is thus possible to influence particularly the pressures prevailing in the cooling shaft, in order to thus change the air quantity discharged from the blow wall and the backflow of the cooling air discharged by means of the exhaust equipment from the suction port.

The blast opening is preferably formed between two mutually opposing air control flaps for adjusting variable discharge cross-sections of the blast opening, the air control flaps being displaced by means of a pivoting movement transversely to the filaments for selecting the size of the blast opening. There is thus an additional influence of the cooling conditions of the filaments and of the suction flow at the inlet end of the cooling shaft. In addition to the blasting speed of the cooling air when impinging upon the filaments, it is also possible to influence the overall air quantity being discharged from the blow walls.

The device according to the invention comprises a suction port having variable size at the inlet end of the cooling shaft for implementing the method according to the invention. The device according to the invention is thus particularly flexible in order to discharge the cooling air exhausted from the cooling shaft for cooling the filaments and for flushing volatile components after the extrusion of the filaments.

The suction port at the inlet end of the cooling shaft is preferably formed by means of one or more moveable shielding means, which can be guided into one of several operating positions for selecting the size of the suction port. The shielding means can be designed to be single-part or multi-part in order to enclose particularly the filaments guided in the form of a group like an envelope. That shape of the suction port is preferably selected, which corresponds congruently to an envelope enclosing the yarn group.

The cooling air stream generated within the cooling shaft can basically be produced using any means such as, for example, blow walls or blowing tubes. However, the device according to the invention is preferably designed in such a way that the cooling air source is connected by means of two blow walls to the mutually opposing inner sides of the cooling shaft. The suction flow of the cooling air at the inlet end of the cooling shaft is discharged by means of two suction channels assigned to the blow walls.

Such refinements of the device are used for extruding and cooling filament groups, which are deposited for being treated subsequently to form a non-woven material. For this purpose, the blow walls are held preferably symmetrically to the spinnerets, which comprises nozzle openings arranged in a row for extruding a filament curtain. The suction port can preferably be formed by means of mutually opposing shielding plates, which can be displaced by means of a pushing movement transversely to the filaments.

The device is preferably improved further for increasing the flexibility in adjusting the suction flow at the inlet end of the cooling shaft by designing the cooling shaft to be height-adjustable for adjusting a suction stretch formed between the inlet end of the cooling shaft and the spinneret. Thus the sucked-in cooling air can bring about a cooling effect on the filaments depending on the length of the suction stretch.

In order to be able to cool various filament deniers and filament types as far as possible within predetermined lengths of a cooling stretch, it is further possible to hold the blow walls alternately in several operating positions relative to the spinneret, the blow wall being moved within the cooling shaft towards the filaments or away from the filaments for changing the operating position. The blow walls are disposed in the selected operating positions preferably symmetrically to the spinnerets so as to achieve a uniform and intensive cooling of all the filaments of the filament group guided in the form of a filament curtain.

In order to generate a counter pressure, which acts inside the cooling shaft and influences particularly the discharged cooling air quantity opposite to the blow wall and the sucked-in cooling air opposite to the exhaust equipment, the device according to the invention is preferably upgraded in such a way that the outlet of the cooling shaft comprises a blast opening, which has a discharge cross-section of changeable size.

When using two mutually opposing blow walls, that design form of the blast opening has proved to be particularly useful in which two mutually opposing pivoting air control flaps are held, which realize, depending on their position, one more or less open blast opening on the outlet side of the cooling shaft.

The method according to the invention and the device according to the invention are particularly suitable for realizing an intensive monomer exhaust in the case of freshly extruded filament strands from a polymer melt. It is thus possible to uniformly control the deposits in the lower sides of the spinnerets substantially over the entire region of the spinneret. In addition to the flushing effect, the sucked-in cooling air can also be used advantageously for cooling the filaments already at their entry into the cooling shaft. The invention can be integrated in every melt spinning process independently of whether the filaments are guided to form a yarn, or individual fiber strands or spinning cables or a planar structure, for example, a non-woven material.

The invention is explained below with reference to a few exemplary embodiments of the device according to the invention, of which:

Fig. 1 schematically shows a cross-sectional view of a first exemplary embodiment of the device according to the invention for implementing the method according to the invention

Fig. 2 schematically shows a view of a longitudinal section of the exemplary embodiment shown in fig. 1

Fig. 3 schematically shows a cross-sectional view of another exemplary embodiment of the inventive device

Fig. 4 schematically shows a view of a longitudinal section of the exemplary embodiment shown in fig. 3.

Fig. 1 and fig. 2 schematically show several views of a first exemplary embodiment of the device according to the invention for implementing the method according to the invention. Fig. 1 shows a cross-sectional view of the exemplary embodiment and fig. 2 schematically shows a view of a longitudinal section thereof. The subsequent description applies to both the figures unless express reference is made to any one of the figures.

