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Lenk

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[54] **SPINNING APPARATUS WITH VAPOROUS HEATING JACKET**

[75] Inventor: **Erich Lenk,** Remscheid, Germany

[73] Assignee: **Barmag Barmer Maschinenfabrik Aktiengesellschaft,** Wuppertal, Germany

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[51] **Int. Cl.** **D01d 1/06**

[58] **Field of Search** ..... 425/382.2, 73, 74, 192, 425/463, 464, 378, 379; 264/176 F, 177 F; 165/105

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Primary Examiner—Robert D. Baldwin

Attorney, Agent, or Firm—Johnston, Keil, Thompson & Shurtleff

[57] **ABSTRACT**

Apparatus for the spinning of threads, filaments, bands, ribbons or the like from molten thermoplastic polymers including at least one screw extruder or pump means, a melt distributor conduit system connected thereto to receive and transport the polymer melt, and a series of spinning heads with each head being in fluid connection with the extruder or pump means through an individual conduit of the distributor system. The melt-conducting conduits of the melt distributor system and the spinning heads are encased or lined by a common vapor generator for heating with diphenyl vapor or the like, this generator having a connected vapor distributor and condensate collecting conduit system extending from the screw to the common vapor generator and also from the generator to each spinning head to heat the same.

8 Claims, 3 Drawing Figures

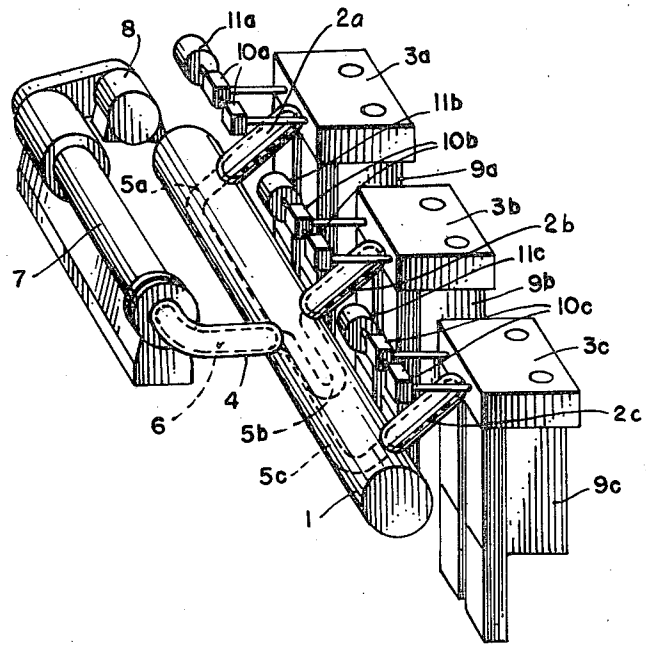


FIG. 1

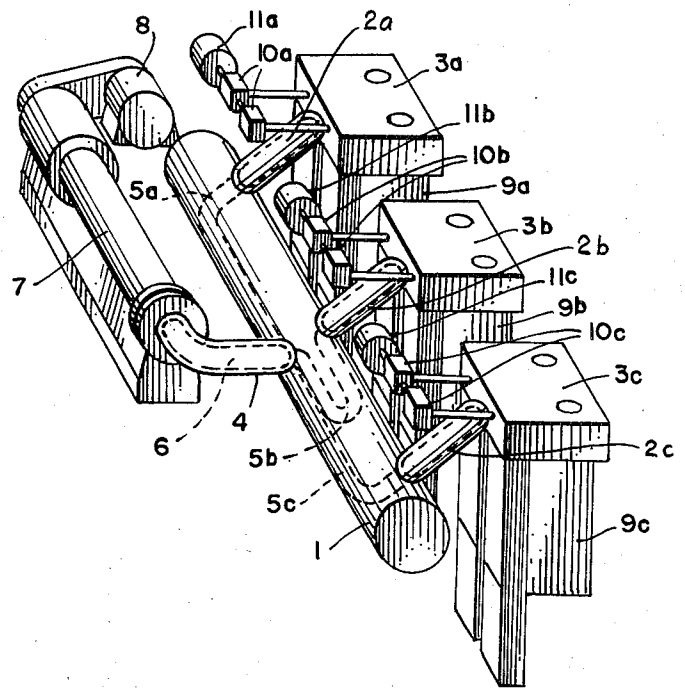


FIG. 2

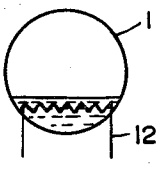
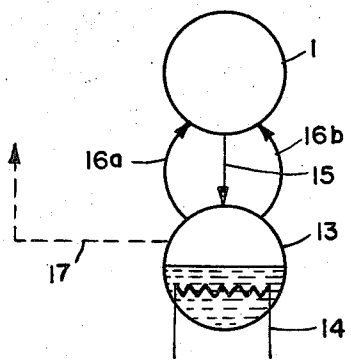