The exemplary embodiment comprises spinning means in order to extrude a plurality of filaments from a polymer melt. The spinning means are shown in fig. 1 and fig. 2 with only the components that are required for extruding the filaments. The filaments are thus extruded by means of a spinneret 1, a spinneret plate 2 having a plurality of nozzle holes being disposed on the lower side of said spinneret 1. The spinneret 1 is connected to a spinning pump (not illustrated) by means of a melt line 4. The spinneret 1 is held in a heated spinning beam 3. As shown in fig. 2, several spinnerets 1 are held side by side in the spinning beam 3 so as to extrude several groups of filaments 10 in parallel simultaneously.

The exemplary embodiment according to figs. 1 and 2 shows a cooling shaft 5 below the spinneret 1. The cooling shaft 5 extends in the running direction of the filaments 10 and forms a cooling stretch, in which the freshly extruded filaments are cooled and solidified. The cooling shaft 5 is delimited from the ambience by means of the cooling shaft walls 6.1 and 6.2 and the walls 6.3 and 6.4 disposed on the front side. The cooling shaft walls 6.1, 6.2, 6.3 and 6.4 form a parallelepiped jacket of the cooling shaft 5. A recess for receiving a blow wall 7 is provided in the cooling shaft wall 6.1 on the inner side of the cooling shaft 5. The blow wall 7 extends substantially over the entire length and width of the cooling shaft 5. The blow wall 7 is designed to be air-permeable and is preferably formed by means of one or more screening sheets or wire meshes. A blow chamber 8, which is connected by means of a cooling air stream inlet 9 to a cooling air source (not illustrated), is assigned to the blow wall 7. The cooling air source generates a cooling air stream, which arrives via the cooling air inlet into the blow chamber 8 and is blown into the cooling shaft 5 uniformly over the entire surface of the blow wall 7.

An exhaust equipment 13 is designed directly below the spinneret 1 between an inlet end of the cooling shaft 5 and the spinneret 1. The exhaust equipment 13 comprises two suction channels 14.1 and 14.2, which extend substantially over the entire longitudinal side of the cooling shaft 5. The suction channels 14.1 and 14.2 are designed such that they are located directly opposite to one another and are air-permeable in relation to the open space formed below the spinneret 1. The suction channels 14.1 and 14.2 are coupled to a low-pressure source (not illustrated) so as to discharge a suction flow by means of the suction channels 14.1 and 14.2.

Directly below the exhaust equipment 13, a shielding means 20 is disposed, which forms a suction port 15 at the inlet end of the cooling shaft 5. In order to form the suction port 15, the shielding means 20 comprises two mutually opposing shielding plates 16.1 and 16.2, one free shielding end of which project into the cooling shaft 5. The suction port 15 formed between the shielding plates 16.1 and 16.2 thus represents an inlet for the cooling shaft 5. The shielding plates 16.1 and 16.2 are held displaceably and can be guided into various operating positions by means of actuators 21.1 and 21.2 for changing the size of the suction port. For this purpose, the shielding plates 16.1 and 16.2 are moved towards the filaments or away from the filaments. It is thus possible to randomly adjust the size of the suction port 15.

Several thread guides 12 are provided below an outlet end of the cooling shaft 5 preferably centrally in relation to the spinneret 1 in order to combine the filaments 10 of a spinneret 1 to form a yarn 19.

The exemplary embodiment shown in fig. 1 and 2 is particularly suitable to spin and cool filaments for producing synthetic yarns. It is common practice in devices of this type to interchangeably hold the spinnerets 1 used in the spinning beam 3 so as to be able to select and exchange the spinneret plates 2 held on the lower sides of the spinnerets 1 depending on the type of the thread and according to the number and the diameter of the nozzle holes of said spinneret plates. In order to exhaust the volatile components, particularly the monomers arising directly when extruding the filaments such that this exhaust is adapted to each of the freshly extruded filaments, the suction port 15 is adjusted by means of an appropriately selected operating position of the shielding plates 16.1 and 16.2.

During operation, a suction flow acting directly in the open space below the spinneret 1 is generated by means of the exhaust equipment 13 in order to discharge the decomposition products, which get released and leave the filaments during the extrusion, directly from the surroundings of the lower side of the spinneret plate 2. A part of the cooling air blown in from the cooling shaft 5 emerges from the suction port 15 in the form of a backflow opposite to the running direction of the filaments 10 and is discharged by means of the suction flow. A flushing effect thus sets in which promotes the discharge of the volatile components within the filament group. In addition, a precooling effect on the filaments sets in during the backflow of the cooling air.

The exhaust of the cooling air and the backflow of the cooling air, said backflow being formed during said exhaust, is substantially determined by means of the size of the suction port 15.

The exemplary embodiment according to figs. 1 and 2 is also particularly suitable in order to combine the filament bundles to form a fiber strand, which is then supplied for further processing after the melt spinning and cooling to form a spinning cable. The spinning cables can thus be supplied continuously or discontinuously by means of an intermediate storage of said spinning cables in a can on the fiber train and subsequently treated further to form staple fibers.

In the exemplary embodiment of the device according to the invention shown in figs. 1 and fig. 2, the suction port 15 formed by the shielding means 20 is designed to be substantially rectangular. However, in order to intensify the backflow of the cooling air within the filament bundles, it is also possible to design recesses in the free ends of the shielding plates 16.1 and 16.2 in order to achieve the most congruent suction port possible in relation to the filament bundles.

Fig. 3 and fig. 4 schematically show several views of another exemplary embodiment of a device according to the invention for implementing the method according to the invention. Fig. 3 shows a cross-sectional view of the device while fig. 4 shows a view of the longitudinal section thereof.

The subsequent description applies to both the figures unless express reference is made to any one of the figures.

In the exemplary embodiment shown in fig. 3 and fig. 4, an oblong spinneret 1 having a rectangular spinneret plate 2 is held in the form of the spinning means in a spinning beam 3. The spinneret 1 is connected via at least one melt line 4 to a spinning pump (not shown). The spinneret plate 2 comprises a plurality of nozzle holes, which are formed in one or more rows. Spinnerets 1 of this type are preferably used for melt spinning a filament group, which is deposited on a moving depositing device, for example, a belt, to form a non-woven material after the melt spinning and cooling. For this purpose, the filaments 10 emerge from the spinneret plate 2 in the form of a filament curtain.

A cooling shaft 5 is formed below the spinneret 1. The inner longitudinal sides of the cooling shaft 5 comprise two mutually opposing blow walls 7.1 and 7.2. The blow walls 7.1 and 7.2 are connected to blow chambers 8.1 and 8.2 respectively. Each of the blow chambers 8.1 and 8.2 comprises a cooling air inlet 9, by means of which cooling air is conducted into the blow chambers 8.1 and 8.2. The blow chambers 8.1 and 8.2 are each held moveably in relation to the spinning beam 3 so as to adjust a cooling shaft width between the blow walls 7.1 and 7.2. The operating positions of the blow walls 7.1 and 7.2 are adjusted by vertically displacing the blow chambers 8.1 and 8.2. A symmetrical arrangement of the blow walls 7.1 and 7.2 in relation to the spinneret 2 is preferably selected so as to form an equal blowing distance on each side of the filaments 10 between the blow walls 7.1 and 7.2 and the filaments 10. For displacing each of the blow chambers 8.1 and 8.2, pushing means 11 are provided, which are formed in this exemplary embodiment by means of piston cylinder units, which engage at the blow chambers 8.1 and 8.2.

A suction port 15 is formed by shielding means 20 at the inlet end of the cooling shaft 5. The shielding means 20 comprise two displaceably designed shielding plates 16.1 and 16.2. By displacing the shielding plates 16.1 and 16.2, it is possible to determine the width of the suction port 15 and thus a suction cross-section.

Suction channels 14.1 and 14.2 are each designed between the lower side of the spinning beam 3 and the shielding plates 16.1 and 16.2 on both sides of the filaments. The suction channels 14.1 and 14.2 are each parts of an exhaust equipment 13, which comprises at least one low-pressure source connected to the suction channels 14.1 and 14.2. The suction channels 14.1 and 14.2 are connected to the cooling shaft 5 by means of the suction port 15.

A blast opening 17 having a discharge cross-section of changeable size is provided at an outlet end of the cooling shaft 5. For this purpose, the blast opening 17 is formed by two air control flaps 18.1 and 18.2 disposed on both sides of the filaments 10. The air control flaps 18.1 and 18.2 are each held over a pivot axis directly below the blow walls 7.1 and 7.2. The air control flaps 18.1 and 18.2 are each displaced by means of a pivoting movement transversely to the filaments 10 for adjusting the blast opening 17 so as to change the width and thus the discharge cross-section of the blast opening 17.

As shown in fig. 4, the blow walls 7.1 and 7.2, the shielding plates 16.1 and 16.2 forming the suction port 15 and the air control flaps 18.1 and 18.2 forming the blast opening 17 extend over the entire width of the spinneret 1. The front sides of the cooling shaft 5 are preferably closed by means of the cooling shaft walls 6.3 and 6.4.

In the exemplary embodiment shown in fig. 3 and fig. 4, the filaments 10 are extruded by means of the spinneret from a polymer melt to form a filament curtain. The filament curtain, which is drawn off from the spinning means by using drawing means in the form of a draw-off nozzle, enters into the cooling shaft 5 for the purpose of cooling and runs through the cooling shaft 5. The blow walls 7.1 and 7.2 each generate a cooling air stream within the cooling shaft 5 on each side of the filaments 10 and blow it into the cooling shaft 5. The cooling shaft width is preset depending on a selected blowing distance between the filaments and the blow walls 7.1 and 7.2. The cooling shaft width is preferably adjusted symmetrically in order to achieve a uniform cooling of all the filaments. However, it is basically also possible to select asymmetrical operating positions of the blow walls

7.1 and 7.2, for example, in order to achieve special effects when cooling the filaments.