FIG. 3



SPINNING APPARATUS WITH VAPOROUS HEATING JACKET

In a known melt-spinning apparatus for producing filaments, the melt distributor conduit system and the vapor distributor for heating the spinning heads as well as the condensate collecting system are all arranged separately. In this apparatus, the melt-conducting device, i.e., a screw extruder or a pump, and the melt distributor conduits or lines are arranged above the spinning heads and the melt distributor lines are connected to the top of the spinning heads. The condensate reflux lines and usually also the vapor-conducting lines are arranged underneath the spinning heads and are connected from below with the spinning heads. The vapor-generating assembly is mounted so as to be spatially separate from the spinning apparatus. Furthermore, another vapor-conducting line for the diphenyl or other heat transfer agent can be directed to a central melt distributor line. Proceeding from this central line, the meltconducting lines are heated, all these melt lines each being surrounded by a mantle or tubular jacket with spacing to provide an annular passage through which the diphenyl vapor can be conducted as the heat transfer medium.

With this known arrangement of the melt-conducting and vapor-conducting lines, including the condensate lines, one needs a considerable structural height to accommodate the entire installation above and below the spinning heads, especially because of the conduit systems required in both places as well as the melt-conveying means provided above the spinning heads and the vapor generator arranged spatially separate therefrom. This is most unfavorable in view of the high space requirements and the lack of accessibility to the spinning heads.

It is further decidedly disadvantageous that the individual lines of the conduit systems in this known spinning apparatus must be installed and fitted at the construction site in exact correspondence to or alignment with the particular arrangement of the spinning heads, the melt-conveyance means and the vapor generator, i.e., in accordance with the length and position of each unit. This means that all lines must be custom fitted before they can be finally and exactly assembled. Such an assembly is time consuming and costly. Moreover, it has been necessary to transport the essential parts of the spinning apparatus, namely the spinning heads, the screw extruder, the vapor generator, the melt-conducting lines, the vapor-conducting lines, etc., from the place of manufacture to the construction site as individual parts. The construction and transportation of the individual parts of the apparatus are therefore separate steps in the development of the installation and the arrangement of the individual parts in the finished apparatus, and it would be much more desirable to preassemble these parts before being transported to the site of installation.

It is one object of the present invention to redesign and simplify the entire spinning installation consisting essentially of spinning apparatus and the individual parts required for vapor heating, vapor distribution and condensate collection so as to provide an improved construction and operation. Further, it is an object of the invention to assemble these construction parts either with or without vapor-generating means into readily mountable structural units in such a way that together with the spinning heads and their associated blowing or cooling shafts they yield a very compact spinning installation.

In accordance with the invention, these and other objects and advantages are achieved in an improved spinning apparatus or assembly for producing melt-spun filaments, bands or the like by the combination which comprises a plurality of spinning units including a series of individual spinning heads arranged in a row; a single extruder or pump means for supplying polymer melt to said spinning heads, a melt distributor system of conduits interconnecting said extruder or pump means with said spinning heads for distribution of the melt to each of the spinning heads, and a second fluid distributor system for a vaporous heating agent including a common jacketing means encasing the conduits of the melt distributor system, at least part of said jacketing means being positioned below the level of said spinning heads.

The jacketing means is preferably an elongated vessel mounted or arranged below the level of the spinning heads so as to receive the individual melt-conducting conduits from the corresponding individual spinning heads as well as the supply conduit from the extruder or pump means within a common enclosure for the vaporous heating agent. Individual vapor lines connected to the vessel then extend outwardly and upwardly so as to surround and accompany the corresponding individual melt conduits leading to each of the spinning heads. As the heating vapors condense during the course of indirect heat exchange in the spinning heads and also in the melt-conducting conduits, the condensate thus can return by gravity flow into the elongated vessel where it can be heated and revaporized or where it can be further conducted to a reboiler or the like preferably located below the vapor distributing vessel.