The operating positions of the blow walls 7.1 and 7.2 are effected in such a way by vertically displacing the blow chambers 8.1 and 8.2 transversely to the filaments that a blowing action that is adapted to the filaments is achieved.

The exhaust equipment 13 exhausts a part of the cooling air in the upper region of the cooling shaft 5 opposite to the running direction of the filaments by means of the suction port 15. The volatile components accumulating during the extrusion of the polymer melt are advantageously flushed away by the cooling air and then discharged by means of the suction channels 14.1 and 14.2. Simultaneously, the filaments are cooled by means of the backflow of the cooling air opposite to the running direction of the filaments. The stretch forming between the lower side of the spinneret plate 2 and the shielding means 20 is referred to as the suction stretch here. The generally applicable rule here is as follows: the shorter the suction stretch, the more intensive the flushing effect below the spinneret plate.

However, it is possible, in principle, to design the devices for forming the cooling shaft 5 to be height-adjustable so as to be able to adjust the length of the suction stretch. Thus, for example, the cooling effect of the exhausted cooling air could be improved by lengthening the suction stretch.

The substantial part of the cooling air arrives together with the filaments 10 by means of the blast opening 17 out of the cooling shaft 5. The blast opening 17 can be adjusted in such a way depending on the pivot position of the air control flaps 18.1 and 18.2 that, for example, a counter pressure builds up within the cooling shaft 5 which counter pressure leads to a reduction of the air quantity blown through the blow walls 7.1 and 7.2 opposite to the blow chambers 8.1 and 8.2. On the other hand, the suction flow generated in the suction port 15 is increased by increasing the counter pressure.

The exemplary embodiment of the device according to the invention shown in fig. 3 and fig. 4 is thus particularly suitable in order to spin and discharge melt-spun filaments for producing planar structures. This exemplary embodiment is preferably used in so-called spun bond processes. The means provided for forming the suction port 15 and for forming the blast opening 17 are preferably coupled fixedly to the blow chambers 8.1 and 8.2 so as to provide a basic adjustment of the suction port and the blast opening 17 by means of the respective operating positions of the blow walls 7.1 and 7.2. The shielding plates 16.1 and 16.2 and the air control flaps 18.1 and 18.2 are guided by means of additional pushing means and pivot means only for making fine adjustments.

The structures and configurations of components of the exemplary embodiments of the device according to the invention are shown in fig. 1 to fig. 4 by way of example. In principle, it is possible to use combinations of the individual exemplary embodiments for designing devices of such type. It is thus possible, for example, to design the exemplary embodiment shown in fig. 1 with moveably held blow walls. For this purpose, the position of the blow wall can be changed relative to the blow chamber by means of pushing means or pivot means. However, it is also possible to introduce the cooling air by means of a blowing tube disposed in the interior of the cooling shaft. A suction port, which is designed in the inlet region of the cooling shaft and which represents a separation between an exhaust equipment and the cooling shaft, is essential to the method according to the invention and the device according to the invention. The suction port is formed by means of displaceable shielding means in order to be able to adjust the size of the suction port such that it is adapted individually to the process and the fiber type. It is thus possible to achieve a high degree of flexibility in the production of melt-spun filaments particularly for discharging the monomers. When using exchangeable spinnerets, the inventive device proves to be most flexible in order to be able to produce filaments with fine deniers or course deniers.

List of reference numerals

1	Spinneret
2	Spinneret plate
3	Spinning beam
4	Melt line
5	Cooling shaft
6.1, 6.2, 6.3, 6.4	Cooling shaft wall
7, 7.1, 7.2	Blow wall
8, 8.1, 8.2	Blow chamber
9	Cooling air stream inlet
10	Filaments
11	Pushing means
12	Thread guide
13	Exhaust equipment
14.1, 14.2	Suction channel
15	Suction port
16.1, 16.2	Shielding plate
17	Blast opening
18.1, 18.2	Air control flap
19	Yarn
20	Shielding element
21.1, 21.2	Actuator

Claims

1. Method for melt spinning and cooling synthetic filaments, in which method a plurality of filaments is extruded from a polymer melt by means of a spinneret having a plurality of nozzle holes, wherein the filaments enter into a cooling shaft after the extrusion and run through the cooling shaft, wherein a cooling air is blown into the cooling shaft, wherein a part of the cooling air is exhausted from an inlet end of the cooling shaft opposite to the running direction of the filaments and wherein a part of the cooling air is discharged together with the filaments from an outlet end of the cooling shaft,
said method being characterized in that
the size of a suction port at the inlet end of the cooling shaft is changed for adjusting the exhaust of the cooling air, the filaments being guided together through the suction port after the extrusion.

2. Method according to claim 1,
characterized in that
the suction port at the inlet end of the cooling shaft extends between one or more moveable shielding means, which are guided into one of several operating positions for selecting the size of the suction port.

3. Method according to claim 1 or 2,
characterized in that
two cooling air streams are blown by means of two blow walls into the cooling shaft for cooling the filaments, the blow walls being located opposite to one another in the cooling shaft and the cooling air being exhausted through two suction channels arranged upstream of the blow walls.