The invention is more particularly illustrated but not limited by the accompanying drawing wherein:

FIG. **1** is a partly schematic perspective view of the entire spinning assembly arranged in accordance with one embodiment of the invention;

FIG. **2** is a schematic end view of the central elongated vessel serving as vapor distributor, condensate collector and vapor generator; and

FIG. **3** is another schematic end view of the elongated vessel to illustrate an embodiment in which the vapor generator is spatially separated from the vapor distributor.

Referring particularly to FIG. **1**, the spinning assembly is constructed around a central elongated vessel or enclosed tubular member **1** having a plurality of tap lines or distribution conduits **2***a*, **2***b*, **2***c*, etc. directed diagonally upwardly to a relatively large number of spinning heads **3***a*, **3***b*, **3***c*, etc., arranged in a row along a substantially horizontal plane. The vessel or tube **1** is preferably situated with its longitudinal axis approximately parallel to the horizontal plane or a central line drawn through the series of spinning heads and is also located laterally and at least partly below the level of the spinning heads. This vessel **1** can then be partly filled with a vaporous heating agent such as diphenyl or the like, as indicated in FIG. **2**, and equipped with any suitable heating means **12** to vaporize the liquid diphenyl. This heating means may be electrical as with heating bands or other resistance heaters or may also be accomplished with other conventional direct or indirect heating devices.

The vessel 1 as shown in FIGS. 1 and 2 with its conduits 2a, 2b, 2c and 4 acts as a complete system for the generation and distribution of the heating vapor and also for the collection of condensate. In its primary function as a fluid distributor system, these elements constitute a common jacketing means encasing the melt distributor system which essentially includes the three branched conduits 5a, 5b and 5c extending to their respective spinning heads and the melt supply conduit or main feed line 6 issuing from the outlet end of the screw extruder 7. Each of the melt distributing lines 5a, 5b and 5c are preferably of the same length so as to maintain a common temperature control in relation to the residence time of the melt in the distribution system.

The screw extruder 7 with its drive means 8 is likewise preferably mounted laterally underneath the spinning heads 3a, 3b and 3c, i.e., to one side of the row of spinning heads so as to be approximately parallel thereto as well as being parallel to the vessel 1. To facilitate the recovery of the heating vapor condensate, the encasing conduit 4 around melt supply conduit 6 is preferably also directed slightly upwardly from the vessel 1 to its connection at the end of the extruder 7.

In some instances, the extruder 7 may be replaced by a conventional pump, e.g., to conduct the polymer melt from a single large extruder which supplies an even larger number of spinning heads. Such variations in the distribution of the initial polymer melt will be readily apparent to those skilled in this art.

In the illustrated embodiment, the condensate return lines are identical with the vapor distribution conduits 2a, 2b, 2c and 4 which form an annular space around the melt conduits 5a, 5b, 5c and 6, respectively. It is also feasible, however, to provide separate return lines for the condensate, including separate lines withdrawing condensate from within the spinning heads and/or from an extruder or pump means which is more advantageously arranged in such a manner that a gravity flow return of the condensate is not possible. With respect to the spinning heads and their melt feed conduits, the common vapor distribution and condensate collection system does represent a significant advantage where a gravity flow return of the condensate is ensured by the positioning of the vessel 1 or at least part of the common jacketing means below the level of the spinning heads.

As is conventional in spinning assemblies, it is desirable to provide spinning shafts or so-called blowing shafts 9a, 9b, 9c,etc. and also suitable metering pumps 10a, 10b, 10c, etc. for the individual spinning heads together with their associated drive means 11a, 11b, 11c, etc. Means for mounting or supporting all of the individual elements or members of the spinning apparatus have been omitted in the drawing since one can readily construct a suitable framework or provide floor and wall arrangements to receive the assembled structure. It is of special advantage that all of the parts can be mounted on supporting means after being formed of structural units mountable in prefinished form and being transportable as a unitary spinning installation.