4. Method according to claim 3,
characterized in that
both the cooling air streams are blown symmetrically in relation to the plurality of the filaments guided in the form of a filament curtain, the suction port extending between two mutually opposing shielding plates and the shielding plates being displaced by means of a pushing movement transversely to the filaments for selecting the size of the suction cross section.

5. Method according to one of the claims 1 to 4,
characterized in that
a suction stretch formed between the suction port and the spinneret changes in length.

6. Method according to claim 5,
characterized in that
the cooling shaft is moved and held in the running direction of the filaments or opposite to the running direction of the filaments for changing the length of the suction stretch.

7. Method according to one of the claims 3 to 5,
characterized in that
one of several operating positions of the blow walls is selected, the blow wall being moved towards the filaments and/or away from the filaments for changing the operating position.

8. Method according to one of the claims 1 to 7,
characterized in that
the cooling air is guided together with the filaments at an outlet end of the cooling shaft through a blast opening having a discharge cross-section of selectable size.

9. Method according to claim 8,
characterized in that
the blast opening extends between two mutually opposing air control flaps, which are displaced by means of a pivot movement transversely to the filaments for selecting the size of the blast opening.

10. Device for melt spinning and cooling synthetic filaments, said device comprising at least one spinneret (1) having a plurality of nozzle holes for extruding a plurality of filaments, a cooling shaft (5), which is disposed below the spinneret (1) and is connected to a cooling air source (8, 7), by means of which a cooling air is blown into the cooling shaft (5), and an exhaust equipment (13), which is formed between the spinneret (1) and an inlet end of the cooling shaft (5) and by means of which a part of the cooling air is exhausted from the inlet end of the cooling shaft (5) opposite to the running direction of the filaments, a part of the cooling air being discharged together with the filaments from an outlet end of the cooling shaft (5), particularly for implementing the method according to one of the claims 1 to 9
characterized in that
a suction port (15) having a variable size is formed at the inlet end of the cooling shaft (5), the filaments (10) being guided together through the suction port (15) after the extrusion.

11. Device according to claim 10,
characterized in that
the suction port (15) is formed at the inlet end of the cooling shaft (5) by means of one or more moveable shielding means (20), which can be guided into one of several operating positions for selecting the size of the suction port (15).

12. Device according to claim 10 or 11,
characterized in that
the cooling air source is connected to the mutually opposing inner sides of the cooling shaft (5) by means of two blow walls (7.1, 7.2), and that one of several suction channels (14.1, 14.2) for exhausting the cooling air is arranged upstream of each of said blow walls (7.1, 7.2).

13. Device according to claim 12,
characterized in that
the blow walls (7.1, 7.2) are held symmetrically to the spinneret (1), which spinneret (1) comprises nozzle openings arranged in a row for extruding a filament curtain, and that the suction port (15) is formed by two mutually opposing shielding plates (16.1, 16.2), which can be displaced by means of a pushing movement transversely to the filaments.

14. Device according to one of the claims 10 to 13,
characterized in that
the cooling shaft (5) is designed to be height-adjustable for adjusting a suction stretch formed between the inlet end of the cooling shaft (5) and the spinneret (1).

15. Device according to one of the claims 12 to 14,
characterized in that
the blow walls (7.1, 7.2) are held alternately in several operating positions relative to the spinneret (1), the blow walls (7.1, 7.2) being moved towards the filaments and/or away from the filaments for changing the operating position.

16. Device according to one of the claims 10 to 15, characterized in that the cooling shaft (5) comprises a blast opening (17) at the outlet end, the discharge cross-section of said blast opening being variable in size.

17. Device according to claim 16, characterized in that several pivoting air control flaps (18.1, 18.2) are held at the outlet end of the cooling shaft (5) for forming the blast opening (17), the air control flaps (18.1, 18.2) being displaceable by means of a pivoting movement transversely to the filaments for selecting the size of the blast opening (17).

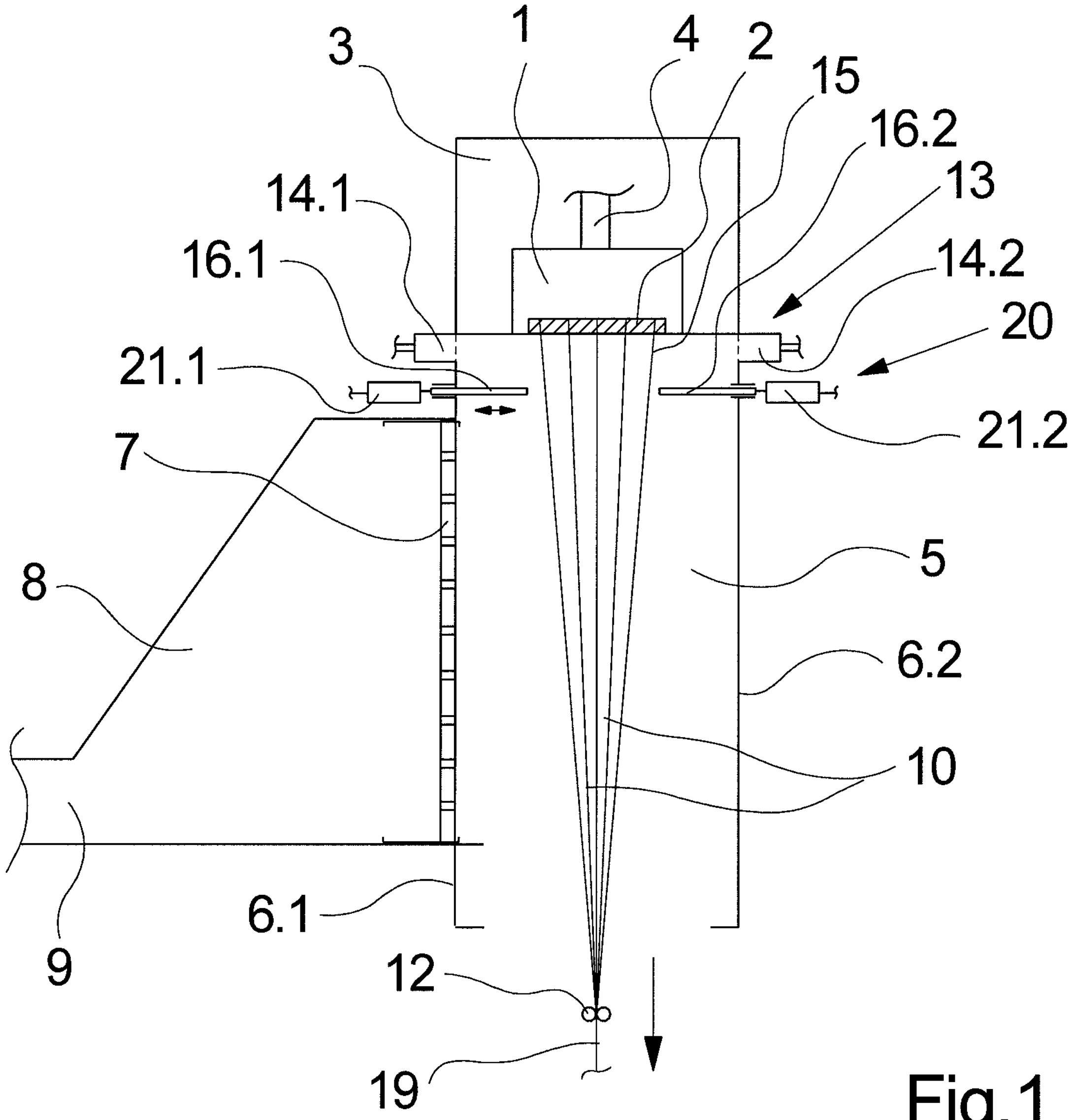

Fig.1

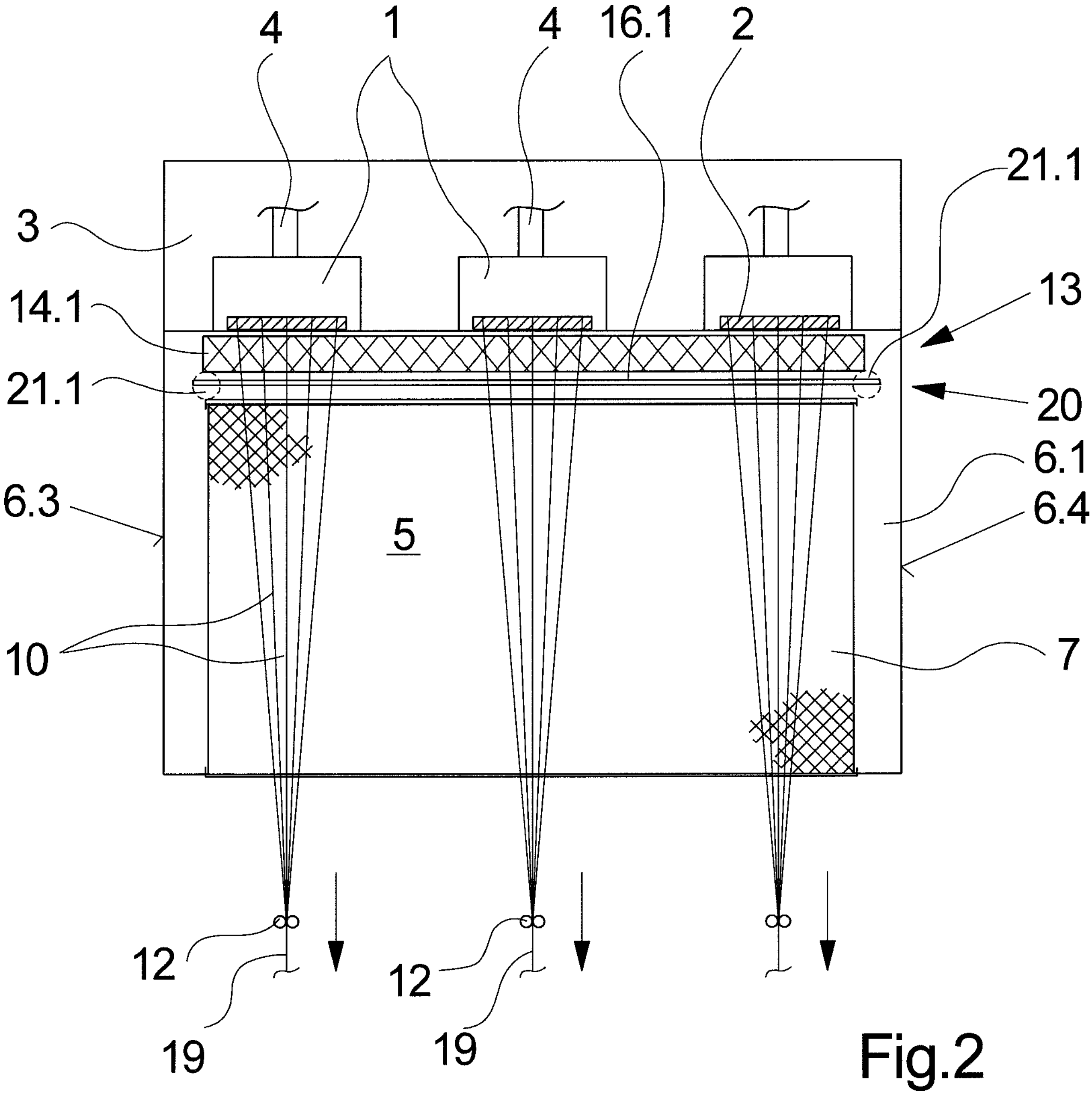

Fig.2