In another embodiment as indicated in FIG. 3, the vessel 1 serves only as a distribution means for the vapor and a part of the condensate collection system while the generation of the heating vapor from the continuously returned liquid condensate is carried out in the spatially separated pot or reboiler 13 equipped with a heating device 14. Condensate is returned from the lowermost level of the vessel 1 through line 15 to the reboiler 13 while vapors are preferably fed upwardly through a number of feed lines 16a, 16b, etc. In many instances, it will be desirable to provide a single reboiler 13 for a large number of vapor distribution systems or vessels 1 so that many other vapor feed lines 17 can also be directed off from the reboiler. In each instance, the reboiler is preferably arranged a short distance below the distribution vessel 1 and can extend longitudinally under one or many such vessels in a large commercial installation. Heating bands are then most advantageous as the means of heating the reboiler. Through the feature that the heat or vapor distribution system simultaneously includes in itself also the melt conducting conduits, i.e., the melt feed line from the extruder and the melt distributor lines, one can achieve in a simple manner and by conventional regulating means a uniform melt temperature and, at the same time with respect to the construction, a space-saving arrangement.

In the event that for reasons of special regulations or precautions concerning safety provisions the vapor distributing system may not directly include a vapor generating means, a spatially separate reboiler or vapor-generating unit is provided which is directly placed in fluid connection with the jacketing means of the vapor distribution system. This embodiment is also preferred when a common vapor generating unit is provided for several spinning installations.

A substantial advantage is to be seen in that all the essential elements or parts which form the spinning apparatus can be mounted in their final or at least preassembled state in the manufacturing plant. Thus, the screw extruder with its drive means, the distributor systems containing the melt conduits and vapor jackets as well as the spinning heads with their required pumps, pump drives and blowing shafts are arranged mounted in their intended position on a carrying or transportable frame, and may even be wired and insulated so as to be ready for operation. These various structural parts yield an installation which is compact in construction with a relatively small overall volume. The entire installation can be loaded into a suitably large transportation container with the aid of a suitable hoisting means or the like, and then transported to the construction site, unloaded and erected. Such a spinning installation further exhibits advantages of improved free viewing of the spinning heads during their operation and free accessibility to the spinning heads for maintenance or repair.

The invention is hereby claimed as follows:

1. Apparatus for spinning filaments, bands or the like of a molten thermoplastic polymer which comprises:

a plurality of spinning units including a series of individual spinning heads arranged in a row;

a single extruder or pump means for supplying polymer melt to said spinning heads;

a melt distributor system of conduits interconnecting said extruder or pump means with said spinning heads for distribution of the melt to each of the spinning heads; and

a second fluid distributor system for a vaporous heating agent including a common jacketing means encasing the conduits of the melt distributor system, at least part of said jacketing means being formed by at least one elongated vessel arranged below the

level of said spinning heads to supply vapor for heating said melt conduits and to collect the condensate being formed during said heating.

2. Spinning apparatus as claimed in claim 1 wherein said jacketing means is an elongated vessel arranged below the level of said spinning heads to receive said conduits from the individual spinning heads and the extruder or pump means within a common enclosure for the vaporous heating agent, individual vapor lines being connected to said vessel to extend outwardly and upwardly together with and surrounding the corresponding individual melt conduits to each of said spinning heads.

3. Spinning apparatus as claimed in claim 2 wherein said elongated vessel arranged below the level of said spinning heads contains heating means for generating said vaporous heating agent from a liquid condensate thereof being collected in said vessel.

4. Spinning apparatus as claimed in claim 1 wherein that portion of the jacketing means positioned below the level of the spinning heads is a vapor generating vessel spatially separated from said second fluid distributor system, said vapor generating vessel including heating means for generating said vaporous heating agent from a liquid condensate thereof being collected in said vessel, with fluid line means to supply vapor to said second distributor system and to return condensate from the upper part of said second distributor system to said vapor generating vessel.

5. Spinning apparatus as claimed in claim 1 wherein the conduits in said melt distributor system all slope downwardly to a common lower level within said common jacketing means.

6. Spinning apparatus as claimed in claim 5 wherein said jacketing means and said extruder or pump means are arranged to one side of the row of spinning heads in approximately parallel relationship to said row and to each other.

7. Spinning apparatus as claimed in claim 1 wherein the spinning units together with their associated metering pumps, pump drives and vertical blowing shafts are mounted on a supporting means which also carries the extruder or pump means for supplying the polymer melt and the intermediate melt-distribution and vapor distribution systems, all of the supported elements being formed of structural units mountable in prefinished form and being transportable as a unitary spinning installation.

8. Spinning apparatus as claimed in claim 7 wherein said intermediate melt-distribution and vapor-distribution systems are constructed in common as a finished element which is replaceable along one side with the extruder or pump means and along the other side with the row of spinning heads.

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