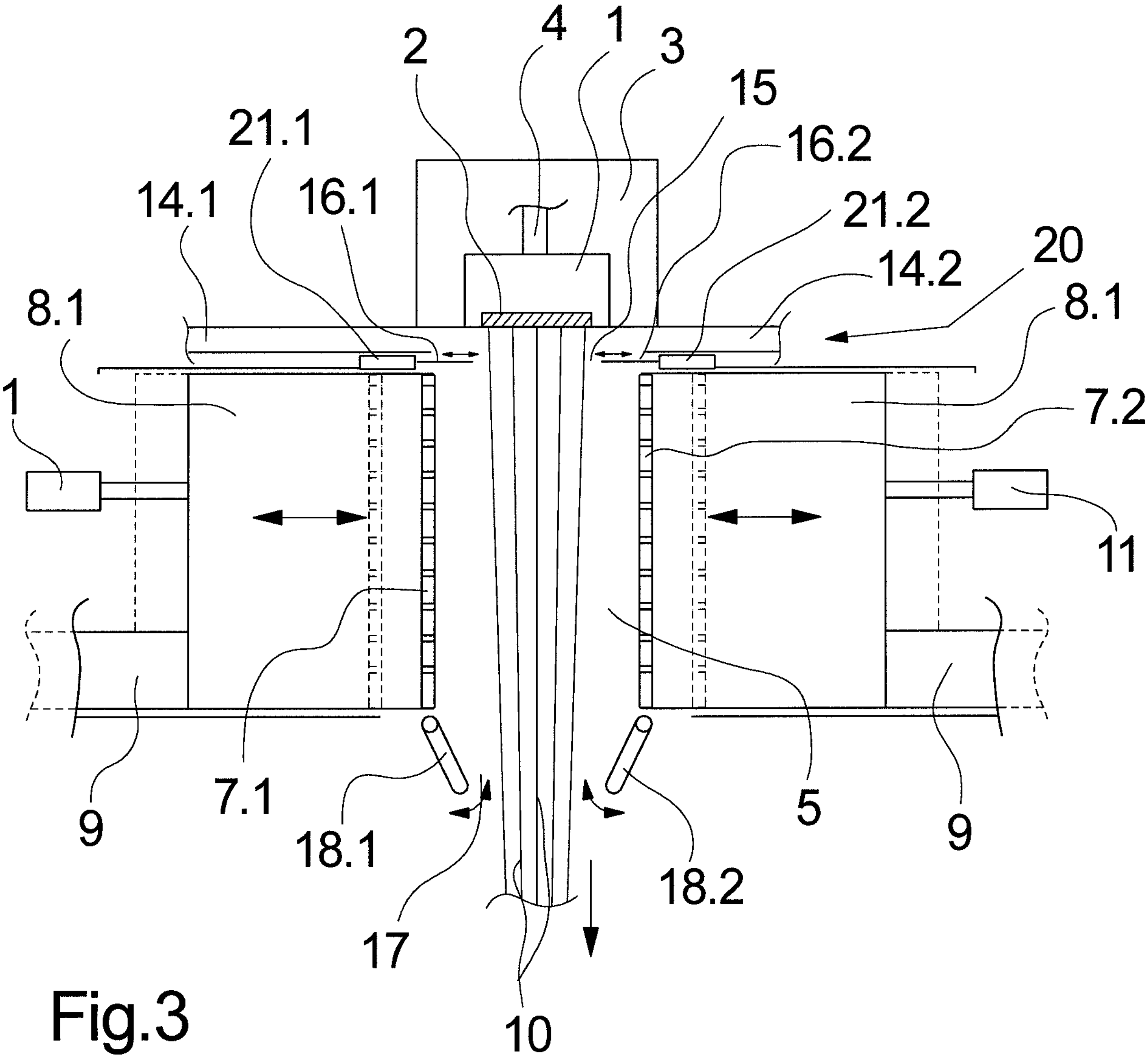
4
1
2
3
15
21.1
16.2
14.1
16.1
21.2
20
14.2
8.1
8.1
11
7.2
11
7.1
5
9
9
18.1
18.2
17
10

Fig.3

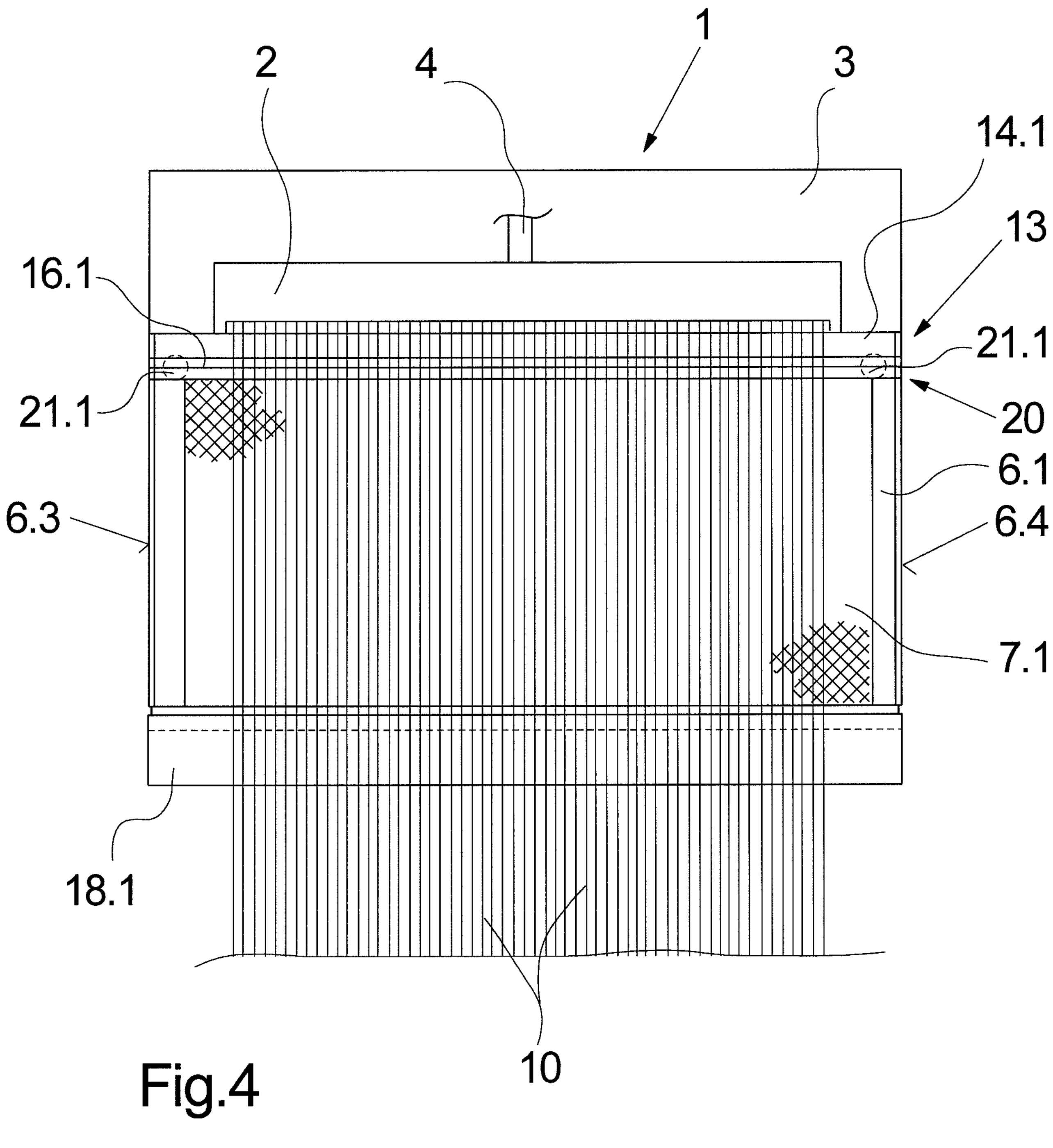

Fig.4